Published in final edited form as:

Addict Behav. 2012 August ; 37(8): 931–939. doi:10.1016/j.addbeh.2012.03.029.

Motivation to change and treatment attendance as predictors of alcohol-use outcomes among project-based Housing First residents

Susan E. Collins, PhD^a, Daniel K. Malone, MPH^b, and Mary E. Larimer, PhD^c

^aDepartment of Psychiatry and Behavioral Sciences University of Washington 325 9th Ave, Box 359911 Seattle, WA 98104, USA

^bDowntown Emergency Service Center 515 3rd Ave Seattle, WA 98104, USA

^cDepartment of Psychiatry and Behavioral Sciences University of Washington 1100 NE 45th Street, Suite 300, Box 354944 Seattle, WA 98105, USA

Abstract

Collins et al. (2012) indicated that time spent in a project-based Housing First (HF) intervention was associated with improved two-year alcohol-use trajectories among chronically homeless individuals with alcohol problems. To explore potential correlates of these findings, we tested the relative prediction of alcohol-use outcomes by motivation to change (MTC) and substance abuse treatment attendance. Participants ($N=95$) were chronically homeless individuals with alcohol problems receiving a project-based HF intervention in the context of a larger nonrandomized controlled trial (Larimer et al., 2009). Participants were interviewed regularly over the two-year follow-up. Treatment attendance and MTC were measured using items from the Addiction Severity Index and the SOCRATES, respectively. Alcohol-use outcomes included alcohol quantity, problems and dependence. Generalized estimating equation modeling indicated that MTC variables and not treatment attendance consistently predicted alcohol-use outcomes over the two-year follow-up. Findings suggest that the importance of motivation to change may outweigh treatment attendance in supporting alcohol behavior change in this population.

Keywords

Housing First; homeless; alcohol use; drinking; motivation to change; treatment attendance

Among the many problems facing chronically homeless people, the experience of alcohol-use disorders (AUDs) is one of the most widespread and physically debilitating. The

© 2012 Elsevier Ltd. All rights reserved

Correspondence concerning this article should be mailed to Susan E. Collins at the University of Washington – Harborview Medical Center, 325 9th Ave, Box 359911, Seattle, WA 98104. Telephone: (206) 832-7885. Fax: (206)744-9939. collinss@uw.edu..

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Contributors S.E. Collins and D.K. Malone codeveloped the study idea. S.E. Collins developed the design and methodology; conducted the primary statistical analyses; and served as the lead author on most sections of the article. D.K. Malone contributed to the study design and interpretation of the findings; outlined and wrote parts of the discussion; and critically reviewed and provided feedback on multiple drafts. M.E. Larimer critically reviewed and provided feedback on the article. All authors approved the final article.

Conflict of Interest All authors declare they have no conflicts of interest.

prevalence of alcohol use in homeless populations has been estimated to be as high as 80% (Velasquez, Crouch, von Sternberg, & Grosdanis, 2000), and a review of 29 studies conducted worldwide estimated a mean alcohol dependence prevalence of 37.9% (Fazel, Khosla, Doll, & Geddes, 2008). Although there are very few studies addressing alcohol use among chronically homeless individuals, the prevalence of alcohol dependence in this population has been estimated to be even higher (Kuhn & Culhane, 1998). Because alcohol dependence is associated with very high levels of alcohol-related harm and increased risk for alcohol-related deaths (Eyrich-Garg, Cacciola, Carise, Lynch, & McLellan, 2008; O'Connell, 2005), effective approaches are needed to engage and address the issues facing chronically homeless people with AUDs.

1.1 Continuum Model of Housing and Abstinence-based Treatment for this Population

Since the 1990s, the most widely used means of housing and service provision to chronically homeless people has been the “continuum-of-care model” of housing (U.S. Department of Housing and Urban Development, 2010). This model typically requires individuals to fulfill certain requirements, such as alcohol abstinence achievement and treatment attendance, before they may transition from a shelter to transitional housing to permanent housing. These aspects of the continuum model of housing are complementary to the medical model of alcohol treatment. The medical model characterizes alcohol dependence as a “chronic, relapsing brain disease” that should be addressed using formal treatments that are designed to help people achieve and maintain abstinence (Leshner, 1997; National Institute on Drug Abuse, 2008). The combined continuum/medical model therefore typically requires abstinence-based treatment and abstinence achievement to be bundled with supportive housing services (U.S. Department of Housing and Urban Development, 2010).

1.2 HF as a Harm Reduction Approach to Housing

In contrast to the continuum/medical model, Housing First (HF) is an approach to housing that advocates immediate, permanent, low-barrier supportive housing that is not dependent upon the fulfillment of specific requirements, such as abstinence achievement and treatment attendance (Larimer, et al., 2009; Pearson, Locke, Montgomery, & Buron, 2007; Tsemberis, Gulcur, & Nakae, 2004). HF is therefore consistent with harm-reduction approaches, which deemphasize pathologizing alcohol use and support the realization of client-driven goals that can reduce harm and improve quality of life (Collins et al., 2011; Denning & Little, 2011; Marlatt, 1996). These goals may but are not required to include abstinence (Harm Reduction Coalition, 2009; Robbins, Callahan, & Monahan, 2009; Zerger, 2002).

One of the fundamental theoretical differences between the continuum/medical and HF/harm reduction models lies in the understanding of the mechanism by which individuals are likely to change their behavior to support a variety of goals (e.g., housing stability, alcohol behavior change). The continuum/medical model holds that alcohol behavior change—particularly among more severely dependent populations—is optimally achieved through external structure, such as treatment attendance and rewarding more “desirable” behavior, such as abstinence achievement, with permanent housing (U.S. Department of Housing and Urban Development, 2010). In contrast, the HF/harm reduction model is built on the assertion that behavior change is most lasting if it is client-driven and thereby reflects clients' own motivation to change (Tsemberis, et al., 2004). This model is consistent with the concept of “self-change,” which implies that some individuals with substance use problems can develop resolution strategies for these problems (Klingemann, Sobell, & Sobell, 2010).

1.3 Motivation to Change and Alcohol Outcomes

Motivation to change (MTC) has been described as a multidimensional, dynamic construct that represents one's openness to enter into a behavior change strategy (W. R. Miller, 1999). To the authors' knowledge, only three studies to date have explored MTC in regards to substance use among homeless adults. In the first of these studies, which involved 342 homeless individuals with co-occurring psychiatric and substance-use disorders, bivariate correlations indicated that higher baseline levels of MTC and readiness for treatment were associated with higher baseline levels of alcohol and other drug use, housing instability and psychiatric severity (De Leon, Sacks, Staines, & McKendrick, 1999). Thus, MTC in this sample appeared to represent participants' problem recognition rather than taking steps towards behavior change. In a study of 100 homeless adults in a shelter program, over half of the participants reported they drank "too much," which again reflected problem recognition, whereas a smaller minority reported currently taking steps to change their behavior (Velasquez, et al., 2000). Finally, a more recent study of 370 homeless and housed patients in an acute care setting showed that homeless individuals were more likely to report being in the "action" stage of change than housed individuals (O'Toole, Pollini, Ford, & Bigelow, 2008). Thus, these individuals were more likely than their housed counterparts to report taking steps towards changing their alcohol-use behavior.

Although the findings are not entirely consistent, these three studies showed that most participants had some interest in changing their substance use and that some were actively taking steps towards that goal—despite the fact that most were neither abstinent nor involved in abstinence-based treatment. These studies also highlight an important literature gap: there are no studies to date testing the longitudinal associations between MTC and alcohol outcomes among chronically homeless individuals.

1.4 Abstinence-based Treatment and Alcohol Outcomes

The literature on the associations between abstinence-based treatment and alcohol outcomes are mixed for homeless populations. Although literature reviews suggest that abstinence-based approaches for homeless individuals are associated with modest improvements in alcohol outcomes (Hwang, Tolomiczenko, Kouyoumdjian, & Garner, 2006; Zenger, 2002), these improvements are only experienced by the few who are fully engaged and retained in treatment. In fact, studies show that few homeless people start treatment (15–28%) (Rosenheck et al., 1998; Wenzel et al., 2001), and of those who start treatment, few complete it (2.5–33%) (Orwin, Garrison-Mogren, Jacobs, & Sonnefeld, 1999). An NIAAA review of US alcohol and drug treatment programs showed that treatment engagement in this population decreased as program demands—particularly abstinence from substances—increased (Orwin, et al., 1999). This finding has recently been corroborated by research showing greater retention and decreased substance use among participants in Housing First programs compared to abstinence-based housing requiring treatment attendance (Padgett, Stanhope, Henwood, & Stefancic, 2011).

Studies have begun to explore potential factors underlying the failure of abstinence-based treatment to adequately engage and thereby optimally treat this population as a whole. Qualitative studies have documented that many chronically homeless individuals do not find abstinence-based goals and treatments to be acceptable or desirable (Collins, Clifasefi, et al., 2012; Padgett, Henwood, Abrams, & Davis, 2008). Such negative evaluations of abstinence-based treatment are correlated with decreased treatment attendance and poorer treatment outcomes (Long, Williams, Midgley, & Hollin, 2000; Pettinati, Monterosso, Lipkin, & Volpicelli, 2003). Relatedly, both theory and empirical data suggest that repeated failed treatment attempts may erode self-efficacy and self-control for later behavioral change

(Marlatt & Gordon, 1985; Muraven & Baumeister, 2000). Our recent documentation of a mean of 16 failed lifetime treatment attempts in a sample of chronically homeless individuals with AUDs highlights the obvious obstacles to abstinence achievement (Larimer, et al., 2009). On the other hand, many of the same individuals who were not motivated for abstinence-based treatment did express interest in changing their drinking to reduce alcohol-related problems (Collins, Clifasefi, et al., 2012). Further, in another recent study on this population, we found that chronically homeless individuals with AUDs who moved into project-based HF significantly reduced their alcohol use and related problems over a two-year period (Collins, Malone, et al., 2012).

1.5 Current Study Aims and Hypotheses

The current, secondary study was conducted to quantitatively explore potential mechanisms associated with these improved, two-year alcohol-use outcomes following exposure to a project-based HF program (see Collins, Malone, et al., 2012 for more information on the parent study). Specifically, we tested the relative strength of both MTC and abstinence-based treatment attendance in predicting alcohol quantity, frequency and problems among chronically homeless people with AUDs for two years after their move into a project-based HF program. In doing so, we are adding to the sparse literature on the association between MTC, treatment and longitudinal alcohol outcomes for this population. We are also extending the current literature, which to our knowledge, does not yet comprise a study testing the relative contributions of internal, self-change oriented constructs (e.g., MTC) versus formal treatment attendance to alcohol behavior change in a project-based HF setting. Based on the current literature on abstinence-based treatment attendance for this population (Orwin, et al., 1999), self-change (Klingemann, et al., 2010) and our own research observations (Collins, Clifasefi, et al., 2012; Collins, Malone, et al., 2012), we hypothesized that alcohol-use outcomes would be more strongly associated with MTC versus treatment attendance.

2. Material and Methods

This study features secondary analyses of data (Collins, Malone, et al., 2012), which were collected in the context of a larger, nonrandomized controlled trial comparing the effects of an HF intervention and a wait-list control condition on public system utilization and associated costs (Larimer, et al., 2009). For more detailed information on the within-subjects' design, methods and 2-year alcohol-use findings, please refer to the parent study (i.e., Collins, Malone, et al., 2012).

2.1 Participants

Participants ($N = 95$; 6.3% women) were chronically homeless individuals with alcohol problems who had been allocated to receive an HF intervention (see Table 1 for sample description). Participants were drawn from 2 sources: (1) a rank-ordered list of individuals who had incurred the highest public costs for alcohol-related use of emergency services, hospital, sobering center (i.e., a local sleep-off facility), and county jail in 2004 and (2) a list of eligible individuals suggested by community providers familiar with the target population.

2.2 Measures

2.2.1 Demographic variables for sample description—Descriptive information, including age, gender, ethnicity, education, employment, partnership status, and housing history, was assessed using single items during the baseline interview to provide sample description.

2.2.2 Predictors and covariates—The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES; W. R. Miller & Tonigan, 1996) comprises 19 items assessing MTC on three factors (i.e., Ambivalence, Recognition, Taking Steps). Participants rated each item on a five-point Likert scale, where 1 = strongly disagree and 5 = strongly agree. Thus, higher agreement ratings for each item of a given scale corresponded to greater self-reported *ambivalence* or concern about alcohol use, *recognition* of alcohol-related problems, and *taking steps* towards actual alcohol-use behavior change, respectively. Mean scores were created to maximize available data and to place the scores on the same 1–5 scale. The reliability of the three factors was adequate in the current study ($\alpha = .70-.91$).

Treatment attendance was recorded using three items from the ASI Current Substance Use Assessment that assessed attendance at substance abuse treatment in the past 30 days (McLellan, Kushner, Metzger, & Peters, 1992). Items were collapsed to represent any substance abuse treatment attendance (drug or alcohol; inpatient or outpatient) and were dummy coded, where 1 = attended and 0 = did not attend. We collapsed the treatment attendance variables to ensure we included abstinence-based treatment episodes that addressed participants' potentially overlapping polysubstance use and to thereby capture any and all exposure to abstinence-based treatments.

Mortality, including all causes of death during the two-year study, was ascertained using agency records. Mortality was included as a dummy-coded covariate to parallel previous analyses (Collins, Malone, et al., 2012; Larimer, et al., 2009), and to account for the fact that the resulting data missingness can affect overall modeling of alcohol-use outcomes in a group that experiences higher mortality due to conditions related to alcohol dependence (Public Health - Seattle and King County, 2004).

2.2.3 Outcome variables—The Alcohol Use Quantity Form was modified from the Timeline Followback for use with this population (Larimer, et al., 2009; Sobell & Sobell, 1992), and yielded alcohol quantity on typical and peak drinking occasions in the past 30 days (typical and peak quantity). Drinking to the point of intoxication in the past 30 days was assessed using a single item from the ASI Current Substance Use Assessment and was dummy-coded (McLellan, et al., 1992). Alcohol-related problems were measured at each interview using the 15-item Short Inventory of Problems (SIP-2R; Blanchard, Morgenstern, Morgan, Labouvie, & Bux, 2003), which was adapted from the Inventory of Drug Use Consequences-2R (InDUC-2R; W. Miller, Tonigan, & Longabaugh, 1995). This measure assesses impulse control; social responsibility; and physical, interpersonal, and intrapersonal consequences of alcohol use. The SIP-2R summary score has been shown to be both reliable and valid in substance-using populations (Kenna, Longabaugh, Gogineni, & Woolard, 2005). Frequency of delirium tremens (DTs; severe symptom of acute alcohol withdrawal) was measured using a single item from the ASI Current Substance Use Assessment (McLellan, et al., 1992). This item was dummy-coded to reflect any versus no self-reported DTs in the last 30 days. Alcohol dependence was assessed using the Alcohol Dependence Checklist. This measure includes dichotomous, self-report items that correspond to DSM-IV-TR criteria for alcohol dependence (American Psychiatric Association, 2000). The items were summed ($K-R = .70$), and a cutoff of 3 symptoms was used to generate a dummy-coded variable indicating presence/absence of symptoms congruent with alcohol dependence.

2.3 Procedure

Housing program staff offered housing to people in the recruitment pool who were found in the community. Once housing was filled (capacity is 75 beds), additional participants were added to a wait-list. Verbal consent for the parent study was collected by housing program

staff. Interested individuals then met with research staff for an information session for which they were compensated \$5, regardless of study participation. Those who still wished to participate either completed the baseline assessment immediately or were scheduled for subsequent appointments. Written, informed consent was obtained at baseline. Next, participants were verbally administered the questionnaires described above as part of a larger questionnaire battery. Participants were paid \$20 for all data collection interviews, which occurred at baseline and 3-, 6-, 9-, 12-, 18- and 24-month follow-ups.

Waitlisted participants were moved into the housing project when turnover occurred. Individuals moving into housing within the first three months of study enrollment ($n = 20$) were also included in the current study ($N = 95$). The remaining wait-list control participants were not systematically assessed after the first 9 months because they either moved into the HF project or other housing as it was made available. Because complete, two-year data were available for the intervention group alone, the current analyses only involve intervention participants. Institutional Review Board approval for all procedures was obtained from the University of Washington and King County Mental Health Chemical Abuse and Dependency Services Division (MHCADSD).

2.4 Data Analysis Plan

Population-averaged generalized estimating equations (GEE; Zeger & Liang, 1986) were used to test the following nested models. The first model was the reduced, covariates-only model and included a) centered, linear *time*, to control for the simple time effects that could reflect some regression to the mean; and b) *mortality*. The second model included the centered *MTC* variables (i.e., Recognition, Ambivalence and Taking Steps mean scores) and two-way *time* $\times$ *MTC* interactions. The third model examined the additive effects of substance abuse *treatment attendance* and the *time* $\times$ *treatment attendance* interaction. The relative fit of the models was determined using quasiliikelihood under the independence model information criterion (QICu) score (i.e., a lower score indicates a better-fitting model; Hardin & Hilbe, 2003) and the Wald test, which tests whether the joint contributions of specified variables (e.g., the addition of treatment attendance to the nested model) are significantly different from zero.

Alcohol-related variables consisted of 30-day quantity-frequency outcomes (i.e., typical and peak quantity, drinking to intoxication); 3-month experience of alcohol-related problems (i.e., SIP summary score, DTs); and self-report of DSM-IV-TR criteria congruent with alcohol dependence. Because alcohol-related outcomes were recoded dichotomously or were positively skewed, overdispersed counts/integers (Neal & Simons, 2007), we specified Bernoulli (with logit link) and negative binomial (with log link) distributions, respectively. Repeated measures on one case served as the sole clustering variable. Because the data were clustered, unbalanced and evinced gaps for some participants, we used an exchangeable correlation structure to ensure model convergence (Hardin & Hilbe, 2003). To enhance model interpretability, exponentiated coefficients (e.g., odds ratios, incident rate ratios) were used. Alpha was set to $p = .05$, and confidence intervals were set to 95%.

3. Results

3.1 Exploratory Data Analyses

Participant response rates were 100%, 82%, 79%, 79%, 80%, 79% and 61% for each respective assessment throughout the 2-year follow-up. Logistic regressions indicated that baseline drinking, demographic, and motivational variables did not significantly predict missingness on corresponding outcome variables at the follow-up points ($ps > .12$). Although missingness occurring completely at random cannot be directly tested because the

probability of missingness on the outcome variable is assessed as a function of the values of both predictors and outcome variables, these tests suggested that the missingness mechanism may be “ignorable” for the primary analyses (Allison, 2001). Further, the current analyses, which use maximum likelihood estimation, can minimize bias that may otherwise be introduced in the case of listwise data deletion (Allison, 2001).

3.2 Descriptive Analyses

Participants in this study evinced relatively high, yet decreasing scores on alcohol-use variables over the two-year follow-up (see Table 2). On the other hand, participants evinced relatively consistent MTC scores (see Table 2). Using the original Likert scale, where 1=strongly disagree and 5 = strongly agree, participants showed mean responses primarily consistent with the “undecided or unsure” level of the scale for Recognition (overall $M = 3.66$, $SD = .98$), Ambivalence (overall $M = 3.28$, $SD = 1.03$), and Taking Steps (overall $M = 3.10$, $SD = 1.05$) over the two-year period. Regarding treatment attendance, 47.4% (45/95) of participants reported attending treatment at some point during the two-year follow-up. Only one participant, however, reported continuous participation in treatment. Of those who did attend treatment, the majority reported attending during only one time period during the two-year follow-up (51.4%; 23/45).

3.3 Correlations Between MTC and Treatment Attendance Predictors

Point-biserial correlations were conducted to document the correlations among MTC (SOCRATES ambivalence, recognition and taking steps scales) and treatment attendance predictor variables. Treatment attendance and recognition ($r_{pb} = .21$, $p = .0001$) and taking steps ($r_{pb} = .22$, $p = .0001$) evinced significant yet weak positive correlations, whereas treatment attendance and ambivalence did not ($r_{pb} = -.04$, $p = .34$).

3.4 Generalized Estimating Equation Models

3.4.1 Typical alcohol quantity—The MTC model was significant, Wald χ^2 (8, $N = 95$) = 65.70, $p < .001$, and contributed significantly above and beyond the covariates alone, χ^2 (6) = 53.68, $p < .001$. Each one-point increase on the Recognition and Taking Steps scales was associated with 34% higher and 19% lower typical drinking quantity, respectively (see Table 3 for model parameters). The QICu statistic indicated the full model, Wald χ^2 (10, $N = 94$) = 73.47, $p < .001$, QICu = 601, including treatment effects, was better-fitting than the MTC-only model (QICu = 624). On the other hand, the Wald test ($p = .27$) and individual parameter tests ($ps > .10$) indicated the effects of treatment attendance in the last 30 days did not significantly contribute to the prediction of drinking outcomes.

3.4.2 Peak alcohol quantity—The MTC model was significant, Wald χ^2 (8, $N = 95$) = 49.88, $p < .001$, and added significantly to the covariates-only reduced model, χ^2 (6) = 28.31, $p < .001$. As shown in Table 3, each one-point increase on Recognition and Taking Steps scales was associated with 26% higher and 17% lower peak drinking rates, respectively. No time x MTC variable interactions were significant ($ps > .16$). The QICu statistic indicated the full model, Wald χ^2 (10, $N = 94$) = 50.43, $p < .001$, QICu = 638, including treatment effects, was better-fitting than the MTC model (QICu = 663). However, the Wald test ($p = .15$) and individual parameter tests ($ps > .06$) indicated the effects of treatment attendance did not significantly contribute to the prediction of peak quantity.

3.4.3 Days not drinking to intoxication—The MTC model was significant, Wald χ^2 (8, $N = 95$) = 61.82, $p < .001$, and added significantly to the covariates-only reduced model, χ^2 (6) = 41.12, $p < .001$. As shown in Table 3, each one-point increase on Recognition and Taking Steps scales was associated with one-third lower and 2.3 times higher odds of

reporting at least one day not drinking to intoxication, respectively. No time $\times$ MTC variable interactions were significant ($p > .61$). The QICu statistic indicated the full model, Wald χ^2 (10, $N = 94$) = 51.79, $p < .001$, QICu = 533, including treatment effects, was better-fitting than the MTC model (QICu = 556). However, the Wald test ($p = .21$) and individual parameter tests ($p > .13$) indicated the effects of treatment attendance did not significantly contribute to the prediction of days not drinking to intoxication.

3.4.4 Alcohol-related problems—The MTC model was significant, Wald χ^2 (8, $N = 94$) = 127.79, $p < .001$, and added significantly to the covariates-only reduced model, χ^2 (6) = 124.81, $p < .001$. As shown in Table 3, each one-point increase on Ambivalence and Recognition scales was associated with 13% and 66% higher rates of alcohol-related problem experience, respectively. Additionally, the time $\times$ Recognition and the time $\times$ Taking Steps interactions were significant. These interactions indicated each one-point increase in Recognition corresponded to a 4% increase in alcohol-related problems every three months; whereas each one-point increase on Taking Steps corresponded to a 3% decrease in alcohol-related problems every three months. The QICu statistic indicated the full model, Wald χ^2 (10, $N = 93$) = 153.97, $p < .001$, QICu = 412, including treatment effects, was better-fitting than the MTC model (QICu = 434). The Wald test supported this finding, $\chi^2(2) = 12.37$, $p = .002$, and individual parameter tests indicated that, averaged over the course of the study, treatment attendance was associated with a 23% higher experience of alcohol-related problems (see Table 3). On the other hand, treatment attendance was not associated with longitudinal change in alcohol-related problems experienced ($p = .96$).

3.4.5 Experience of delirium tremens—The MTC model was significant, Wald χ^2 (8, $N = 95$) = 61.70, $p < .001$, and contributed significantly above and beyond the covariates-only reduced model, χ^2 (6) = 22.87, $p < .001$. Each one-point increase on the Recognition scale was associated with 56% higher odds of self-reported DTs (see Table 3). No time $\times$ MTC interactions were significant ($p > .61$). The QICu statistic indicated the full model, Wald χ^2 (10, $N = 94$) = 61.19, $p < .001$, QICu = 620, including treatment effects, was better-fitting than the MTC model (QICu = 643). The Wald test, however, did not support the model fit analyses ($p = .15$), and there were no significant treatment effects ($p > .08$).

3.4.6 Symptoms congruent with alcohol dependence—The MTC model was significant, Wald χ^2 (8, $N = 95$) = 47.08, $p < .001$, and contributed significantly above and beyond the covariates-only reduced model, χ^2 (6) = 38.08, $p < .001$. As shown in Table 3, each one-point increase on the Ambivalence and Recognition scales was associated with 1.5 and over 2 times the odds of reporting symptoms congruent with alcohol dependence, respectively. No time $\times$ MTC variable interactions were significant ($p > .20$). The QICu statistic indicated the full model, Wald χ^2 (10, $N = 94$) = 52.01, $p < .001$, QICu = 394, including treatment effects, was better-fitting than the MTC model (QICu = 409). The Wald test ($p = .21$) and individual parameter tests ($p > .10$), however, indicated the effects of treatment attendance did not significantly contribute to the prediction of alcohol dependence.

4. Discussion

In a previous study, we found a consistent association between exposure to a project-based HF intervention and two-year decreases in alcohol-use outcomes among formerly chronically homeless individuals with alcohol problems (Collins, Malone, et al., 2012). In this secondary analysis, we tested potential motivational and treatment-related correlates of these findings. As hypothesized, we found that aspects of MTC, as measured by the ambivalence, recognition and taking steps scales of the SOCRATES, were associated with

alcohol-use outcomes. On the other hand, treatment attendance, an oft-cited underlying change mechanism, did not consistently add to the prediction of alcohol-use outcomes.

4.1 MTC as a Predictor of Alcohol-use Outcomes

“Recognition” of problem drinking was consistently associated with greater overall alcohol-use during the two-year follow-up. Although it seems contradictory, this finding corresponds to the MTC literature, which suggests that recognition may serve as a proxy for drinkers' awareness of their alcohol-related problems and heavy drinking (Carey, Purnine, Maisto, & Carey, 1999; Collins, Logan, & Neighbors, 2010; Maisto et al., in press). Problem recognition has been acknowledged as an early step in movement towards behavior change and was included in the SOCRATES to represent the transition between the precontemplation and determination stages of change (W. R. Miller & Tonigan, 1996). It does not, however, necessarily follow that people who recognize their own alcohol problems will actually engage in subsequent behavior change. Recognition may therefore represent a necessary but not sufficient condition for alcohol behavior change that must also occur in the presence of people's belief that change is important and possible (W. R. Miller & Rollnick, 2002; Rollnick, 1998).

“Ambivalence” about alcohol use is represented by items such as “sometimes I wonder if I am an alcoholic” and “sometimes I wonder if my drinking is hurting other people.” The ambivalence scale was positively associated with self-reported alcohol-problem experience and odds of reporting symptoms congruent with alcohol dependence. These findings are somewhat similar to those from a previous study with patients who were dually diagnosed with persistent and severe mental illness and alcohol dependence (Zhang, Harmon, Werkner, & Arthur, 2004). In that study, however, greater baseline ambivalence was associated with greater alcohol *quantity* at the 9-month follow-up (Zhang, et al., 2004). In this study--similar to the findings for recognition--ambivalence appeared instead to reflect an awareness or contemplation of alcohol-related problems that did not necessarily translate into actual alcohol behavior change.

The “Taking Steps” scale represents an individual's movement into the “action” stage of change (W. R. Miller & Tonigan, 1996), and includes items such as “I have already started making some changes in my drinking” and “I am actively doing things now to cut down or stop drinking.” This is the scale of the SOCRATES that has been most consistently associated with improved longitudinal alcohol outcomes (Carey, et al., 1999), and of the three SOCRATES scales, it is most closely identifiable with what is commonly considered motivation to change. This scale predicted lower alcohol quantity on typical and peak drinking occasions and greater odds of reporting days not drinking to intoxication averaged over the 2-year follow-up. Taking steps also predicted longitudinal reductions in alcohol-related problems over time. Thus, greater self-reported action towards alcohol-behavior change was correlated with improved alcohol-use outcomes. This finding corresponds to those of other studies showing a similar inverse relationship between individuals' MTC and alcohol consumption (Bertholet, Cheng, Palfai, Samet, & Saitz, 2009; Demmel, Beck, Richter, & Reker, 2004).

Despite significant contributions of MTC variables, linear time often continued to predict longitudinal alcohol-use outcomes after controlling for MTC. Thus, the MTC variables included in these analyses were not sufficient to explain all of the variance in alcohol use and problems. Further study is needed to examine the potential additive contributions of other measures of MTC, including self-efficacy for change, goals/strivings and decisional balance (W. R. Miller, 1999). Finally, although main effects of MTC factors were predictive of alcohol outcomes, most of the time $\times$ MTC interactions were not. There were a few exceptions: greater recognition of problem drinking predicted increases in alcohol-related

problems over the two-year period, and taking steps towards alcohol behavior change predicted reductions in alcohol-related problems. Taken together, these findings correspond to other findings in the literature (Carey, et al., 1999; Collins, et al., 2010; Maisto, et al., in press), and suggest that higher scores on recognition and ambivalence reflect an increased consciousness of alcohol use and related problems, whereas taking steps is associated with lower levels of drinking, albeit not always with a linear, longitudinal decrease.

4.2 Treatment Attendance as a Predictor of Alcohol-use Outcomes

We also tested the ability of self-reported substance abuse treatment attendance to predict alcohol-use outcomes. Although 47% of participants reported attending treatment at least once over the past two years, only one individual reported regular treatment attendance. In the primary analyses, we found that treatment attendance was not consistently associated with alcohol-use outcomes. There was one exception to this finding: treatment attendance predicted greater levels of alcohol-related problems over the 2-year follow-up. The latter finding suggests that treatment attendance may serve as a proxy for alcohol problem severity, such that greater problem experience would increase one's likelihood of being either informally (e.g., via friends, family, housing staff) or formally (e.g., via the criminal justice system) persuaded into treatment. Further, as shown in other studies involving homeless substance users, some individuals may seek out treatment as a brief respite from the negative consequences of substance use but not necessarily to achieve longer-term abstinence (O'Toole, Pollini, Ford, & Bigelow, 2006; O'Toole, et al., 2008). Finally, this is a very treatment-experienced population, which may have made the relative impact of yet another treatment experience less powerful. As previously mentioned, theory and empirical data suggest that repeated failed treatment attempts may erode self-efficacy and self-control for later behavioral change (Marlatt & Gordon, 1985; Muraven & Baumeister, 2000).

The findings regarding treatment attendance challenge the continuum/medical model that dominates mainstream housing and treatment approaches for this population. The continuum/medical model holds that alcohol-dependent individuals must be exposed to abstinence-based treatment to achieve alcohol behavior change (Cloud, McKiernan, & Cooper, 2003; Institute of Medicine (IOM), 1990; National Institute on Drug Abuse, 2008). In contrast, the current findings support the HF/harm reduction stance that MTC--an internal commitment to change--is a more important factor in alcohol-use behavior change than formal treatment attendance.

On the other hand, it is possible that MTC leads some individuals to seek formalized abstinence-based treatment, and abstinence-based treatment may be helpful if that individual's MTC is in-line with the treatment facility's goals and style (Denning & Little, 2011). Further, the current findings may reflect activation of retained knowledge gained during participants' previous treatment episodes. That said, our findings indicate that behavior change can and does occur within a HF/harm reduction approach, even in a severely affected segment of the larger homeless population. These findings therefore suggest the need for further development of alcohol-specific, harm-reduction approaches that better support individuals' MTC, are compatible with HF, and may serve as more effective alternatives to abstinence-based treatment among chronically homeless individuals with alcohol problems (Podymow, Turnbull, Coyle, Yetisir, & Wells, 2006).

4.3 Limitations

There are some limitations that warrant discussion. First, we used self-report measures to assess the predictor and outcome variables in this study. Self-report can be subject to inaccuracy due to cognitive impairment, memory biases, social desirability and item wording (Belli, 1998; Bickart, Phillips, & Blair, 2006; Garry, Sharman, Feldman, Marlatt, &

Loftus, 2002; Langenbucher & Merrill, 2001; Yoshino & Kato, 1995), and these inherent limitations may have affected the current findings. There is, however, also evidence supporting the validity of the self-report data in this study. Questions were piloted and developed with the current population in mind and therefore focused on the discrete, recent and manageable timeframes recommended by researchers working with homeless populations (Clifasefi, Collins, Tanzer, Burlingham, & Larimer, 2011; Gelberg & Siecke, 1997) and alcohol-use outcomes (Maisto, Sobell, & Sobell, 1982). Further, a psychometric study conducted parallel to the current study indicated that participants' self-reported, 30-day service utilization showed acceptable concordance with archival records (Clifasefi, et al., 2011). Taken together, these means of enhancing the validity of self-report have increased our confidence in the current findings.

Next, we used a limited number of variables to assess and compare the relative associations of MTC (SOCRATES questionnaire) and self-reported treatment attendance with alcohol-outcome variables. Because MTC is a complex latent factor, we have certainly omitted some aspects that were beyond the scope of the current study (Collins, Carey, & Otto, 2009; Curry, Grothaus, & McBride, 1997; W. R. Miller, 1999; Rollnick, Heather, Gold, & Hall, 1992; Ryan & Deci, 2000). Further, the treatment attendance variables used in the current study did not take into account the likely heterogeneity in treatment modality, intensity and length. Such a broadly defined treatment attendance variable may have weakened the treatment effect compared to more differentiated treatment attendance variables. Further studies are needed to test a more differentiated set of indicators that may more fully encompass and test these constructs.

The 61% retention rate at the 24-month time period is another limitation of this study. The resulting data missingness may have introduced bias into the dataset and reduced power to find significant effects (Allison, 2001). Although this limitation may restrict the conclusions that can be drawn, the robustness of the current findings is encouraging. Further, the decreased participation was not due to study attrition per se. Toward the end of the study, the research team added the 24-month follow-up to increase the overall follow-up period. This change in protocol required the research team to locate, reconsent and assess participants within a shortened data collection window. Thus, data missingness does not represent attrition as much as it reflects changes to the research protocol.

Because we did not have a continuum/medical model group to serve as a contrasting condition, this design did not allow us to test housing type $\times$ MTC/treatment interaction effects. Future studies may randomize participants to these two housing conditions to parse out the potential moderating effects of different housing models (i.e., HF/harm reduction and continuum/medical models) and MTC/treatment on alcohol-use outcomes. Finally, this study was conducted with a specific segment of the homeless population in a specialized setting (i.e., a single, project-based HF program) and its larger social context (i.e., location in a progressive, urban setting in a mid-sized city in the US Pacific northwest). The generalizability of the current findings should be carefully considered in their interpretation and application within other populations, settings and approaches.

4.4 Conclusions and Future Directions

Concerns about HF for individuals with substance-use problems have hinged on the premise that the absence of external motivators, such as treatment and abstinence requirements, may remove incentives to change substance-use behavior (Jamieson, 2002; Kertesz, Crouch, Milby, Cusimano, & Schumacher, 2009; Milby et al., 2010). A previous study exploring the association of HF and alcohol-use outcomes indicated this is not necessarily the case: participants receiving a project-based HF intervention reduced their alcohol use and experience of alcohol-related problems over a two-year follow-up as a function of length of

exposure to HF (Collins, Malone, et al., 2012; Larimer, et al., 2009). The current secondary study explored potential underlying mechanisms associated with these decreases and found that MTC was a more consistent predictor of alcohol-use outcomes than treatment attendance. The fact that treatment attendance was not associated with alcohol-use outcomes in the expected direction suggests that eliciting, supporting and enhancing residents' MTC might be a more helpful means of promoting improved alcohol-use outcomes in this population. Future studies are planned to test alcohol-specific, harm reduction interventions that are compatible with project-based HF and provide additional support for MTC alcohol-use behavior among chronically homeless individuals with alcohol problems.

Acknowledgments

First and foremost, we would like to thank the staff and residents at the housing facility where this project was conducted for their time, information and assistance in shaping this research. We would like to thank Elizabeth A. Dana, Sara Hoang, Megan Kirouac, Adam Pierce, Natalie Stahl, and Iris Steine for their help in entering and cleaning participant data. We would also like to acknowledge the DESC-UW Housing First team, including David C. Atkins, Bonnie Burlingham, Seema L. Clifasefi, Joshua A. Ginzler, Michelle D. Garner, William G. Hobson, Heather S. Lonczak, G. Alan Marlatt, and Kenneth Tanzer for their work on the parent study that provided the basis for this secondary analysis. We dedicate this manuscript to the memory of Dr. Marlatt, who continues to inspire and motivate us to truly meet our clients where they're at.

The parent study was primarily supported by a grant from the Substance Abuse Policy Research Program (SAPRP) of the Robert Wood Johnson Foundation (SAPRP # 053672) awarded to Dr. Larimer. Susan E. Collins was supported in part by an NIAAA Institutional Training Grant (T32AA007455 to Mary E. Larimer) and a National Institute on Alcohol Abuse and Alcoholism K22 Career Transition Award (K22AA018384 to Susan E. Collins). Neither NIAAA nor the RWJ Foundation had a further role in study design; in the collection, analysis, and interpretation of the data; in the writing of the article; or in the decision to submit the article for publication.

Role of Funding Sources The parent study was primarily supported by a grant from the Substance Abuse Policy Research Program (SAPRP) of the Robert Wood Johnson Foundation (SAPRP # 053672) awarded to Dr. Larimer. Susan E. Collins was supported in part by an NIAAA Institutional Training Grant (T32AA007455 to Mary E. Larimer) and a National Institute on Alcohol Abuse and Alcoholism K22 Career Transition Award (1K22AA018384-01 to Susan E. Collins). Neither NIAAA nor the RWJ Foundation had a further role in study design; in the collection, analysis, and interpretation of the data; in the writing of the article; or in the decision to submit the article for publication.

References

- Allison, PD. Missing data. Sage; Thousand Oaks, CA: 2001.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 4th edition, text revision (DSM-IV-TR). 4th ed.. Author; Washington, DC: 2000.
- Belli R. The structure of autobiographical memory and the event history calendar: Potential improvements in the quality of retrospective reports in surveys. *Memory*. 1998; 6:383–406. doi: 10.1080/741942610. [PubMed: 9829098]
- Bertholet N, Cheng DM, Palfai TP, Samet JH, Saitz R. Does readiness to change predict subsequent alcohol consumption in medical inpatients with unhealthy alcohol use? *Addictive Behaviors*. 2009; 34:636–640. doi: 10.1016/j.addbeh.2009.03.034. [PubMed: 19428189]
- Bickart BA, Phillips JM, Blair J. The effects of discussion and question wording on self and proxy reports of behavioral frequencies. *Marketing Letters*. 2006; 17:167–180. doi: 10.1007/s11002-006-5232-1.
- Blanchard KA, Morgenstern J, Morgan TJ, Labouvie E, Bux DA. Motivational subtypes and continuous measures of readiness for change: concurrent and predictive validity. *Psychology of Addictive Behaviors*. 2003; 17:56–65. doi: 10.1037/0893-164X.17.1.56. [PubMed: 12665082]
- Carey KB, Purnine DM, Maisto SA, Carey MP. Assessing readiness to change substance abuse: A critical review of instruments. *Clinical Psychology: Science and Practice*. 1999; 6:245–266. doi: 10.1093/clipsy.6.3.245.

- Clifasefi SL, Collins SE, Tanzer K, Burlingham B, Larimer ME. Agreement between self-report and archival public service utilization data among chronically homeless individuals with severe alcohol problems. *Journal of Community Psychology*. 2011; 39:631–644. doi: 10.1002/jcop.20457.
- Cloud RN, McKiernan P, Cooper L. Controlled drinking as an appropriate treatment goal. *Alcoholism Treatment Quarterly*. 2003; 21:67–82. doi:10.1300/J1020v1321n1304_1306.
- Collins SE, Carey KB, Otto J. A new decisional balance measure of motivation to change among at-risk college drinkers. *Psychology of Addictive Behaviors*. 2009; 23:464–471. doi: 10.1037/a0015841. [PubMed: 19769430]
- Collins SE, Clifasefi SL, Dana EA, Andrasik MP, Stahl NE, Kirouac M, Welbaum C, King M, Malone DK. Where harm reduction meets Housing First: Exploring alcohol's role in a project-based Housing First setting. *International Journal of Drug Policy*. 2012; 23:111–119. doi: 10.1016/j.drugpo.2011.07.010. [PubMed: 21852096]
- Collins, SE.; Clifasefi, SL.; Logan, DE.; Samples, L.; Somers, J.; Marlatt, GA. Ch. 1 Harm Reduction: Current Status, Historical Highlights and Basic Principles. In: Marlatt, GA.; Witkiewitz, K.; Larimer, ME., editors. *Harm reduction: Pragmatic strategies for managing high-risk behaviors*. 2nd ed. Guilford; New York: 2011.
- Collins SE, Logan DE, Neighbors C. Which comes first: The readiness or the change? Longitudinal relationships between readiness to change and drinking among college drinkers. Manuscript submitted for publication. *Addiction*. 2010; 105:1899–1909. doi: 10.1111/j.1360-0443.2010.03064.x. [PubMed: 20854333]
- Collins SE, Malone DK, Clifasefi SL, Ginzler JA, Garner MD, Burlingham B, Lonczak HS, Dana EA, Kirouac M, Tanzer K, Hobson WG, Marlatt GA, Larimer ME. Project-based Housing First for chronically homeless individuals with alcohol problems: Within-subjects analyses of two-year alcohol-use trajectories. *American Journal of Public Health*. 2012; 102:511–519. doi: 10.2105/AJPH.2011.300403. [PubMed: 22390516]
- Curry SJ, Grothaus L, McBride C. Reasons for quitting: Intrinsic and extrinsic motivation for smoking cessation in a population-based sample. *Addictive*. 1997; 22:727–739. doi: 10.1016/S0306-4603(97)00059-2.
- De Leon G, Sacks S, Staines G, McKendrick K. Modified therapeutic community for homeless mentally ill chemical abusers: Emerging subtypes. *American Journal of Drug and Alcohol Abuse*. 1999; 25:495–515. [PubMed: 10473011]
- Demmel R, Beck B, Richter D, Reker T. Readiness to change in a clinical sample of problem drinkers: Relation to alcohol use, self-efficacy and treatment outcomes. *European Addiction Research*. 2004; 10(133–138) doi: 10.1159/000077702.
- Denning, P.; Little, J. *Practicing harm reduction psychotherapy: An alternative approach to addictions*. 2nd edition. Guilford Press; New York: 2011.
- Eyrich-Garg KM, Cacciola JS, Carise D, Lynch KG, McLellan AT. Individual characteristics of the literally homeless, marginally housed and impoverished in a US substance abuse treatment-seeking sample. *Social Psychiatry and Psychiatric Epidemiology*. 2008; 43(831–842) doi: 10.1007/s00127-008-0371-8.
- Fazel S, Khosla V, Doll H, Geddes J. The prevalence of mental disorders among the homeless in western countries: Systematic review and meta-regression analysis. *PLOS Medicine*. 2008; 5:e225. doi: 10.1371/journal.pmed.0050225. [PubMed: 19053169]
- Garry M, Sharman SJ, Feldman J, Marlatt GA, Loftus EF. Examining memory for heterosexual college students' sexual experiences using an electronic mail diary. *Health Psychology*. 2002; 21:629–634. doi: 10.1037/0278-6133.21.6.629. [PubMed: 12433018]
- Gelberg L, Siecke N. Accuracy of homeless adults' self-reports. *Medical Care*. 1997; 35:287–290. doi: 10.1097/00005650-199703000-00008. [PubMed: 9071259]
- Hardin, JW.; Hilbe, JM. *Generalized estimating equations*. Chapman & Hall/CRC; Boca Raton, FL: 2003.
- Harm Reduction Coalition. *Mission and Principles of Harm Reduction* [website]. Harm Reduction Coalition; Oakland, CA: 2009.
- Hwang SW, Tolomiczenko G, Kouyoumdjian FG, Garner RE. Interventions to improve the health of the homeless. *American Journal of Preventative Medicine*. 2006; 29:311–319.

- Institute of Medicine (IOM). Broadening the base of treatment for alcohol problems. National Academy Press; Washington, DC: 1990.
- Jamieson, RL. Off street corners, but not off the alcohol. *Seattle Post-Intelligencer*. 2002. Retrieved from <http://www.seattlepi.com/news/article/Off-street-corners-but-not-off-the-alcohol-1101603.php>
- Kenna GA, Longabaugh R, Gogineni A, Woolard R. Can the short index of problems (SIP) be improved? Validity and reliability of the three-month SIP in an emergency department sample. *Journal of Studies on Alcohol*. 2005; 66:433–437. [PubMed: 16047535]
- Kertesz SG, Crouch K, Milby JB, Cusimano RE, Schumacher JE. Housing First for homeless persons with active addiction: Are we overreaching? *Milbank Quarterly*. 2009; 87:495–534. doi: 10.1111/j.1468-0009.2009.00565.x. [PubMed: 19523126]
- Klingemann HK-H, Sobell MB, Sobell LC. Continuities and changes in self-change research. *Addiction*. 2010; 105:1510–1518. doi: 10.1111/j.1360-0443.2009.02770.x. [PubMed: 19919592]
- Kuhn R, Culhane DP. Applying cluster analysis to test a typology of homelessness by pattern of shelter utilization: Results from the analysis of administrative data. *American Journal of Community Psychology*. 1998; 26:207–232. doi:10.1023/A:1022176402357. doi: 10.1023/A:102217640235. [PubMed: 9693690]
- Langenbucher J, Merrill J. The validity of self-reported cost events by substance abusers: Limits, liabilities, and future directions. *Evaluation Review*. 2001; 25:184–210. doi: 10.1177/0193841X0102500204. [PubMed: 11317716]
- Larimer ME, Malone DK, Garner MD, Atkins DC, Burlingham B, Lonczak HS, Tanzer K, Ginzler J, Clifasefi SL, Hobson WG, Marlatt GA. Health Care and Public Service Use and Costs Before and After Provision of Housing for Chronically Homeless Persons With Severe Alcohol Problems. *Journal of the American Medical Association*. 2009; 301:1349–1357. doi: 10.1001/jama.2009.414. [PubMed: 19336710]
- Leshner AI. Addiction is a brain disease and it matters. *Science*. 1997; 278:45–47. doi:10.1126/science.1278.5335.1145. [PubMed: 9311924]
- Long CG, Williams M, Midgley M, Hollin CR. Within-program factors as predictors of drinking outcome following cognitive-behavioral treatment. *Addictive Behaviors*. 2000; 25:573–578. doi: 10.1016/S0306-4603(99)00018-0. [PubMed: 10972448]
- Maisto SA, Krenek M, Chung T, Martin CS, Clark D, Cornelius J. A comparison of the concurrent and predictive validity of three measures of readiness to change alcohol use in a clinical sample of adolescents. *Psychological Assessment*. in press.
- Maisto SA, Sobell MB, Sobell LC. Reliability of self-reports of low ethanol consumption by problem drinkers over 18 months of follow-up. *Drug and Alcohol Dependence*. 1982; 9:273–278. doi: 10.1016/0376-8716(82)90066-7. [PubMed: 7128449]
- Marlatt GA. Harm reduction: Come as you are. *Addictive Behaviors*. 1996; 21:779–788. doi: 10.1016/0306-4603(96)00042-1. [PubMed: 8904943]
- Marlatt, GA.; Gordon, JR. Relapse prevention: Maintenance strategies in the treatment of addictive behaviors. The Guilford Press; New York: 1985.
- McLellan AT, Kushner H, Metzger D, Peters R. The fifth edition of the Addiction Severity Index. *Journal of Substance Abuse Treatment*. 1992; 9:199–213. doi: 10.1016/0740-5472(92)90062-S. [PubMed: 1334156]
- Milby JB, Schumacher JE, Wallace D, Vuchinich R, Mennemeyer ST, Kertesz SG. Effects of sustained abstinence among treated substance-abusing homeless persons on housing and employment. *American Journal of Public Health*. 2010; 100:913–918. doi:10.2105/AJPH.2008.152975. [PubMed: 19833998]
- Miller, W.; Tonigan, J.; Longabaugh, R. The Drinker Inventory of Consequences (DrInC): An instrument for assessing adverse consequences of alcohol abuse *Test manual*. Vol. 4. National Institute on Alcohol Abuse and Alcoholism; Rockville: 1995. Project MATCH Monograph Series
- Miller, WR. Enhancing motivation for change in substance abuse treatment. Vol. 35. US Department of Health and Human Services; Rockville, MD: 1999.
- Miller, WR.; Rollnick, S. Motivational interviewing: Preparing people for change. Second ed.. US Guilford Press; New York: 2002.

- Miller WR, Tonigan JS. Assessing drinkers' motivation to change: The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES). *Psychology of Addictive Behaviors*. 1996; 10:81–89. doi: 10.1037//0893-164X.10.2.81.
- Muraven M, Baumeister RF. Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*. 2000; 126:247–259. doi: 10.1037/0033-2909.126.2.247. [PubMed: 10748642]
- National Institute on Drug Abuse. *Drugs, brains and behavior: The science of addiction*. National Institutes of Health; Bethesda, MD: 2008. NIH Pub No. 07-5605
- Neal DJ, Simons JS. Inference in regression models of heavily skewed alcohol use data: A comparison of ordinary least squares, generalized linear models, and bootstrap resampling. *Psychology of Addictive Behavior*. 2007; 21:441–452. doi: 10.1037/0893-164X.21.4.441.
- O'Connell, JJ. *Premature mortality in homeless populations: A review of the literature*. National Health Care for the Homeless Council, Inc; Nashville, TN: 2005.
- O'Toole TP, Pollini RA, Ford D, Bigelow G. Physical health as a motivator for substance abuse treatment among medically ill adults: Is it enough to keep them in treatment? *Journal of Substance Abuse Treatment*. 2006; 31:143–150. doi: 10.1016/j.jsat.2006.03.014. [PubMed: 16919741]
- O'Toole TP, Pollini RA, Ford D, Bigelow G. The health encounter as a treatable moment for homeless substance-using adults: The role of homelessness, health seeking behavior, readiness for behavior change and motivation for treatment. *Addictive Behaviors*. 2008; 33:1239–1243. doi: 10.1016/j.addbeh.2008.04.015. [PubMed: 18562126]
- Orwin RG, Garrison-Mogren R, Jacobs ML, Sonneck LJ. Retention of homeless clients in substance abuse treatment: Findings from the National Institute on Alcohol Abuse and Alcoholism Cooperative Agreement Program. *Journal of Substance Abuse Treatment*. 1999; 17:45–66. [PubMed: 10435252]
- Padgett D, Henwood B, Abrams C, Davis A. Engagement and retention in services among formerly homeless adults with co-occurring mental illness and substance abuse: voices from the margins. *Psychiatric rehabilitation journal*. 2008; 31(3):226–233. doi: 10.2975/31.3.2008.226.233. [PubMed: 18194950]
- Padgett D, Stanhope V, Henwood BF, Stefancic A. Substance use outcomes among homeless clients with serious mental illness: Comparing housing first with treatment first programs. *Community Mental Health Journal*. 2011; 47:227–232. doi: 10.1007/s10597-009-9283-7. [PubMed: 20063061]
- Pearson, C.; Locke, G.; Montgomery, AE.; Buron, L. *The applicability of Housing First models to homeless persons with serious mental illness: Final report*. US Department of Housing and Urban Development: Office of Policy Development and Research; Washington DC: 2007.
- Pettinati HM, Monterosso J, Lipkin C, Volpicelli JR. Patient attitudes toward treatment predict attendance in clinical pharmacotherapy trials of alcohol and drug treatment. *American Journal on Addictions*. 2003; 12:324–335. [PubMed: 14504025]
- Podymow T, Turnbull J, Coyle D, Yetisir E, Wells G. Shelter-based managed alcohol administration to chronically homeless people addicted to alcohol. *Canadian Medical Association Journal*. 2006; 174:45–49. doi:10.1503/cmaj.1041350. [PubMed: 16389236]
- Public Health - Seattle and King County. *King County 2003 Homeless Death Review*. Health Care for the Homeless Network; Seattle, WA: 2004.
- Robbins PC, Callahan L, Monahan J. Perceived coercion to treatment and housing satisfaction in housing-first and supportive housing programs. *Psychiatric Services*. 2009; 60(9):1251–1253. doi: 10.1176/appi.ps.60.9.1251. [PubMed: 19723741]
- Rollnick, S. Readiness, importance, and confidence: Critical conditions of change in treatment. In: Miller, WR.; Heather, N., editors. *Treating addictive behaviors*. 2nd edition. Plenum Press; New York: 1998.
- Rollnick S, Heather N, Gold R, Hall W. Development of a short "Readiness to Change Questionnaire" for use in brief, opportunistic interventions among excessive drinkers. *British Journal of Addictions*. 1992; 87 0443.1992.tb02720.x.
- Rosenheck RA, Morrissey J, Lam J, Calloway M, Johnsen M, Goldman H, Randolph F, Blasinsky M, Fontana A, Calsyn R, Teague G. Service system integration, access to services, and housing

- outcomes in a program for homeless persons with severe mental illness. *American Journal of Public Health*. 1998; 88:1610–1615. [PubMed: 9807525]
- Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development and well-being. *American Psychologist*. 2000; 55:68–78. doi: 10.1037//0003-066X.55.1.68. [PubMed: 11392867]
- Sobell, LC.; Sobell, MB. Timeline followback: A technique for assessing self-reported ethanol consumption. In: Allen, J.; Litten, RZ., editors. *Measuring Alcohol Consumption: Psychosocial and Biological Methods*. Humana Press; Totowa, NJ: 1992. p. 41-72.
- Tsemberis S, Gulcur L, Nakae M. Housing first, consumer choice and harm reduction for homeless individuals with a dual diagnosis. *American Journal of Public Health*. 2004; 94:651–656. doi: 10.2105/AJPH.94.4.651 U.S. [PubMed: 15054020]
- U.S. Department of Housing and Urban Development. The 2009 annual homeless assessment report. Author; Washington, DC: 2010. Retrieved from http://www.huduser.org/Publications/pdf/2009_homeless_508.pdf on 7/25/11
- Velasquez MM, Crouch C, von Sternberg K, Grosdanis I. Motivation for change and psychological distress in homeless substance abusers. *Journal of Substance Abuse Treatment*. 2000; 19:395–401. [PubMed: 11166504]
- Wenzel SL, Burnam MA, Koegel P, Morton SC, Miu A, Jinnett KJ, Sullivan JG. Access to inpatient or residential substance abuse treatment among homeless adults with alcohol or other drug use disorders. *Medical Care*. 2001; 39:1158–1169. doi: 10.1097/00005650-200111000-00003. [PubMed: 11606870]
- Yoshino A, Kato M. Influence of social desirability response set on self-report for assessing the outcome of treated alcoholics. *Alcoholism: Clinical and Experimental Research*. 1995; 19:1517–1519. doi: 10.1111/j.1530-0277.1995.tb01016.x.
- Zeger SL, Liang K-Y. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics*. 1986; 42:121–130. doi: 10.2307/2531248. [PubMed: 3719049]
- Zerger, S. Substance abuse treatment: What works for homeless people? A review of the literature. National Health Care for the Homeless Council; Nashville, TN: 2002.
- Zhang AY, Harmon JA, Werkner J, Arthur R. Impacts of motivation for change on the severity of alcohol use by patients with severe and persistent mental illness. *Journal of Studies on Alcohol*. 2004; 65:392–397. [PubMed: 15222596]

Highlights

- A prior study showed time spent in a project-based Housing First program was associated with improved alcohol-use outcomes among chronically homeless individuals with alcohol problems.
- This manuscript explored motivation to change and treatment attendance as potential correlates of these improved alcohol-use outcomes.
- Motivation to change but not treatment attendance consistently predicted alcohol-use outcomes over the two years after entry into a project-based Housing First program.

Table 1

Baseline Descriptive Statistics for the Study Sample (N = 95)

Variable	<i>M(SD) / %</i>
Sociodemographic variables	
Age	48.39(9.39)
Race/Ethnicity	
American Indian/Alaska Native	27.4%
Asian	1.1%
Black/African-American	7.4%
Hispanic/Latino/a	7.4%
Native Hawaiian/Pacific Islander	3.2%
White/Caucasian	40.0%
“More than one race”	10.5%
Self-reported “Other”	3.2%
Relationship status	
Married	2.1%
Consider self married	1.1%
Widowed	4.3%
Separated	7.4%
Divorced	33.0%
Never married	52.1%
Highest education level	
Some high school	37.2%
HS graduate/GED	29.8%
Vocational school	8.5%
Some college	18.1%
College graduate	4.3%
Some graduate school/advanced degree	2.2%

Table 2
Descriptive Statistics for Primary Predictor and Outcome Variables Across Time M(SD)/%

Variables	Baseline	3 mo	6 mo	9 mo	12 mo	18 mo	24 mo
Treatment attendance							
Treatment attendance	21.79%	18.92%	19.81%	21.62%	15.79%	21.62%	21.67%
Motivation to change (SOCRATES)							
Ambivalence	3.37 (1.08)	3.20 (1.13)	3.13 (.88)	3.41 (.98)	3.21 (1.06)	3.41 (.98)	3.22 (1.03)
Recognition	3.93 (.95)	3.59 (1.08)	3.54 (.88)	3.64 (.94)	3.59 (1.03)	3.76 (.97)	3.53 (.96)
Taking steps	3.27 (1.04)	2.87 (1.05)	2.95 (.96)	3.13 (1.04)	3.12 (1.11)	3.25 (1.07)	3.09 (1.07)
Alcohol-related variables							
Typical quantity	24.38 (21.85)	25.07 (29.09)	21.52 (20.46)	21.59 (35.06)	21.15 (19.76)	20.29 (21.01)	17.66 (21.72)
Peak quantity	39.86 (39.26)	35.23 (42.41)	34.19 (35.57)	33.58 (48.49)	35.48 (39.55)	28.95 (32.77)	26.09 (32.46)
Days not drinking to intoxication	53.66%	64.47%	69.01%	72.97%	72.97%	68.92%	73.21%
Alcohol-related problems (SIP)	23.34 (12.62)	19.12 (14.49)	17.94 (13.20)	17.85 (14.41)	19.39 (14.55)	19.33 (15.15)	14.55 (13.96)
Delirium tremens	65.17%	49.35%	39.44%	36.49%	29.17%	39.19%	22.95%
Alcohol dependence	90%	77.33%	76.06%	71.01%	75.34%	76.47%	71.93%

Table 3

GEE Models of the Prediction of Alcohol-use Outcomes by MTC and Treatment Attendance

	Model 1 (Covariates)	Model2 (Intrinsic only)	Model 3 (Full model)
Predictors	<i>IRR/OR(SE)</i>	<i>IRR/OR(SE)</i>	<i>IRR/OR(SE)</i>
Typical Quantity (number of drinks consumed on typical day in last 30 days) ^a			
Mortality covariate	.56(.23)	.69(.26)	.71(.29)
Time	.96(.02) [*]	.96(.02) [*]	.97(.02)
Ambivalence		.97(.04)	.96(.04)
Recognition		1.34(.09) ^{**}	1.33(.09) ^{**}
Taking steps		.79(.04) ^{**}	.82(.04) ^{**}
Time × Ambivalence		.99(.02)	.97(.02)
Time × Recognition		1.03(.02)	1.04(.02) [*]
Time × Taking steps		.97(.02)	.97(.02)
Treatment attendance			.87(.08)
Time × Treatment attendance			.98(.04)
Peak Quantity (number of drinks consumed on peak drinking day in last 30 days) ^a			
Mortality covariate	.29(.11) ^{**}	.31(.11) ^{**}	.32(.13) ^{**}
Time	.95(.02) ^{**}	.95(.02) ^{**}	.96(.02) [*]
Ambivalence		.98(.06)	.94(.06)
Recognition		1.26(.11) [*]	1.29(.12) ^{**}
Taking steps		.83(.05) ^{**}	.87(.05) [*]
Time × Ambivalence		.98(.02)	.97(.02)
Time × Recognition		1.04(.03)	1.04(.02)
Time × Taking steps		.98(.01)	.99(.01)
Treatment attendance			.78(.11)
Time × Treatment attendance			.98(.04)
1 days not drinking to intoxication in the last 30 days ^b			
Mortality covariate	3.44(2.84)	1.87(1.66)	1.73(1.53)
Time	1.11(.04) ^{**}	1.10(.04) [*]	1.06(.05)
Ambivalence		.78(.11)	.78(.13)
Recognition		.67(.11) [*]	.65(.12) [*]
Taking steps		2.32(.33) ^{**}	2.28(.34) ^{**}
Time × Ambivalence		1.04(.05)	1.05(.05)
Time × Recognition		1.02(.05)	.99(.05)
Time × Taking steps		1.01(.04)	1.01(.04)
Treatment attendance			1.54(.45)
Time × Treatment attendance			1.15(.14)

	Model 1 (Covariates)	Model2 (Intrinsic only)	Model 3 (Full model)
Predictors	<i>IRR/OR(SE)</i>	<i>IRR/OR(SE)</i>	<i>IRR/OR(SE)</i>
Short Inventory of Alcohol Problems (SIP-2R) ^a			
Mortality covariate	.79(.18)	.85(.19)	.91(.22)
Time	.97(.01) **	.96(.01) **	.96(.01) **
Ambivalence		1.13(.05) **	1.14(.05) **
Recognition		1.66(.10) **	1.68(.11) **
Taking steps		.95(.03)	.93(.03) *
Time × Ambivalence		1.02(.01)	1.02(.01)
Time × Recognition		1.04(.01) **	1.04(.02) *
Time × Taking steps		.97(.01) **	.98(.01) *
Treatment attendance			1.23(.08) **
Time × Treatment attendance			1.001(.02)
Experience of delirium tremens in past month ^b			
Mortality covariate	.69(.40)	.67(.43)	.63(.42)
Time	.83(.02) **	.83(.02) **	.83(.03) **
Ambivalence		1.05(.12)	1.06(.13)
Recognition		1.56(.22) **	1.50(.23) **
Taking steps		1.13(.11)	1.12(.12)
Time × Ambivalence		.98(.04)	.98(.04)
Time × Recognition		1.01(.04)	1.02(.04)
Time × Taking steps		.98(.03)	.98(.03)
Treatment attendance			1.50(.35)
Time × Treatment attendance			1.06(.08)
Symptoms congruent with DSM-IV alcohol dependence ^b			
Mortality covariate	.92(.03) **	1.20(1.21)	1.22(1.26)
Time	.74(.60)	.90(.03) **	.89(.04) *
Ambivalence		1.50(.25) *	1.59(.28) **
Recognition		2.14(.37) **	2.14(.38) **
Taking steps		.97(.14)	.92(.15)
Time × Ambivalence		.97(.04)	.96(.04)
Time × Recognition		1.00(.04)	1.01(.04)
Time × Taking steps		.96(.03)	.96(.03)
Treatment attendance			1.64(.51)
Time × Treatment attendance			.94(.09)

Note. Model 1 was the covariates-only reduced model including time and mortality. Model 2 additionally included Ambivalence, Recognition and Taking steps and the time × intrinsic motivation interactions. Model 3 additionally included the extrinsic motivation variables: treatment attendance and the time × treatment interaction.

SE = Robust standard errors.

^aDenotes a negative binomial generalized estimating equations model, and associated exponentiated coefficients represent incident rate ratios (*IRRs*).

^bDenotes a logistic model, and associated exponentiated coefficients represent odds ratios (*ORs*).

*
 $p < .05$.

**
 $p < .01$.