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Efficacy of Ecologically-Based Treatment with Substance-Abusing Homeless Mothers: Substance Use and Housing Outcomes

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Abstract

This randomized pilot study tested the efficacy of an integrative treatment targeting homeless substance abusing mothers with young children in their care. Sixty mothers with 2–6 year old children were recruited from a local family shelter. The mothers were randomly assigned to Ecologically-Based Treatment ($n = 30$) or treatment as usual ($n = 30$). The intervention group received 3 months of rental and utility assistance up to \$600 per month, case management services, and substance abuse counseling (referred to as supportive services). The treatment as usual group received housing and services through the family shelter and community housing programs. All participants completed follow-up assessments at 3, 6, and 9 months post-baseline. Mothers receiving Ecologically-Based Treatment showed a quicker decline in alcohol frequency and a quicker increase in housing stability. Furthermore, with supportive services, two-thirds of women were successful in maintaining their apartments 6 months after rental assistance ended.

Keywords

Homeless mothers; housing; substance abuse treatment; randomized controlled trial

1. Introduction

Substance-abusing homeless mothers are one of the most vulnerable populations in the nation. In addition to the stress of being without a place to live, many homeless mothers experience significant substance abuse difficulties, with higher rates than among comparison samples of housed women with children (National Alliance to End Homelessness, 2006). For example, Rog et al. (1995) interviewed 781 homeless mothers and found that 74% of the mothers reported using drugs within one year of the assessment (69% marijuana, 34% cocaine, 27% crack, and 21% amphetamines), and 29% of these mothers met diagnostic criteria for alcohol dependence. More recently, Hanrahan et al. (2005) and Chambers et al. (2013) reported that 50% of the homeless mothers reported substance use problems at intake. It is also important to note that homeless mothers with children have significant strengths. In particular, studies indicate that homeless mothers with children, compared to homeless mothers without children, have better overall health status, lower substance use

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and higher perceived access to social support (Chambers et al., 2013). Others have found lower recidivism rates among incarcerated parents compared to non-parents (Parke & Clarke-Stewart, 2002). However, homeless mothers with a minor child in their care are less likely to receive substance abuse treatment than those without a minor child (Tucker et al., 2011). Clearly, homeless mothers with children in their care have unique strengths and needs which need to be taken into consideration when designing interventions.

Little research has assessed which types of treatment are effective with this group. Successful intervention directed at both substance abuse and housing has the potential to prevent continuing homelessness, substance use and related problems. Given the individual and societal costs associated with substance abuse and homelessness, the need for systematic treatment development and evaluation with this vulnerable population is paramount. Therefore, the current study tested a systematically-developed housing intervention, combined with ongoing substance abuse treatment and case management, referred to as Ecologically-Based Treatment (Slesnick, Glassman, Katasfiasz, & Collins, 2012), for substance abusing homeless mothers with young children in their care.

1.11 Interventions for Substance Abusing Homeless Mothers—The needs of homeless mothers differ from homeless men and women without children in their care. In particular, homeless mothers have the additional responsibility of caring for their children and are reluctant to seek substance abuse treatment for fear that their children will be removed from their care (National Alliance to End Homelessness, 2006). Only two randomized controlled trials were identified that focused on intervening with substance abusing homeless mothers (Sacks et al., 2004; Smith, North & Fox, 1995). Smith and colleagues (1995) compared substance use outcomes and housing stability among 149 homeless mothers randomly assigned to a drug-free modified therapeutic community or to a non-residential condition. Treatment drop-out rates at 12 weeks were 75% in the non-residential program and 50% in the residential condition, though few other differences between conditions were found. The authors concluded that therapeutic communities show low effectiveness but that the provision of housing appears to reduce drop-out. Sacks et al. (2004) also evaluated a modified therapeutic community for drug addicted homeless mothers as compared to a traditional therapeutic community. Again, no differences were found for parenting or housing stabilization between groups.

In a small nonrandomized pilot (Slesnick & Erdem, 2012), substance abusing homeless women with young children were recruited from a homeless family shelter. Three months of rental and utility assistance for permanent housing, in addition to six months of case management and substance abuse treatment were provided. Rental assistance was not abstinent or treatment contingent. Women (n = 15) showed statistically significant reductions in substance use and homelessness with the majority of women maintaining their housing at the final follow-up, three months after rental assistance ended.

1.12 Housing Interventions—Several randomized trials have examined integrated housing and substance abuse treatment among substance abusing and/or seriously mentally ill homeless men and women without children in their care. In general, these studies report findings from examinations of 1) transitional housing plus substance abuse treatment compared to transitional housing without substance abusing treatment (Smith, Meyers, & DeLaney, 1998), 2) the housing first model compared to the continuum of care model (Tsemberis, Gulcur, & Nakae, 2004; Padgett, Stanhope, Henwood, & Stefancic, 2009; Sadowski, Kee, VanderWeele, & Buchanan, 2009), and 3) abstinence-based housing compared to non-abstinence based housing (Tsemberis et al., 2004; Milby et al., 2003).

Smith, Meyers, and Delaney (1998) compared abstinent-based transitional housing + substance abuse treatment (the Community Reinforcement Approach (CRA; Meyers & Smith, 1995)) to abstinent-based transitional housing alone among alcohol abusing homeless adults. They found that housing rates improved in both conditions, but no significant differences on outcomes other than alcohol were observed. In the prior decade, efforts to end chronic homelessness have coincided with a rise in popularity of the Housing First approach. The traditional approach is termed the continuum of care or linear approach in which homeless persons enter the shelter system and move to transitional living and then permanent housing as self-sufficiency (e.g., employment), substance use and/or mental health goals have been met (Kertesz et al., 2009). In contrast, Housing First assumes that housing is a fundamental human right, and therefore provides permanent housing to individuals without the pre-requisites for sobriety or mental health (Tsemberis & Asmussen, 1999). Tsemberis et al. (2004) and more recently, Padgett, Stanhope, Henwood, and Stefancic (2009) found that compared to participants in the continuum of care, participants in the Housing First program were able to obtain and maintain independent housing without compromising psychiatric or substance abuse symptoms at 12 and 24-months follow-up. Similarly, in regard to abstinent-based versus non abstinent-based housing, some research indicates that abstinent-contingent housing is no better than a non-housing condition on housing and substance use outcomes (Milby, 2003). Other research shows the superiority of non-abstinent contingent housing on housing outcomes (Tsemberis et al., 2004), though similar substance use outcomes (Milby, 2005, Tsemberis, 2004). In summary, the research to date suggests that regardless of the presenting symptoms among those experiencing homelessness, such as substance abuse or mental health problems, housing is a powerful intervention. That is, the primary problem leading individuals into various housing and service interventions may be less of a determinant of success than the provision of housing itself. Even so, treatment interventions offered to individuals receiving housing need to take differences in presenting problems seriously, and tailor interventions to individuals' unique needs.

1.2 Current study

The present study came from a larger study designed to develop a comprehensive intervention for homeless mothers with young children in their care. The first phase of the project included data gathering on the treatment needs of the homeless mothers (Dashora, Slesnick, & Erdem, 2012; Sznajder-Murray & Slesnick, 2011), followed by the development and pilot testing of Ecologically-Based Treatment in a small sample (Slesnick et al., 2012; Slesnick & Erdem, 2012). The current paper presents the primary outcomes from the randomized controlled trial, testing the efficacy of Ecologically-Based Treatment among homeless mothers on housing and substance use. Secondary outcomes regarding maternal mental and physical health, parenting stress, and child behavioral problems are reported elsewhere (Slesnick & Guo, under review). In the current study, women rented an apartment of their choosing and the project paid the first three months rent and utilities. Housing was non-contingent on drug abstinence or treatment attendance. Support services (case management and CRA) were offered for six months. It was hypothesized that the mothers in the intervention condition, compared to those in the shelter condition or treatment as usual, would have greater reductions in their substance use and substance use related problems over time. It was also expected that a greater proportion of the mothers in the Ecologically-Based Treatment condition would maintain their independent living at 9 months post-baseline, compared to the mothers in the treatment as usual condition.

2. Materials and methods

2.1 Participants

Homeless mothers (n=60) were recruited from a family shelter from June 2010 to January 2011. Two-hundred forty women were approached at the homeless family shelter, and 180 were not eligible. All women who were eligible for the study agreed to participate. Eligible participants met the criteria of homelessness as defined by the McKinney-Vento Act (2002) as lacking a fixed, regular, stable, and adequate nighttime residence and living in a publicly or privately operated shelter designed to provide temporary living accommodations; or a public or private place not designed for, or ordinarily used as, regular sleeping accommodations for human beings, had a biological child between the ages of 2 to 6 years in their care and met the DSM-IV (APA, 2000) criteria for substance abuse or dependence. Characteristics of the sample are presented in Table 1.

2.2 Procedure

Potential participants were engaged and briefly screened by the shelter staff. Ineligible mothers continued with the services at the shelter. Mothers deemed eligible were referred to the project coordinator to set up an initial appointment. A research assistant met with the mother, determined formal eligibility and obtained informed consent for the project. The initial assessment was conducted at the family shelter and included interviewer-administered and self-reported questionnaires. The interview took approximately 2 hours to complete and all mothers received a \$40 gift card to Walmart for their time.

Upon completion of the initial assessment, mothers were randomized using an urn randomization program with the urns balanced on age and race/ethnicity, to either the intervention (n=30) or treatment as usual condition (n=30). The intervention group received the integrated treatment (Ecologically-Based Treatment) over 6 months whereas the treatment as usual group continued with services through the family shelter. Mothers in both groups were evaluated at 3, 6 and 9 months post baseline. The follow-up interviews took 1–1.5 hours to complete and mothers in both conditions received a \$40 gift card to Walmart for completing each assessment. All research procedures were approved by the IRB at The Ohio State University. The study design and flow of participants are presented in Figure 1.

2.3 Therapists, clinical training and supervision

Three White, female therapists delivered Ecologically-Based Treatment. Clinicians were master's level therapists and were graduate students at The Ohio State University Couple and Family Therapy program or in the Clinical Social Work program. The supervisor provided the initial two-day didactic training with role plays and case studies and also delivered ongoing weekly supervision and case consultation to the therapists. Weekly supervision included audiotape review to ensure treatment fidelity.

2.4 Ecologically-Based Treatment

The intervention integrates independent housing, case management services and substance abuse counseling. Specifically, the mothers were housed in an apartment of their choosing and received three months of utility and rental assistance of up to \$600 per month. The independent housing was not contingent on mother's substance abuse or attendance in treatment services. Upon completion of the three months of housing support, mothers were not offered additional vouchers or rent subsidy. However, case management and counseling components of the intervention continued to assist mothers up to six months. This approach complies with the mothers' treatment needs and desires as they reported in the focus groups (Dashora, Slesnick, & Erdem, 2012). Specifically, mothers reported that rental assistance up to three months would be helpful for them to get 'on their feet.' The pilot study indicated

that up to 26 case management sessions and up to 20 CRA sessions should be offered to the mothers over a period of 6 months. Therefore, the case management component focused on assisting mothers to meet their basic needs (i.e., referrals to food pantries), obtain government entitlements (i.e., SSDI/SSI, cash assistance, food stamps, Title XX for child care), and obtain employment. The therapists advocated for the mothers to connect them to social services through providing referrals and/or transporting clients to their appointments such as job interviews.

The Community Reinforcement Approach (CRA; Meyers & Smith, 1995) is an evidence-based treatment for substance abuse which has been shown to be efficacious in reducing alcohol and illicit drug use in both outpatient and inpatient settings (Smith, Meyers, & Miller, 2001). CRA has also been tested with homeless populations (i.e., Smith, Meyers, & DeLaney, 1998; Slesnick, Prestopnik, Myers, & Glassman, 2007). In Smith, Meyers, and DeLaney's (1998) study, CRA outperformed shelter services (i.e., 12 step meetings) with higher reductions in drinking days through the 9 month follow-up period. The counseling component of CRA explored the function of using substances and aimed to reinforce non-substance using, adaptive behaviors through communication skills training, relapse prevention and refusal skills training. The project therapists provided all intervention components and worked closely with the mothers, always on-call for potential crises and urgent needs. Mothers in the Ecologically-Based Treatment group attended an average of 23.1 sessions (SD=6.52; Range=9–46). Specifically, mothers received an average of 10.57 (SD=3.31) CRA sessions and 12.53 (SD=5.84) case management sessions. More information on the integrative intervention can be found elsewhere (Slesnick et al., 2012; Slesnick & Erdem, 2012).

2.41 Treatment fidelity—Substance abuse counseling (CRA) session tapes were transcribed and coded by research assistants. Codes followed the CRA standard treatment manual (Meyers & Smith, 1995) requiring ratings of the fidelity of 9 procedures. Sample items included “Did the therapist examine triggers or reasons the client is using drugs/ participating in problematic behavior? If yes, how effectively?” and “Did the therapist link positive rewards to non-drinking/non-problematic behavior? If yes, how effectively?” Therapist competence on each procedure was rated on a 7-point Likert scale ranging from 1=very poorly to 7=exceptional.

Thirty-five CRA tapes were coded and rated for adherence and competence. It was found that therapists utilized 4.69 procedures on average which indicated good adherence to CRA treatment (SD=1.88, range 1.00 – 9.00). On a scale from 0 to 7, therapists averaged 4.90 in their competence ratings (SD = 1.02, range 1.00 – 6.60), revealing that competence was in the “well” range. Inter-rater reliability for five double-coded tapes for procedure occurrence (adherence) was Kappa = 0.70, and the rater reliability of the procedure rating (competence) was ICC = 0.72.

2.5 Treatment as Usual (TAU)

TAU includes emergency shelter for women and their children up to three weeks at the shelter and linkage to housing and support services in the community. The shelter conducts “rapid re-housing” with the goal for all clients to be discharged to an independent housing situation. The shelter partners with agencies who provide that housing, otherwise, the shelter provides 3 months of subsidized housing with the expectation that women will secure employment within that time frame and become responsible for the rent. Women were placed in a variety of housing programs which included both abstinence- and non-abstinence based, as well as treatment contingent and non-contingent. In this study, those assigned to TAU did not receive project supported housing or the accompanying support services of

CRA and case management, but received the services that they would normally receive through the community.

2.6 Measures

A *demographic form* was administered by research assistants, exploring the ethnicity, age, current marital status, and employment of the mothers as well as characteristics of their children. Mothers also completed *Homeless Experiences Form*, documenting the age of first homelessness, duration and frequency of previous homeless experiences and the reasons for currently having no permanent housing. At the follow-up assessments, research assistants updated locator forms of participants and tracked their present living condition (i.e., supportive housing couch surfing, shelter). In addition, mothers were administered a *Housing Form* to assess whether they obtained and/or maintained housing assistance or related services. The form also documented the income resources and government benefits mothers received to maintain their apartments. In addition, mothers were asked how many nights (in the past 90) they spent at a friend's house, family member's house, in jail, in a homeless shelter, in residential treatment, in abandoned buildings or in an outdoor location. The dependent variable, time spent in independent housing, was assessed by the question, "During the past 3 months (90 days), how many nights did you spend in your own room or apartment?"

Substance use was measured via *The Form 90 Interview* (Miller, 1996) at both baseline and follow-up assessments. The Form 90 is a semi-structured questionnaire that measures the frequency and quantity of drug and alcohol use in the past 90 days. The questionnaire has shown high validity among adults (Westerberg, Tonigan & Miller, 1998) and excellent test-retest reliability for indices of drug use in major categories with kappas for different drug classes ranging from .74 to 1.0 (Tonigan, Miller, & Brown, 1997). The current study utilized the calendar data information to provide scores for the percent days of substance use in the last 90 days.

Research assistants also collected urine samples from the mothers at baseline and at the 3, 6, and 9 month follow-up assessments. *BMC ToxCup® Test Kit* tested for various drug categories including Cannabinoids, Amphetamines, Methamphetamines, Phencyclidine (PCP), Cocaine/Crack, and Opiates (Branan Medical Corp., Irvine, CA). ToxCup reports that THC is detected in the urine for 3–5 days after use for occasional users and up to 14 days for chronic users. Opiates are detectable for up to 3 days, cocaine for 24–60 hours, and amphetamines for 3–5 days after last use. This biological drug screening procedure has shown high specificity and sensitivity to the drugs tested converging with the findings from self-reported drug use (Lennox et al., 2006).

Mothers also self-reported problem consequences of their substance abuse by completing *Inventory of Drug Use Consequences* (InDUC-2L; Arciniega, Miller, Schermer, & Tonigan, 2004; Miller, Tonigan & Longabaugh, 1995). The questionnaire includes 50 dichotomized (yes/no) items which assess physical, intrapersonal, interpersonal, and legal issues associated with substance use. The total INDUC score was used for the present study as a composite measure of problems related to drug and alcohol abuse in the past 3 months. The measure had high reliability in the current sample; Cronbach alphas ranged from .92 to .95 across baseline and 3-, 6- and 9 month follow-up assessments.

2.7 Statistical analyses

2.7.1 Data screening for randomization and attrition—Chi square and t tests were run to explore differences between the intervention and TAU groups at baseline. Specifically, the study arms were compared on the demographic characteristics of the

participants (i.e., age, ethnicity, employment status) as well as mother's substance use and homeless days at pretreatment. In addition, t tests were conducted to test for differential attrition between groups over time. SPSS Version 19 (2010) was utilized for the preliminary analysis.

2.72 Testing treatment outcomes—Treatment effects were investigated using multilevel modeling and primary outcomes included mother's frequency of substance use, problem consequences of their substance use, and independent living days. Hierarchical Linear Modeling (HLM; Raudenbush, Bryk, & Congdon, 2004) was utilized to examine mixed effects over time and between treatment conditions. Following a stepwise model construction procedure, the unconditional model was tested first and ICC scores were estimated. Next, the random coefficients models were run to determine the general form of change that best fit the data across four time points. The within subjects level (Level 1) tested for time effects, exploring the change in outcomes across the 3, 6, and 9 months. At level 1, the linear factor (TIME) estimated the linear growth in outcome, such as the decrease in substance use or increase in independent living days. The quadratic factor (TIME²) estimated the acceleration in the rates of change such as increase in frequency of substance use or decrease in independent living days.

The treatment effect was tested by adding intervention type at the between subjects level (level 2) to explain the variability in change in substance use. This mixed effects model tested the differences between study arms and explored whether the treatment condition explained the linear or quadratic change in outcomes. Treatment type was dummy coded into two variables with treatment as usual as the reference group (EBT = 1 vs. TAU = 0). The results of this analysis provided estimates of the treatment effects over-all taking into account the baseline levels of substance use, problem consequences of substance use and independent living days. The following formulas represent the full mixed effects model for the HLM analyses:

$$\begin{array}{ll} \text{Level 1} & \text{Outcome}_{ij} = \pi_{0j} + \pi_{1j}(\text{TIME}) + \pi_{2j}(\text{TIME}^2) + e_{ij} \\ \text{Level 2} & \pi_{0j} = \beta_{00} + r_{0i} \\ & \pi_{1i} = \beta_{10} + \beta_{11}(\text{EBT}) + r_{1i} \\ & \pi_{2i} = \beta_{20} + \beta_{21}(\text{EBT}) + r_{2i} \end{array}$$

All analyses were run with the full sample using an intent to treat design and Full Maximum Likelihood estimation. Final models with both between and within subject variables are presented in the current paper.

3. Results

3.1 Data screening

3.11 Randomization: Comparison of groups at baseline—As presented in Table 1, mothers in the Ecologically-Based Treatment condition did not differ in age [t (58) = .90, p > .05], ethnicity [χ² (4) = 3.49, p > .05], marital status [χ² (5) = 1.88, p > .05], or monthly income [t (58) = .31, p > .05] from those in the treatment as usual condition. In addition, days of homelessness [t (57) = .31, p > .05], frequency of substance use [t (57) = -.38, p > .05], and substance-use related problems [t (49) = -.58, p > .05] were not statistically different between the groups at baseline. In addition, 6 women (3 EBT, 3 TAU) reported incarceration during the 9 month trial.

3.12 Validity of substance use data—Urine screens obtained from the mothers were compared to their self-reported substance use. Percent days of substance use in the past 90 days (as reported in Form 90) showed high agreement with the urine screening at follow-ups with rates ranging from 90% to 96.7%. These findings indicate high concurrent validity of the substance use data in the current sample.

3.13 Differential attrition from assessments—Follow-up assessments were conducted at 3 time points (3, 6, and 9 months). There were no participants in the Ecologically-Based Treatment condition who refused to complete their assessments (Figure 1). In the treatment as usual group, 6 (20%) mothers missed their 3 month assessment while 5 mothers (16.7%) missed their 6 and 9 month follow-up assessments. Mothers in the treatment as usual condition were more likely to be lost at follow-up than those in the intervention condition [$t(58) = -3.04, p < .01$]. Differential attrition between study arms is understandable given that women in the Ecologically-Based Treatment condition were housed through the project and maintained personal contact with the project staff. Women in the treatment as usual group, on the other hand, were more difficult to reach/track once they left the family shelter.

Attrition was further explored through missing data analyses (Hansen et al., 1985) and descriptives. Specifically, participants who completed assessments were compared to those who missed at least one assessment. T tests revealed no differences between groups in their substance use, problem consequences or independent living days at all time points ($p > .05$). Of 9 participants who were lost to follow-up, 5 (8.3%) women missed only one assessment, 2 (3.3%) women missed two assessments and 2 (3.3%) women missed all three follow-ups. HLM can use all useable data even with attrition as long as there are at least two data points per case (Raudenbush, Bryk, & Congdon, 2009). Given that only two women missed all follow-ups, HLM was preferred for multilevel modeling to handle missing data. Table 2 presents the means and standard deviations of study outcomes

3.14 Mothers seeking additional treatment—Six mothers (20%) in the Ecologically-Based Treatment condition reported seeking additional treatment for substance abuse and mental health issues at baseline, 3 months, and 6 months and four mothers (13.3%) sought additional services at 9 months. Among those in the treatment as usual condition, five mothers (20.8%) reported seeking substance abuse and mental health counseling at baseline, 3, 6, and 9 months. Chi square tests revealed that the groups did not differ in their reports of seeking outpatient counseling services in the current sample ($p > .05$).

3.2 Primary treatment outcomes: Independent living days, substance use, and related problems

3.21 Housing assistance and living conditions among homeless mothers—All women ($n = 30, 100%$) in the Ecologically-Based Treatment group received housing and reported living in their own apartments at the 3 month follow-up. Twenty-four of these mothers (80%) maintained their housing at 6 months and 20 mothers (66.7%) reported residing in their own apartments at the 9 month follow-up. Women in the treatment as usual group received housing through referrals or rental support from the family shelter. At 3 months, 12 mothers (40%) were independently housed, 3 (10%) mothers were in transitional housing, and 2 (6.7%) mothers received Section 8 housing. At 6 months, 14 (46.7%) mothers were housed in their own apartment, and at 9 months, 20 (66.7%) mothers resided in their own apartment. Taken together, these findings revealed that both groups had a 66.7% success rate in independent housing at the 9 month follow-up.

Among the non-housed mothers, at 3 months, 8 (26.6%) mothers in treatment as usual were living with family members while 6 (20%) mothers were staying at friend's houses. Similarly, 5 (16.6%) women in Ecologically-Based Treatment were living with family, and 2 (6.6%) were living with friends at 6 months. In the Ecologically-Based Treatment group, if women were not living in their own apartments at 6 months, they reported that they stayed with family members ($n = 3$; 10%). Only three women ($n = 3$, all in Ecologically-Based Treatment group) went back to shelter at the 6 month follow-up and none of the women reported living in abandoned buildings, or any other outdoor locations.

3.3 Testing treatment and time effects: HLM findings

3.31 Independent living days—The unconditional model suggested significant variability in the baseline independent living days between participants [$\chi^2(59) = 89.6, p < .01$]. The conditional model with mixed effects and random coefficients yielded a main effect for time with a linear pattern (Table 3); mothers in both conditions reported an increasing number of days living in their own apartments over time [$b = 42.26, SE = 11.43, t(58) = 3.69, p < .001$]. There was also a significant quadratic time effect [$b = -5.48, SE = 2.28, t(58) = -2.4, p < .05$], indicating a gradual deceleration of the increase in independent living days by the 9 month follow-up. Treatment effects were also observed in the current sample. Differences in patterns of change were observed within the intervention conditions. For instance, both linear and quadratic rates of change were higher for mothers in the Ecologically-Based Treatment condition than in treatment as usual [linear: $b = 28.85, SE = 5.79, t(58) = 4.98, p < .001$] and [quadratic: $b = -6.82, SE = 1.63, t(58) = -4.19, p < .001$]. That is, mothers receiving housing and rental assistance through the current study showed a faster rate of increase in their independent living days than women in the treatment as usual condition. On the other hand, the Ecologically-Based Treatment group also had a more rapid decrease in independent living days at the 9 month follow-up. As shown in Figure 2, independent living days among mothers in the Ecologically-Based Treatment group continued to increase at 6 months even after rental assistance ended at 3 months. However, the Ecologically-Based Treatment group showed a quick decline at 9 months whereas the treatment as usual group remained unchanged at 9 months. These findings indicate that the differences between treatment groups in their independent living days diminished at 9 month follow-up.

3.32 Frequency of substance use—Multilevel modeling was also utilized to estimate changes in alcohol and drug use among the mothers. The chi square test for the unconditional model was highly significant, revealing variability in baseline alcohol use between participants [$\chi^2(59) = 157.5, p < .001$]. The combined model with mixed effects yielded a significant negative intercept for the linear slope [$b = -16.86, SE = 7.27, t(58) = -2.32, p < .05$] and a positive intercept for the quadratic slope [$b = 1.68, SE = 1.42, t(58) = 1.18, p < .05$]. These results indicate significant reductions in the frequency of alcohol use over time with a slight increase at post-treatment (Table 3). Furthermore, a main effect for treatment was found; mothers in the Ecologically-Based Treatment group showed a quicker decline in alcohol use [$b = -12.08, SE = 5.02, t(58) = -2.4, p < .05$] than mothers in the treatment as usual group (Figure 3). In addition, there were differences in rates of change in frequency of alcohol use over time [$b = 3.13, SE = 1.25, t(58) = 2.5, p < .05$]. As shown in Figure 3, the treatment as usual group reported a different pattern of alcohol use (with an initial increase followed by a decrease) whereas those receiving Ecologically-Based Treatment maintained their reductions in alcohol use.

The same model was run to estimate the rate of change in drug use among treatment conditions. Drug use in that model referred to the frequency of any substance use except tobacco and alcohol. First, the unconditional model was tested and suggested significant

variability in the frequency of drug use among mothers [$F(59) = 250.5, p < .001$]. The conditional model with mixed effects revealed significant linear [$b = -52.32, SE = 10.76, t(58) = -4.86, p < .001$] and quadratic [$b = 9.38, SE = 2.11, t(58) = 4.44, p < .001$] change over time (Table 3). Mothers reported using drugs less frequently over the 6 months, with a slight increase at the 9 month follow-up (Figure 4). Contrary to expectations, no treatment differences were found in drug use ($p > .05$).

3.33 Problem consequences of substance use—The unconditional model suggested significant variability in problems associated with substance use at baseline [$F(59) = 383.8, p < .001$]. Treatment and time effects were also tested to explain this variability in change in problems associated with substance use. Similar to previous models, the mixed effects model retained a significant quadratic [$b = 1.08, SD = .3, t(176) = 3.57, p < .05$] time effect, but yielded no differences across treatment conditions ($p > .05$) (Table 3). That is, mothers experienced fewer interpersonal, social and/or legal problems associated with substance use over time, and their problems slightly increased at the final follow-up in all treatment conditions, and none of the interventions was superior to the other (Figure 5).

3.34 Exploratory analysis: Housing assistance and substance use—As mentioned, the current study found improvements in independent living days, substance use and related problems among the mothers over time. Interestingly, treatment differences were observed for alcohol use and independent living at 3 and 6 months, but not at 9 months. In addition, no differences were found between treatment conditions for drug use and related problems. These findings were further explored through additional analysis. To that aim, the association between housing assistance and substance use was investigated. Preliminary analysis using independent samples t-test suggested that those who moved in to their own apartments at 3 months reported lower substance use at 6 months than those who did not obtain independent living [$t(51) = -2.23, p < .05$]. In addition, housed mothers' frequency of alcohol use at 6 months was lower than those who were not housed [$t(51) = -2.86, p < .01$]. Similarly, women who were housed at 6 months reported lower alcohol use at the 9 month follow-up than non-housed mothers [$t(42) = -2.3, p < .05$]. However, housing at 6 months did not predict drug use at 9 months ($p > .05$).

Multilevel modeling was used to further explore substance use outcomes among mothers as a function of treatment group (Ecologically-Based Treatment vs. treatment as usual) and housing assistance (received housing vs. no housing). Level 1 of the HLM model included linear (TIME) and quadratic time effects (TIME²). Because mothers in the Ecologically-Based Treatment condition received housing assistance earlier than mothers in the treatment as usual condition, housing condition was dummy-coded, accounting for the time mothers were housed. At level 2, variables included HOUSED3 (received housing at 3 months = 1 vs. no housing = 0), HOUSED6 (received housing at 6 months = 1 vs. no housing = 0), and TXGROUP (EBT = 1 vs. TAU = 0). Results suggested that housing at 3 months predicted a reduction in substance use over time [$b = -7.6, SE = 2.73, t(55) = -2.78, p < .01$] with a slight increase in substance use. When the treatment condition was entered in to the model, it was not significant, indicating no association between treatment and substance use after controlling for housing assistance. In other words, women who were housed at 3 months reported decreased substance use at 6 months, regardless of the intervention condition [$b = -7.7, SE = 3.5, t(55) = -2.19, p < .05$]. In sum, the current exploratory findings suggest that housing (either project- or shelter-facilitated) is associated with improvements in substance use over time (Figure 5).

4. Discussion

This study compared Ecologically-Based Treatment, a systematically-developed intervention that included housing and supportive services, to treatment as usual for a sample of substance abusing homeless mothers. The study hypotheses were partially met. Women showed a quicker decline in alcohol use and a quicker increase in housing than women in treatment as usual. However, by the nine month follow-up, the differences between conditions were not apparent. Further, all mothers showed significant improvements in problem consequences associated with alcohol and drug use and in frequency of drug use over time, with no statistically significant differences between the treatment conditions. Although it appeared to require more time for women to receive independent housing in the treatment as usual condition compared to the Ecologically-Based Treatment condition, by nine months, both conditions resulted in 66% of women residing in their own apartments. This compares favorably with prior research. Kertesz et al. (2007) found that 30% (11/37) of cocaine-abusing homeless women in their sample reported stable housing six months after project supported and administered housing ended. However, in their study, stable housing also included living with others in their home. Furthermore, in this study, substance use rates declined significantly over time indicating that substance use did not increase as a result of non-abstinent contingent housing.

The exploratory analysis examined the relationship between housing and substance use, showing that housing at 3 months was associated with reduced drug and alcohol use at six months and housing at 6 months was associated with reduced alcohol use at nine months. This finding supports research suggesting that housing itself is associated with reductions in substance use among those experiencing homelessness (Milby et al, 2005; Tsemberis et al., 2004). It remains unclear whether housing alone is sufficient to observe reductions in drug and alcohol use or whether targeted substance abuse treatment can enhance substance use outcomes. While substance abuse problems can precede homelessness (Caton et al., 2005), research also suggests that homelessness leads to drug use (Roy et al., 2003). That is, resolution of homelessness and the associated stress associated with it may have a substantial impact on alcohol and drug use frequency.

Overall, these findings may offer support for the utility for housing interventions. It is likely that the treatments women received in the experimental and control condition were less important than the non-abstinent based housing itself, in terms of substance use outcomes. Padgett et al. (2006) found less substance use in the Housing First modality at 12 months compared to a greater likelihood of substance use in the abstinence-based continuum of care condition. Substance use not only causes expulsion from abstinence-based housing programs, but being expelled from housing may cause continuing and increased substance use. In regard to housing outcomes, longitudinal research indicates that subsidized housing is virtually the only predictor of residential stability following a shelter stay among homeless families (Padgett et al., 2013). Individual characteristics (including substance use) were more important in predicting shelter requests than later stability.

4.1 Limitations

This study's findings have to be interpreted cautiously as five (16%) mothers in treatment as usual could not be located for the six and nine month follow-up assessment interviews, suggesting that they may have less stable housing and potentially high levels of substance use. As all mothers in the Ecologically-Based Treatment condition were located and interviewed, the findings reported here are likely to be conservative estimates of the difference between the groups. While most women in treatment as usual received apartments between six and nine months post-baseline, those in Ecologically-Based Treatment received their apartments between baseline and three months. Therefore, it is unclear whether women

in treatment as usual would continue to maintain their apartments once rental assistance or other supportive services end, as the final follow-up did not extend long enough to capture that information. Also, the services received through the treatment as usual condition (i.e., shelter) varied significantly, whereas services received by mothers in the Ecologically-Based Treatment condition were manualized and well-documented.

The findings from this sample of convenience may not be generalizable to homeless families in other parts of the country. In this study, 75% of homeless mothers were African American and 11.6% were White, non-Hispanic, which is similar to the city's annual report (Community Shelter Board, 2012) describing homeless families in Columbus Ohio (66% African American and 22% White, non-Hispanic). The U.S. Department of Housing and Urban Development (2011) reports that 42% of all families in shelters between October 2009 and September 2010 were African American and 31% were White/non-Hispanic. That is, African Americans are overrepresented among homeless families in Columbus, Ohio, as compared to other cities in US.

Furthermore, this was a pilot study with a small number of participants in each condition ($n = 30$). Some researchers argue that to have the conventional 80% power (Cohen, 1992), for a significance test of medium difference between two treatment groups, an investigator needs 50 clients per condition (Chambless & Hollon, 1998). Kraemer et al. (2006) similarly state that pilot studies should “serve to check the availability of eligible and willing subjects using the recruitment methods proposed, test the feasibility of the treatment and measurement protocol, and train researchers in study tasks” (p. 488-9). Therefore, although the housing and substance use findings of this study could be interpreted to favor Ecologically-Based Treatment, further testing using a larger sample and longer follow-up are needed. In addition, the current study was a Stage 1 randomized controlled trial and the goal was to develop and test the efficacy of a comprehensive treatment intervention. Therefore, cost-effectiveness and cost-benefit analyses comparing Ecologically Based Treatment to shelter services are lacking in this pilot study. However, future studies utilizing a Stage 2 randomized controlled design can test the extent to which Ecologically-Based Treatment is a cost-effective treatment option as compared to shelter services.

4.2 Conclusions and future directions

Taken together, this is one of the first studies to show that the majority of substance abusing homeless mothers can be successfully housed in their own apartments and maintain those apartments. Furthermore, substance use was found to decrease as a result of housing. In Ecologically-Based Treatment, the decrease in independent housing days occurred between six and nine months, coinciding with the cessation of support services. Future research should test whether longer-term support services are associated with greater housing stability as well as improved alcohol and drug use outcomes. Given the range and severity of presenting struggles, women may benefit from longer-term supportive services.

As this was a pilot study, conclusions regarding the superiority of Ecologically-Based Treatment over treatment as usual cannot be made. Both conditions were associated with positive outcomes including reduced alcohol and drug use, problems associated with drug and alcohol, and maintaining independent apartments. In fact, the family shelter, used as treatment as usual in this study employs a rapid re-housing intervention and is considered a national model for ending homelessness among families. However, in light of the small sample size and short follow-up, the findings show promising outcomes for Ecologically-Based Treatment in terms of a quicker exit from systems-based services and into independent housing, and superior alcohol use outcomes at least to six months. In addition, a quicker entrance into independent housing may have cost implications, such as reducing the costs associated with an extended shelter stay and/or transitional housing or other supervised

housing programs. Also, mothers who received Ecologically-Based Treatment were less likely to be lost at follow-up compared to those in treatment as usual, suggesting greater stability and service connection.

A limited number of studies have examined substance abuse and housing outcomes for this population, and given that the mothers' functioning and housing situation also impacts the children in her care, more attention in this area is needed. Further study of the impact of housing on substance use and other maternal and child outcomes is similarly important. That is, homelessness is a complex multidimensional phenomenon and it is associated with multiple life domains for the mother as well as the child. Resolution of substance abuse problems and homelessness likely impact physical and mental health, employment, educational and other psychosocial outcomes among family members. As substance-abusing homeless women are often reluctant to seek substance abuse treatment services, efforts towards enhancing housing stability can provide a good opportunity for addressing substance abuse problems. In sum, quick entrance into briefly supported permanent housing (three month rent) combined with longer term supportive services (six months or longer) is a promising intervention approach, and may not require a shelter stay. Residing in a shelter does not appear to enhance outcomes, and in fact, this study suggests that a quicker entrance into independent housing may be beneficial to homeless mothers.

Acknowledgments

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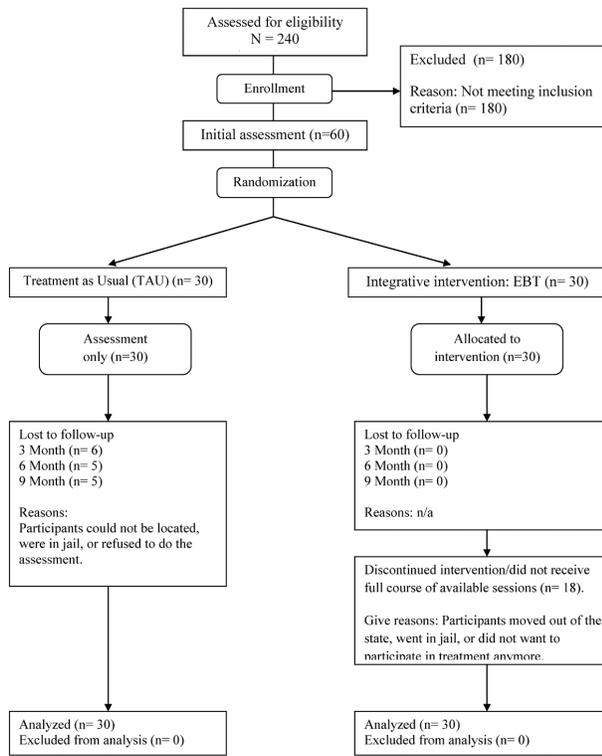


Figure 1.
The CONSORT Flowchart

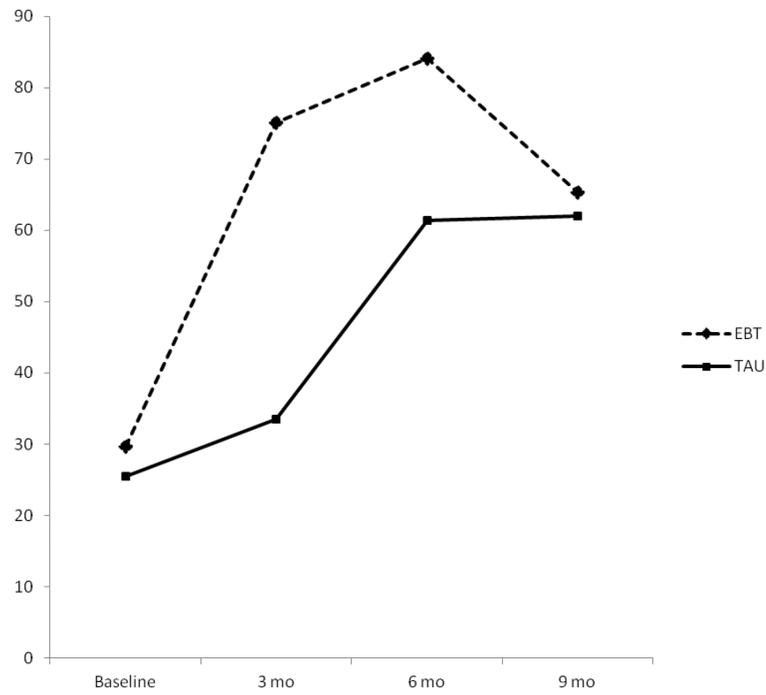


Figure 2. Average number of days mothers resided in their own apartments in the past 90 days by treatment condition

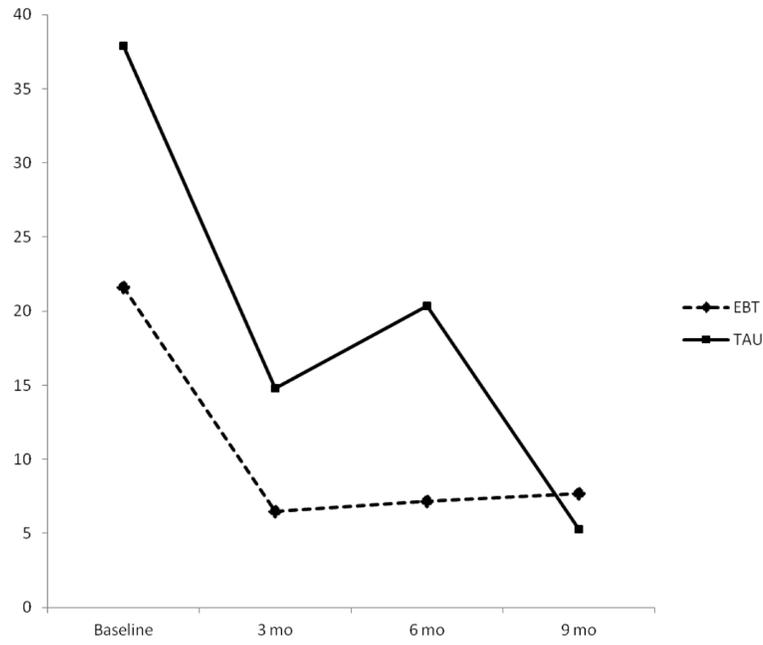


Figure 3. Average percent days of alcohol use in the past 90 days by treatment condition

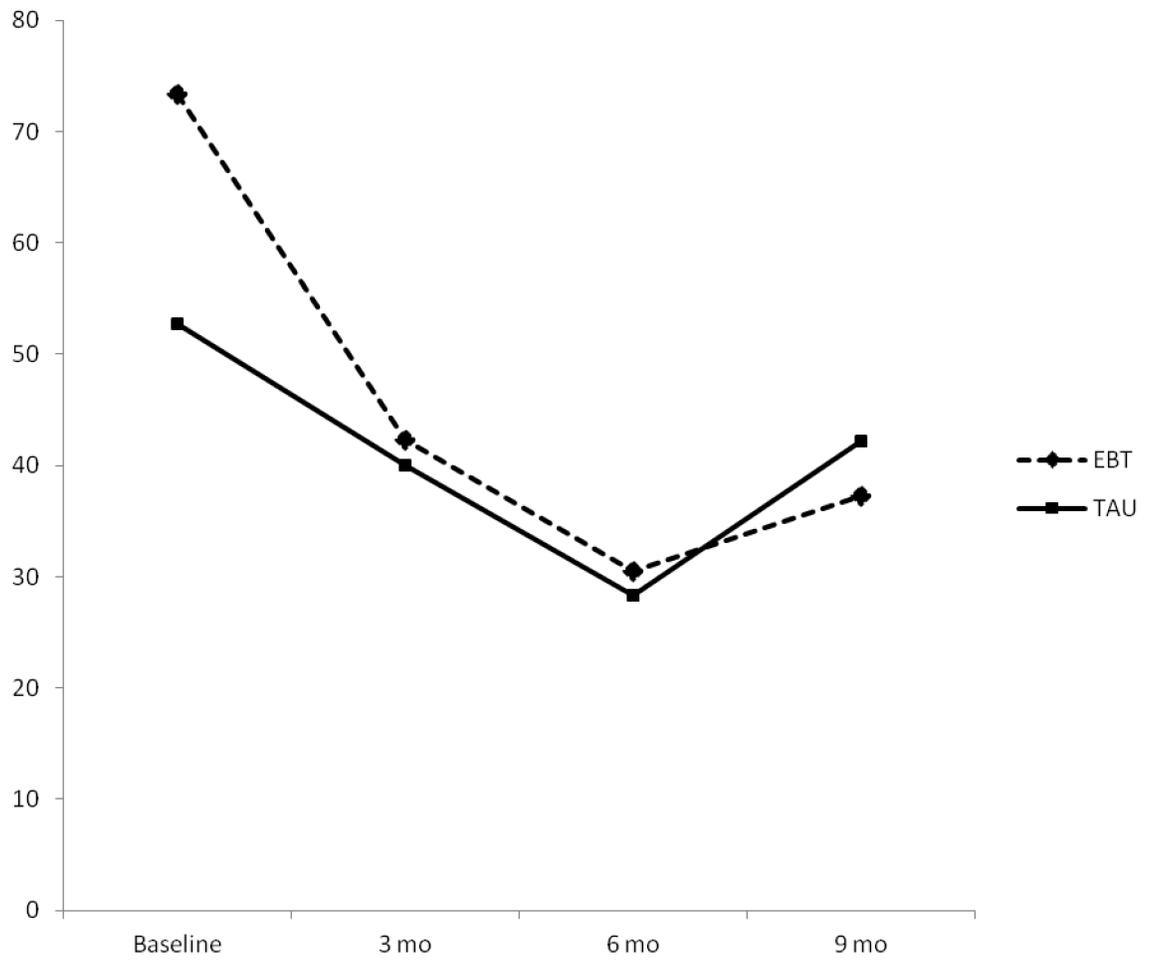


Figure 4. Average percent days of drug use in the past 90 days by treatment condition

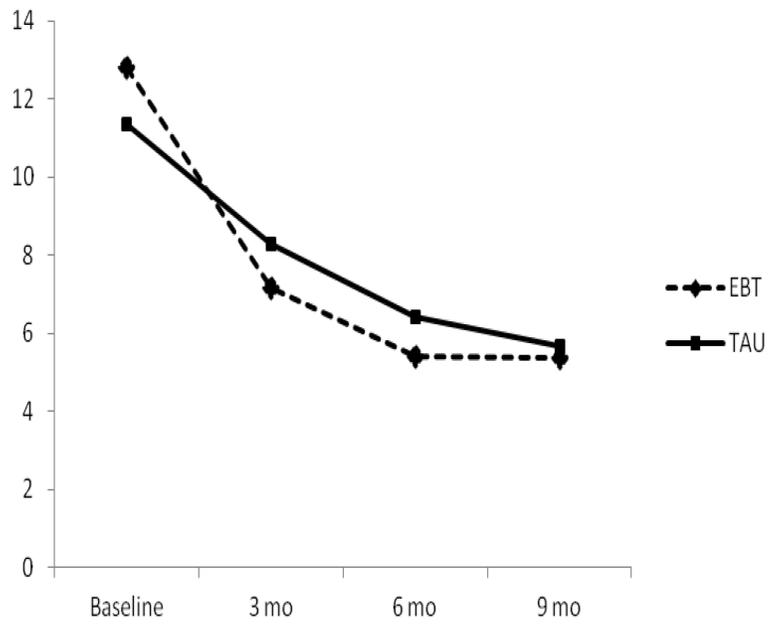


Figure 5.
Average problem consequences of substance use score by treatment condition

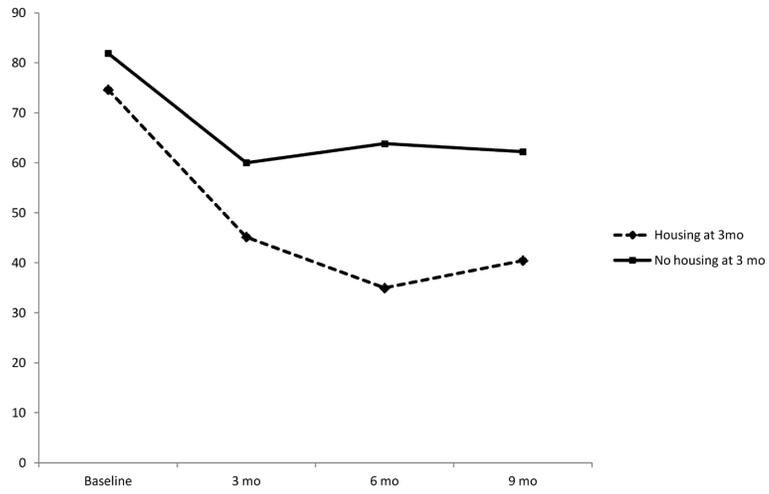


Figure 6. Average percent days of substance use except tobacco in the past 90 days by housing condition

Table 1

Sample characteristics and comparison of study arms at baseline

Variables	Total (N = 60)		EBT (n = 30)		TAU (n = 30)		Test statistic
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	
<i>Demographic characteristics</i>							
Age		26.3 (6.01)		25.6 (5.54)		27.0 (6.46)	t (58) = .90, p > .05. ns
Ethnicity							² (4) = 3.49, p > .05. ns
African/African American	45 (75%)		24 (80%)		21 (70.0%)		
White, non-Hispanic	7 (11.6)		3 (10.0%)		4 (13.3%)		
Asian/Asian American	1 (1.7%)		0		1 (3.3%)		
Hispanic	1 (1.7%)		0		1 (3.3%)		
Mixed/Other	6 (10%)		3 (10.0%)		3 (10.0%)		
Current marital status							² (5) = 1.88, p > .05. ns
Single, never been married	45 (75.0%)		24 (80.0%)		21 (70.0%)		
Separated but still married	6 (10.0%)		2 (6.7%)		4 (13.3%)		
Married and still together	4 (6.7%)		2 (6.7%)		2 (6.7%)		
Cohabiting with partner	2 (3.3%)		1 (3.3%)		1 (3.3%)		
Divorced	2 (3.3%)		1 (3.3%)		1 (3.3%)		
Widowed	1 (1.7%)		0		1 (3.3%)		
Highest level of education in years		11.75 (1.55)		11.83 (1.29)		11.67 (1.79)	t (58) = -.41, p > .05. ns
<i>Employment and Income</i>							
Employment status							
Work 40+ hours a week	1 (1.7%)		1 (3.3%)		0		(3) = 1.11, p > .05. ns
Work less than 40 hours	4 (6.7%)		2 (6.7%)		2 (6.7%)		
Homemaker	9 (15.0%)		4 (13.3%)		5 (16.7%)		
Unemployed	46 (76.7%)		23 (76.7%)		23 (76.7%)		
Personal monthly income		\$300.9 (\$346.9)		\$287.0 (\$352.5)		\$314.9 (\$346.6)	t (58) = .31, p > .05. ns
<i>Homelessness experiences</i>							
Age homeless for the first time		22.02 (7.29)		20.97 (7.69)		23.1 (6.82)	t (57) = 1.13, p > .05. ns
% days homeless in the past 3 months		13.98 (19.3)		13.21 (18.33)		14.77 (20.55)	t (57) = .31, p > .05. ns
<i>Children</i>							
Currently expecting a baby	9 (15%)		5 (16.75)		4 (13.3%)		(1) = .13, p > .05. ns
Average number of children		2.82 (1.73)		2.60 (1.59)		3.03 (1.87)	t (58) = .34, p > .05. ns

Variables	Total		EBT		TAU		Test statistic
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	
Average age of target children		3.68 (1.41)		3.70 (1.26)		3.67 (1.56)	t (58) = -.09, p > . 05. ns
Gender of target children							² (1) = .60, p > .05. ns
Female	29 (48.3%)		16 (53.3%)		13 (43.3%)		
Male	31 (51.7%)		14 (46.7%)		17 (56.7%)		

Table 2

Means and standard deviations of independent living days, substance use and problem consequences of substance use across time

	TOTAL		EBT		TAU	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)
<i>Independent living days</i>						
Baseline	60	27.6 (34.76)	30	29.7 (35.77)	30	25.47 (34.19)
3 months	54	56.61 (34.87)	30	75.13 (17.06)	24	33.46 (37.79)
6 months	53	74.23 (30.69)	30	84.1 (15.46)	23	61.35 (40.08)
9 months	54	63.85 (34.61)	30	65.33 (34.68)	24	62 (35.19)
<i>Alcohol use</i>						
Baseline	59	29.62 (30.74)	30	21.63 (26.6)	29	37.88 (32.9)
3 months	54	10.16 (18.81)	30	6.47 (11.47)	24	14.78 (24.69)
6 months	53	12.9 (23.24)	30	7.18 (13.6)	23	20.37 (30.51)
9 months	55	6.59 (13.52)	30	7.7 (14.84)	25	5.3 (11.9)
<i>Drug use</i>						
Baseline	59	63.26 (37.83)	30	73.4 (33.6)	29	52.76 (39.59)
3 months	54	41.26 (41.14)	30	42.26 (39.8)	24	40.01 (43.49)
6 months	53	29.57 (38.48)	30	30.5 (40.1)	23	28.35 (37.18)
9 months	55	39.96 (41.39)	30	37.2 (39.6)	25	43.25 (43.99)
<i>Problem consequences</i>						
Baseline	51	12.1 (8.84)	26	12.81 (8.7)	25	11.36 (9.1)
3 months	52	7.6 (9.3)	29	7.17 (8.9)	23	8.13 (9.9)
6 months	52	5.87 (8.5)	29	5.4 (9.8)	23	6.43 (6.54)
9 months	53	5.51 (7.6)	29	5.4 (7.9)	24	5.67 (7.4)

Table 3
Results of mixed effects modeling testing change in outcomes over time across treatment conditions

	Primary outcome variables							
	Independent living days		Alcohol use		Drug use		Problem consequences of substance use	
	Coefficient (SE)	t-value	Coefficient (SE)	t-value	Coefficient (SE)	t-value	Coefficient (SE)	t-value
<u>Fixed effects</u>								
Intercept	-20.62 (12.48)	-1.65	48.83 (8.34)	5.73 ***	103.28 (11.03)	9.36 ***	4.35 (1.03)	4.23 ***
<u>Linear slope</u>								
Intercept	42.26 (11.43)	3.69 ***	-16.86 (7.27)	-2.32 *	-52.32 (10.76)	-4.86 ***	-1.9 (1.23)	-1.5
EBT	28.85 (5.79)	4.98 ***	-12.08 (5.02)	-2.40 *	8.71 (7.88)	1.10	-49 (1.55)	-32
<u>Quadratic slope</u>								
Intercept	-5.48 (2.28)	-2.4 *	1.68 (1.42)	1.18	9.38 (2.11)	4.44 ***	1.08 (.3)	3.57 *
EBT	-6.82 (1.63)	-4.19 ***	3.13 (1.25)	2.5 *	-2.74 (1.81)	-1.53	.07 (.38)	.18
<u>Random effects</u>								
Intercept	4696.76 (68.53)	109.21 ***	2551.75 (50.5)	137.1 ***	2491.08 (49.9)	79.18 **	22.99 (4.79)	75.06 *
Linear slope	3056.67 (55.29)	93.91 ***	1231.92 (35.1)	96.54 ***	1485.77 (38.5)	69.0 *	23.88 (4.88)	75.72 *
Quadratic slope	98.86 (9.94)	85.41 **	34.66 (5.9)	80.26 **	39.62 (6.3)	64.31	1.89 (1.38)	96.76 ***
Level 1 error	551.40 (23.48)		187.12 (13.7)		567.42 (23.82)		3.45 (1.86)	

Note: Table presents the final random coefficients mixed model results with quadratic time.

* p < .05

** p < .01

*** p < .001