

Factors Mediating the Association Between Drinking in the First Year After Alcohol Treatment and Drinking at Three Years*

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ABSTRACT. Objective: Previous research has shown a significant relationship between alcohol consumption in the first year following alcohol treatment admission and longer term functioning. This finding is clinically important and pertains to the clinical course of alcohol-use disorders (AUDs). This study investigated mediators of these relationships, focusing on the first year after treatment admission and alcohol consumption 3 years later. **Method:** Analyses were conducted on the outpatient Project MATCH (Matching Alcohol Treatment to Client Heterogeneity) sample at baseline ($N = 952$) and at Months 37-39 after treatment admission ($n = 802$; hereafter referred to as 3 years). Participants were classified as first-year "abstainer," "moderate drinker," or "heavy drinker." A model featuring three latent variables (psychosocial functioning, self-efficacy, and treatment experiences) whose indicators were collected at 15 months after treatment admission was initially tested for its fit to the data. The 3-year outcomes were percentage of days abstinent and drinks per drinking day. Each model was run on randomly split subsamples and then cross-validated on the remaining participants. **Results:** Model tests by use of structural equation modeling methods showed poor model fit, owing primarily to problems involving the psychosocial-functioning variable.

Consequently, a reduced model was tested that dropped the psychosocial factor. Initial tests of this model showed an excellent fit to the data that replicated across subsamples and 3-year drinking variables at the overall model and individual path levels. There was strong support for the hypothesis that the total effects of first-year alcohol use on 3-year drinking is mediated in part (31% and 23% for the two drinking outcomes) through self-efficacy to abstain from alcohol at 15 months. **Conclusions:** First-year posttreatment admission alcohol use predicts longer term (3-year) alcohol use, and a substantial portion of this relationship seems to be mediated through self-efficacy at 15 months to abstain from alcohol use. The apparent benefit of sustained abstinence in the first year may be in part the result of facilitation in the rate or strength of the acquisition of self-efficacy. Discussed are the clinical implications of these findings as well as directions for future research involving longitudinal studies of alcohol use, treatment experiences, psychosocial factors, and their interaction both within the first year and afterward in the determination of the clinical course of alcohol-use disorders. (*J. Stud. Alcohol Drugs* 69: 728-737, 2008)

ALTHOUGH DRINKING BEHAVIOR in the first year after alcohol treatment has been identified for some time as an important predictor of longer term clinical course (Miller et al., 1992; Polich et al., 1980), it has been investigated as a primary research topic in only a few studies (Maisto et al., 1998, 2002; Weisner et al., 2003). In two recent studies, Maisto et al. (2006, 2007a) conducted secondary analyses on the Project MATCH (Matching Alcohol Treatment to Client Heterogeneity) outpatient sample data set to investigate the relationship between drinking in the first year after treatment initiation and drinking at 3 years. In the 2007 study, participants were classified as abstainers, moderate drinkers, or heavy drinkers based on their drinking

in the first year following the initiation of one of the three MATCH treatments. Analyses of the relationship between drinker classification and percentage of days abstinent and drinks per drinking day at the Months 37-39 follow-up (hereafter referred to as the 3-year follow-up) showed that the first-year abstainers had a higher percentage of days abstinent and the fewest drinks per drinking day at 3 years than did either of the other two groups. Furthermore, the drinking outcomes of the moderate drinkers were superior to those of the heavy drinkers. Drinker group was also associated with the frequency of alcohol-related negative consequences at 3 years, because heavy drinkers reported more consequences than did either the moderate drinkers or the abstainers, who did not differ from each other.

The purpose of this study was to extend the Maisto et al. (2007a) findings through an investigation of the factors that might mediate the association between first-year drinking behavior and drinking at 3 years. A conceptual model was developed to guide this study of mediation. The development of an initial conceptual model representing mediation processes specific to posttreatment drinking behaviors and longer term functioning proceeded from a review of longer term outcomes of alcohol and other drug treatment (e.g.,

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McKay and Weiss, 2001), alcohol research centered on posttreatment functioning (e.g., Maisto et al., 2002; Moos et al., 1990), and relapse research (e.g., Connors et al., 1996; Marlatt and Gordon, 1985; Witkiewitz and Marlatt, 2004).

As McKay and Weiss (2001) noted in their review of alcohol and other drug treatment outcomes, posttreatment factors correlated with longer term functioning are similar to those variables that have been shown to be related to relapse. A popular relapse model that has been researched extensively is that proposed by Marlatt and Gordon (1985) and updated by Witkiewitz and Marlatt (2004). A main hypothesis of the Marlatt and Gordon model is that relapse can be attributed to both interpersonal and intrapersonal factors and is likely to occur when an individual encounters a stressful situation with which he or she is ill prepared to cope (i.e., skill deficit) and/or experiences affective interference (e.g., anxiety), which reduces the likelihood that effective action (e.g., drink refusal skills) will be implemented.

Connors et al. (1996; see also Witkiewitz and Marlatt, 2004) extended the Marlatt and Gordon (1985) model of relapse precipitants to enhance understanding of relapse within the broader context of posttreatment functioning. Their work can be viewed as an extrapolation of the Moos and Finney (1983) "systems model." Within this framework, treatment reflects a single event among others that interact over time and contribute to posttreatment functioning; several recent articles that Moos and colleagues have published update and integrate this systems approach with elements of four conceptual models of psychosocial factors and alcohol-use disorder (AUD) remission and relapse (Moos, 2006, 2007; Moos and Moos, 2007).

The Connors et al. (1996) model was designed to reflect the associations among five sets of hypothesized factors (i.e., background characteristics, alcohol involvement and symptomatology, treatment, coping skills and responses, and stressors) related to relapse. The recursive path analytic model used by Connors and colleagues included determinants of relapse that varied in temporal proximity to the outcome event. For example, setting variables that are part of the relapse event itself are possible determinants of drinking that are closer in proximity to it than, say, the level of chronic stress. Thus, the Connors et al. model views relapse within the broader context of treatment outcome and highlights the importance of temporal factors.

Our earlier research in this area (Maisto et al., 1998, 2002) also points to the importance of temporal considerations. This research shows that drinking behaviors during the posttreatment period are related to longer term functioning and that the association between short-term posttreatment drinking behaviors and longer term functioning may be mediated via posttreatment social and personal factors. With this background in mind, the alcohol and other drug treatment outcome literature was reviewed for the identification of potential mediator variables. Emphasis was placed

on the identification of variables that studies have shown consistently to be associated with longer term functioning and that are available in the MATCH data sets.

To (1) remain theoretically consistent across the Connors et al. (1996) relapse model and the Maisto et al. (2002) posttreatment drinking behavior and longer term functioning model and to (2) simultaneously reconcile differences between the two models, the Connors et al. relapse model was revisited. Model changes were such that four broad categories of factors (i.e., alcohol involvement, treatment experiences, personal factors, and social factors) were identified that were hypothesized to be related to longer term functioning among adults receiving AUD treatment.

Figure 1 presents the initial, full path model that was developed to represent the hypothesized mediation of the association between drinking behaviors in the first 12 months following treatment initiation and longer term alcohol use and other functioning at 37-39 months (the interval covered in the MATCH 3-year follow-up assessment).

According to Figure 1, the index treatment has direct effects on alcohol use in Months 1-12 as well as social functioning and psychological functioning/self-efficacy at 15 months after treatment initiation (in Project MATCH's case, 12 months after the termination of the index treatment). Furthermore, alcohol use during the initial posttreatment period influences alcohol use at 3 years as well as psychological functioning/self-efficacy and social functioning at 15 months. Finally, social functioning and psychological functioning/self-efficacy at 15 months each directly influences alcohol use at 39 months, and subsequent treatment (in this case, Alcoholics Anonymous [AA] involvement, number of AA step meetings attended, and number of outpatient alcohol counseling sessions) at 15 months has a direct effect on alcohol use at 39 months. Subsequent treatment at 15 months also is associated with social functioning and psychological functioning/self-efficacy. However, that is not the focus of the proposed research, because the model is intended to reflect hypothesized mediation effects.

Within this framework, therefore, the relationship between short-term (i.e., 12 months) posttreatment drinking behavior and longer term functioning (i.e., 39 months) is mediated by both psychological and social factors at 15 months. The specific mediator variables indicators were selected from the MATCH outpatient sample data set. The 15-month indicators are viewed as autocorrelated with later assessments and directly related to alcohol use at 39 months. However, alcohol use (and other functioning) also is viewed as related indirectly to 39-month drinking behavior through the mediator variables at 15 months.

With this background, the following analysis strategy was used in this study. As is described in more detail in the Method section, the first-year drinker classifications and 3-year drinking outcomes were defined as in Maisto et al. (2007a), and confirmatory factor analysis procedures were

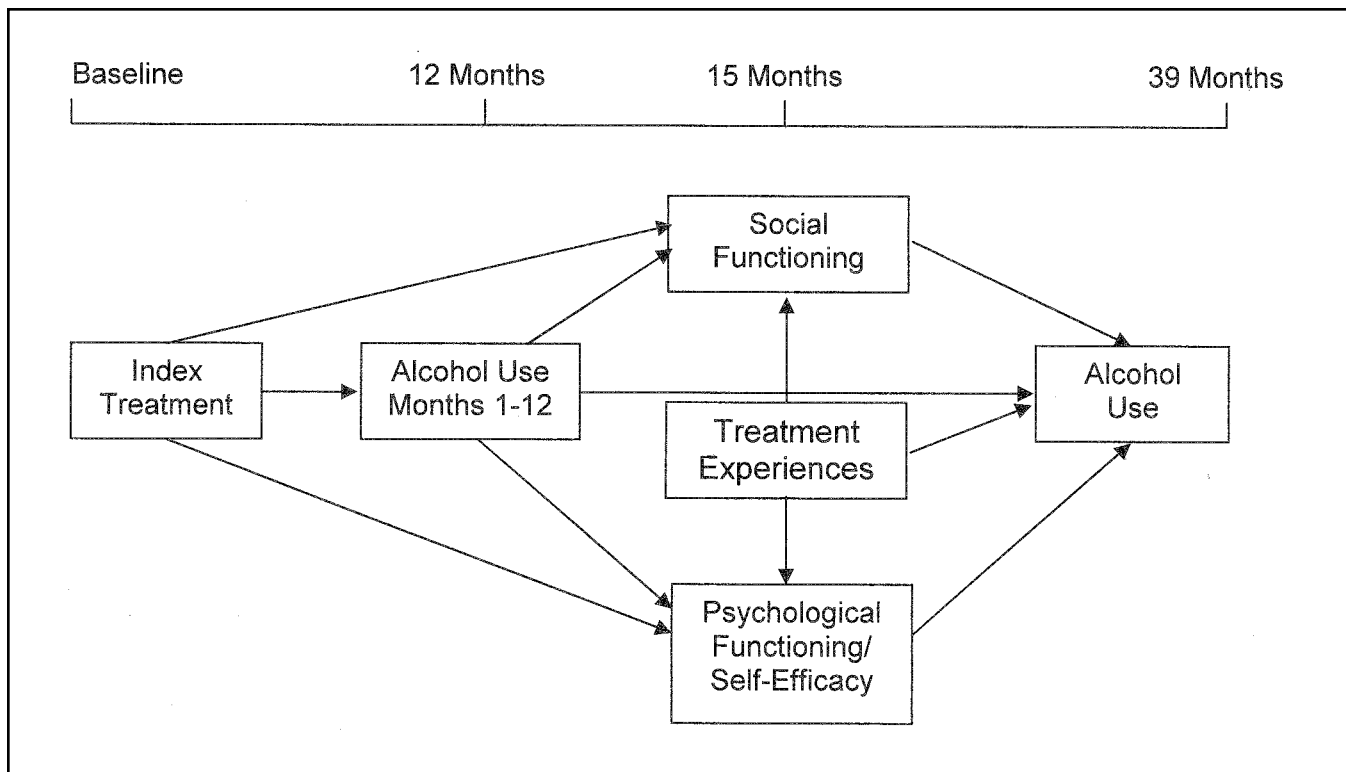


FIGURE 1. Initial full path model of the mediation of the association between first-year alcohol use with longer term alcohol use and related functioning

used to define the 15-month mediator latent variables. The MATCH outpatient sample ($N = 802$ participants with complete 3-year follow-up data) then was randomly split into two equal-sized subsamples. Structural equation modeling methods were used to test the fit of a model derived from that illustrated in Figure 1 (described later in the Method section) to the data provided by the first subsample, and then the findings of this first modeling effort were cross-validated on the second subsample of participants.

Method

Participants

Project MATCH was designed as two parallel (i.e., aftercare therapy: $N = 774$ and outpatient therapy: $N = 952$) but independent randomized, clinical trials. Regardless of study arm, participants were randomly assigned to one of three manual-guided, individually delivered psychosocial treatment conditions (i.e., cognitive-behavioral coping skills therapy, motivational enhancement therapy, or 12-step facilitation therapy). Study participation eligibility criteria were such that potential study participants had to have a current diagnosis of alcohol abuse or dependence according to the Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised (DSM-III-R; American Psychiatric Association, 1987); be at least 18 years old; be able to read

at a sixth-grade level; and agree to be randomized into any of the three treatments. Potential study participants who met any other current DSM-III-R substance dependence criteria (excluding marijuana), used intravenous drugs within the previous 6-month period, manifested acute psychosis or severe organic impairment, were considered a danger to self or others, lacked a place of residence, or did not provide a "locator" person who could be contacted if the subject became lost to follow-up were excluded from study participation (Project MATCH Research Group, 1998).

In-person follow-up assessment interviews were scheduled at 3-month intervals beginning 3 months after the first therapy session and terminating 15 months after treatment initiation (i.e., 12 months after treatment completion). An additional follow-up interview, covering Months 37-39 after treatment initiation (3 years after MATCH treatment completion), was added later to the outpatient study arm, thereby providing 3-year posttreatment completion outcome data on this study sample. Of the 952 outpatient subjects originally recruited, 806 (84.7%) provided 3-year outcome data. Posttreatment completion data were not collected from this sample during the intervening 2-year period (i.e., the interval between the 1-year and 3-year follow-up interviews).

This sample of 806 subjects who participated in the outpatient study arm of Project MATCH and provided 3-year outcome data were the primary data source for this study. This sample is 72% male, is 80% white, and had a mean

(SD) age of 38.9 (10.7) years at the time of intake. Additionally, 43% of this sample were married or cohabiting and 69% were employed at the time of study intake. A total of 45% of the sample reported at least one episode of prior alcohol treatment at intake. Based on the Structured Clinical Interview for DSM-III-R (SCID) and the Computerized Diagnostic Interview Schedule (C-DIS), 96% of study participants met alcohol dependence criteria and 33% had one or more lifetime Axis I nonsubstance diagnoses, respectively. Based on their series of missing data analyses, the Project MATCH Research Group (1998) concluded that "the 806 participants who completed the Months 37-39 interview were representative of the original outpatient sample" (p.1302).

Measures

Project MATCH involved the administration of an extensive battery of measures at the baseline and follow-up assessments. These have been described in detail in several of the major MATCH publications (e.g., Project MATCH Research Group, 1997). The analyses completed for this study and reported in this article include data from a baseline demographic questionnaire and baseline psychiatric diagnosis measured by the SCID (Spitzer and Williams, 1985). Also used were baseline and 15-month follow-up interview data that included measures of depression (Beck Depression Inventory; Beck et al., 1961); self-efficacy (Alcohol Abstinence Self-Efficacy, [AASE]), including both the temptation to drink and confidence to abstain summary scales (DiClemente, 1986; DiClemente et al., 1994); psychosocial functioning (Psychosocial Functioning Inventory; Feragne et al., 1983); psychiatric severity (psychiatric composite score of the Addiction Severity Index [ASI]; McLellan et al., 1980); anger (trait anger scale, Spielberger et al., 1983); involvement in AA (AA Involvement Scale; Tonigan et al., 1996); and alcohol counseling, 12-step participation, and alcohol use collected via Form 90 (Miller, 1996).

As described by the Project MATCH Research Group (1997), Form 90 is administered by personal interview to obtain retrospective self-reports of daily alcohol consumption. The Form 90 data were used to derive two measures of alcohol consumption that were the primary dependent variables in this study. The first, percentage of days abstinent, was defined in MATCH as the percentage of the total number of days in an interval during which the individual reported no alcohol consumption (this measure does not reflect other drug use). It is a measure of the frequency of drinking. Drinks per drinking day is a measure of drinking intensity or severity and, in Project MATCH, was defined as the average number of drinks per drinking occasion.

The 3-, 9-, and 15-month follow-up interviews (Connors et al., 1994) and the 3-year follow-up interview (Project MATCH Research Group, 1998) were considered major participant evaluation points and included the majority of

baseline assessments, blood and urine samples, and collateral interviews (i.e., interviews with individuals who were familiar with the participants' drinking). Overall, assessments were conducted with more than 90% of the participants across each of the originally scheduled five follow-up points. Extensive testing and data analyses were conducted to ensure the reliability and validity of subject self-reported data.

The results of these reliability and validity efforts show that "a high degree of confidence can be placed in the accuracy of the verbal report data obtained in Project MATCH" (Project MATCH Research Group, 1997, p. 12). The focus of this study was to develop and test a structural equation model regarding psychosocial factors that predict and explain (i.e., mediate) longer term posttreatment functioning.

The relationship between shorter term and longer term drinking outcomes was investigated in this study using categorical definitions of shorter term alcohol use. As presented in Maisto et al. (2007a), drinking in the first year after treatment initiation was defined by classifying participants into one of three groups according to their reports of daily alcohol consumption. Abstainers ($n = 93$) reported no alcohol consumption at all during this time period. Moderate drinkers ($n = 157$) reported at least one standard drink (0.5 oz ethanol) but fewer than 6 heavy (five or more standard drinks on an occasion for men, four or more for women) drinking days. Heavy drinkers ($n = 546$) reported drinking during Months 1-12 that included 6 or more heavy drinking days. The resulting $N = 796$ reflects insufficient drinking data provided by 10 of the 806 outpatient subjects at the 3-year follow-up.

As Maisto et al. (2007a) showed, the three drinker groups did not differ significantly on any baseline demographic or alcohol-related variable, including history of alcohol treatment and frequency of alcohol-related problems 90 days before treatment. However, the three groups did differ in age, as moderate drinkers tended to be about 2 years older than either the abstainers or heavy drinkers. Baseline age, however, was not correlated with percentage of days abstinent or drinks per drinking day at 3 years.

Analysis plan

A two-step approach (Kline, 2005) was taken in planning the analyses. First, the plan was to conduct a confirmatory factor analysis (CFA) on the 15-month measures (indicators) hypothesized to load on the mediating constructs shown in Figure 1 of social functioning, psychological functioning/self-efficacy, and treatment experiences. In the CFA, "psychological functioning/self-efficacy" was split into two separate constructs of psychological functioning and self-efficacy. This was done because of the consistent finding in research on AUD clinical course that self-efficacy is related to longer term alcohol use (McKay et al., 2006; Moos and Moos, 2007).

The Project MATCH indicators hypothesized to reflect the constructs were entered into the CFA measurement model test. Following the CFA, the plan was to use structural equation modeling (SEM) procedures to test the full model depicted in Figure 1. A cross-validation strategy was planned in completing the SEM analyses. In this regard, the plan was to randomly divide the full sample into two equal-sized subsamples. In this strategy, the hypothesized model's fit to the first subsample's data was to be tested, and then the results of these analyses was to be replicated on the second subsample's data.

Results

Measurement model

The hypothesized 15-month mediating constructs and their associated indicators in the MATCH data set are as follows. The Social Functioning indicators were the three subscales of the Psychosocial Functioning Inventory, which are social behavior, housemate/roommate, and social role performance. Psychological Functioning indicators were the ASI psychiatric functioning severity score, Beck Depression Inventory total score, and Trait Anger Scale total score. Self-efficacy was indicated by the temptation and confidence subscales of the Alcohol Abstinence Self-Efficacy Scale. Finally, treatment experiences were hypothesized to be indicated by the AA Involvement Scale total score; the number of alcohol outpatient counseling sessions attended in the last 90 days, as reported on Form 90; and the number of AA step meetings attended in the last 90 days, also reported on Form 90. In conducting the CFA, all raw data were used, and the measures were reverse-scored as necessary (e.g., Beck Depression, ASI psychiatric severity) so that higher scores reflected better functioning. The number of participants with sufficient data to be included in these analyses was 790, and the residual variances were assumed to be uncorrelated. The measurement model is depicted in Figure 2.

The results of the analyses showed that the hypothesized measurement model was a good fit to the data ($\chi^2 = 186.61$, 38 df, $p < .01$; Comparative Fit Index [CFI] = .95; Taylor-Lewis Fit Index [TLI] = .93; standardized root mean square residual [SRMSR] = .036). It is important to note that these four fit indexes are used as indicators of how well hypothesized models fit the data in question. Many fit indexes have been developed and evaluated and often have distinct advantages and disadvantages associated with their use in a given analytic context. The four indexes presented here are commonly used and are technically acceptable to statisticians (Kline, 2005).

All of the hypothesized indicator- (measure-) construct (latent variable) loadings were statistically significant at the $p < .01$ level or greater. Despite this good fit, inspection of the pattern of simple correlations among the indicator

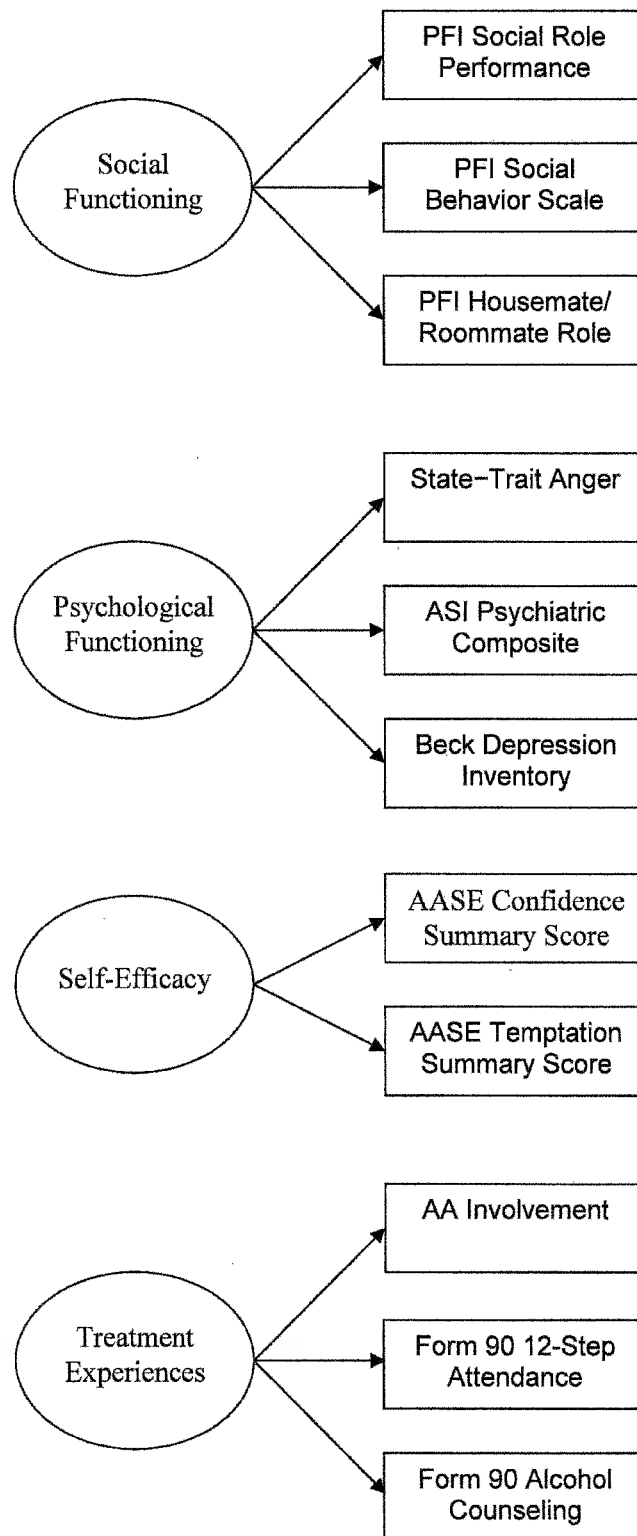


FIGURE 2. Initial measurement model of hypothesized 15-month mediation latent variables. PFI = Psychosocial Functioning Inventory; ASI = Addiction Severity Index; AASE = Alcohol Abstinence Self-Efficacy scale; AA = Alcoholics Anonymous.

variables suggested that there may be a simpler measurement model that involved combining the psychiatric and social functioning indicators to form a “psychosocial functioning” latent variable. In this regard, the data showed that several of the indicators were more highly correlated with indicators of the other domain (i.e., psychiatric with social) than they were with indicators within their domains. Accordingly, the three-latent variable model was tested for its fit to the data.

The CFA of the three-factor model also showed an excellent fit to the data ($\chi^2 = 201.32$, 41 df, $p < .01$; CFI = .94; TLI = .93; SRMSR = .037). All of the hypothesized factor loadings were statistically significant. Based on these findings, the three-factor model was tested for its fit to the data by use of SEM methods.

SEM testing

Sample division. Table 1 presents baseline demographic data and alcohol-related information for the full sample ($N = 796$) and each of the two subsamples (n for each = 398). Analyses showed that the two subsamples did not differ on any of the variables included in Table 1.

Data preparation. As in the procedures used in testing the measurement model and following recommendations of Kline (2005) and others, the raw indicator scores were used in the SEM analyses. The only exceptions were the two 3-year drinking outcome measures: percentage of days abstinent and drinks per drinking day. Both of these measures were transformed, because the transformation substantially improved the distribution of each respective set of scores' approximation to normal. An arc sine/square root transformation was applied to the percentage of days abstinent data, and a square root transformation was applied to the drinks per drinking day data.

Model testing. The difference between the model depicted in Figure 1 and the model tested is that the psychological functioning and social functioning indicators were combined to form a “psychosocial functioning” latent variable. In addition, baseline psychosocial functioning and baseline self-efficacy were hypothesized to be directly related to alcohol use in Months 1-12 as well as to their respective 15-month values. In addition, the “index treatment” shown in Figure 1 represents random assignment in MATCH to one of three treatment conditions, with a hypothesized direct path to alcohol use in the first 12 months. Baseline psychosocial functioning was hypothesized to be correlated with baseline self-efficacy but not to MATCH treatment group assignment, because the latter was determined randomly. Finally, two 12-month alcohol-use mediated effects were hypothesized, one through 15-month psychosocial functioning and one through 15-month self-efficacy.

The results of the analyses showed poor model fit to the data for both split samples and the full sample for both dependent variables. For the full-sample percentage of days abstinent model, the results were as follows: $\chi^2 = 1,176.21$, 178 df, $p < .01$; CFI = .83; TLI = .80; SRMSR = .072. The counterpart statistics for the drinks per drinking day model test were $\chi^2 = 1,190.49$, 178 df, $p < .01$; CFI = .83; TLI = .80; SRMSR = .072. Besides these findings, the model tests showed suppression effects (Maassen and Bakker, 2001) for both percentage of days abstinent and drinks per drinking day. In this context, a suppression effect meant that the psychosocial variable partialled out extraneous variance from the self-efficacy variable in the prediction of the drinking outcomes. In this regard, the patterns of simple correlations suggested that (1) the psychosocial variable was more highly correlated with self-efficacy than it was with either drinking outcome and (2) when both self-efficacy and psychosocial

TABLE 1. Participant demographic and baseline characteristics

Characteristic	Full sample ($N = 796$)	Split A ($n = 398$)	Split B ($n = 398$)
Drinker group, Mos. 1-12, n			
Abstainer	93	48	45
Moderate	157	78	79
Heavy	546	272	274
MATCH treatment assignment, n (%)			
CBT	259 (32.5)	130 (32.7)	129 (32.4)
MET	254 (31.9)	113 (28.4)	141 (35.4)
TSF	283 (35.6)	155 (38.9)	128 (32.3)
Gender, male, n (%)	72.4	72.1	72.6
Age, mean (SD)	38.5 (10.69)	39.1 (10.96)	37.96 (10.40)
Ethnicity, white, %	79.4	81.7	77.1
Marital, married/cohabit, %	44.2	43.7	44.8
Prior treatment, yes, %	45.0	44.5	45.5
SCID, alcohol dependence, %	95.7	94.5	97.0
Percentage of days abstinent, mean (SD)	34.20 (29.99)	33.89 (30.95)	34.59 (29.04)
No. of drinks/drinking days, mean (SD)	13.50 (8.05)	13.18 (7.54)	13.81 (8.52)

Notes: Split A = subsample A; Split B = subsample B; mos. = months; CBT = cognitive-behavior therapy; MET = motivational enhancement therapy; TSF = twelve-step facilitation therapy; SCID = Structured Clinical Interview for the DSM-III-R.

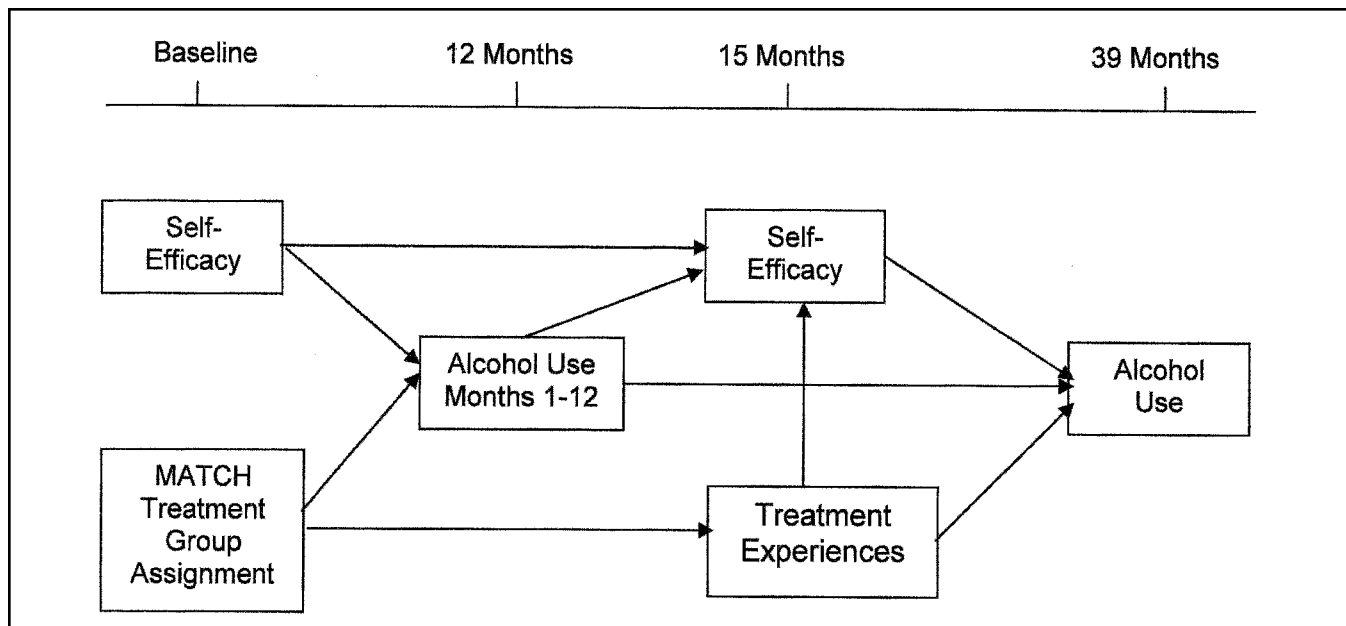


FIGURE 3. Reduced path model

functioning were in the same model, the direction of the effect of the psychosocial variable with outcome was the opposite (the expected direction was positive for percentage of days abstinent and negative for drinks per drinking day and consistent with the simple indicator-outcome correlations, albeit weak) of that expected and not statistically significant.

There was additional evidence found for suppression in the three-factor model when a two-factor (including self-efficacy and treatment experiences at 15 months) model was tested, as we describe later. In this regard, the hypothesized self-efficacy paths were significant in both the two- and three-factor model, but the magnitude of the effects was larger in the three-factor model. Again, this suggests that the psychosocial variable partialled out extraneous variance from the self-efficacy variable in the prediction of the drinking outcomes.

As a result of these findings and their low substantive value beyond confirming that the 15-month psychosocial indicators were weakly correlated with outcomes and shared extraneous variance with 15-month self-efficacy, we moved to testing a model that included only self-efficacy and treatment experiences as the 15-month latent variables. This "reduced" model is presented in Figure 3.

As can be seen in Figure 3, the index MATCH treatment assignment, following our original model, was hypothesized to be related to alcohol use in the first year. We also hypothesized that MATCH treatment assignment would be related to treatment experiences at 15 months because of the finding that individuals in the 12-step facilitation condition reported more AA involvement in the first year after treatment (Connors et al., 2001). Baseline self-efficacy was hypothesized to be related both to alcohol use in Months 1-12 and to

self-efficacy at 15 months. Alcohol use and both 15-month constructs were predicted to be related to drinking at 3 years, and treatment experiences at 15 months were expected to be concurrently correlated with self-efficacy. The model also set to zero the path from alcohol use in Months 1-12 to treatment experiences at 15 months. Finally, the indirect effect of alcohol use at 12 months to self-efficacy at 15 months to alcohol use at 3 years was included in the model's testing. The residual variance of all measures was assumed to be independent, except in the case of the baseline and 15-month self-efficacy assessments.

The model's fit to the data was tested for each subsample and the full sample on each 3-year drinking measure; means and standard deviations of each of the indicator variables and their intercorrelations for each test may be obtained from the authors by request. Table 2 summarizes the results of the SEM analyses by presenting indexes of model fit and significance of the unstandardized path coefficients. As can be seen in Table 2, the model showed excellent fit for both drinking outcomes and across both subsamples, suggesting its robustness. This conclusion is indicated not only by the fit indexes but also by the significance of the individual path coefficients and the consistency of findings across subsamples at the individual path level. It is important to note that Table 2 shows that about 31% (indirect effect of drinker group on 3-year drinking through self-efficacy divided by direct effect of drinker group on 3-year drinking + indirect effect of drinker group through self-efficacy on 3-year drinking) of the total effect of drinker group on percentage of days abstinent in the full sample is the result of its effects through self-efficacy. The counterpart value for drinks per drinking day is 23%.

TABLE 2. Unstandardized path coefficients results for testing fit of modified path model (Figure 3) to the data for the two subsamples and the full sample

Effect	% Days abstinent, Mos. 37-39			Drinks/drinking day, Mos. 37-39		
	Split A	Split B	Full	Split A	Split B	Full
SEBL → SE15	.34 [†]	.64 [†]	.49 [†]	.34 [†]	.66 [†]	.50 [†]
Tx15 → SE15	.10 [†]	.04	.07 [†]	.10 [†]	.04	.07 [†]
DGp → SE15	-.45 [†]	-.29 [†]	-.37 [†]	-.45 [†]	-.30 [†]	-.37 [†]
DGp → Tx15 (fixed)	.00	.00	.00	.00	.00	.00
SE15 → Alc39	.18 [†]	.18 [†]	.18 [†]	-.39 [†]	-.42 [†]	-.41 [†]
Tx15 → Alc39	.07 [†]	.07 [†]	.07 [†]	-.20 [†]	-.20 [†]	-.20 [†]
SEBL → DGp	-.17*	-.31 [†]	-.25 [†]	-.17*	-.31 [†]	-.25 [†]
DGp → Alc39	-.13 [†]	-.17 [†]	-.15 [†]	.42 [†]	.61 [†]	.52 [†]
TxBL → Tx15	.23 [†]	.07	.15 [†]	.23 [†]	.07	.15 [†]
TxBL → DGp	-.05	-.04	-.04	-.05	-.04	-.04
TxBL with PFBL	.03	.01	.02	.03	.01	.02
DGp → SE15 → Alc39	-.08 [†]	-.05 [†]	-.07 [†]	.18 [†]	.13 [†]	.15 [†]
R ² Alc39	.18	.22	.20	.17	.22	.19
χ ² , 29 df	57.52 [†]	54.44 [†]	91.12 [†]	57.87 [†]	56.56 [†]	93.87 [†]
CFI	.97	.97	.97	.97	.97	.97
SRMSR	.04	.04	.03	.04	.04	.03
TLI	.95	.96	.95	.95	.96	.95

Notes: Mos. = months; Split A = subsample A, Split B = subsample B, Full = full sample; SEBL = self-efficacy at baseline; SE15 = self-efficacy at 15 mos.; Tx15 = treatment at 15 mos.; DGp = drinker group (coded 0 = abstainer, 1 = moderate, 2 = heavy); Alc39 = respective alcohol use variable, Mos. 37-39; TxBL = MATCH treatment group assignment; PFBL = psychosocial functioning at baseline; CFI = Comparative Fit Index; SRMSR = Standardized Root Mean Square Residual; TLI = Taylor-Lewis Fit Index.
**p* < .05; [†]*p* < .01.

Discussion

The results of the SEM analyses show that the model depicted in Figure 3 fit the data well, as reflected by the fit indexes and the tests of the individual hypothesized paths. The analyses also suggest the stability of the findings both in overall fit indexes and in individual paths. Because the model was tested with longitudinal data, these findings—while, of course, not giving direct evidence of causal relationships—give a stronger approximation to sequences of causal relationships among the constructs. It is important to note that the results of the tests of individual paths took into account variance resulting from important baseline factors, including self-efficacy and MATCH treatment condition assignment.

The findings of this study extend Maisto et al.’s (2007a) study by showing that early alcohol use (i.e., less frequent, lighter volume of drinking) post-AUD treatment is associated with better drinking outcomes at 3 years both directly and in part (31% and 23% for percentage of days abstinent and drinks per drinking day, respectively) through its beneficial effects on an individual’s self-efficacy to abstain from alcohol use. In addition, the data show the beneficial direct effects of level of self-efficacy at 15 months and of treatment experiences at 15 months on drinking at 3 years.

The data also reveal a significant concurrent relationship between treatment experiences and self-efficacy at 15 months, as predicted. Given the magnitude of the factor loadings of the two AA-related indicators on the treatment experiences construct and the correlations of both AA indicators at 15 months with 3-year drinking, the findings on

treatment experiences reaffirm the literature supporting AA involvement during and post-AUD treatment (Humphreys, 2004).

Although the model included the initial treatment episode as exerting a direct effect on alcohol use in Months 1-12, none of the model tests showed this path to be statistically significant. This finding does not necessarily fail to support the concept that initial AUD treatment episode has no bearing on shorter term alcohol use. In this regard, the finding of no overall treatment effects in the MATCH trial is well known; therefore, the results of the model tests in this study are not surprising.

The “alcohol use at 12 months” construct was represented by the drinker-group categorization. Our earlier research using this classification suggested that the most direct clinical implications of the findings are that the highest likelihood of good functioning in the drinking domain at 3 years is afforded by complete abstinence in the first year after treatment initiation. Additional analyses treating alcohol use in Months 1-12 as a continuous variable suggested that the crucial proportion of days abstinent was at least 180 of the 360 (Maisto et al., 2006). The model tests in this study suggest that the benefits of abstinence in the first year operate in part through its effects on building self-efficacy to abstain from alcohol use.

It is not that there are no benefits in keeping alcohol use in the first year at a moderate level; Maisto et al. (2007a) showed that individuals classified as moderate drinkers had drinking outcomes at 3 years that tended to be considerably better than did individuals who were in the heavy

drinker category. But as far as 3-year drinking outcomes are concerned, abstainers clearly were functioning the best of the three groups, and this study's data suggest that it is in part because complete abstinence facilitates the rate or the strength (or both) of the building of self-efficacy regarding maintaining abstinence from alcohol use.

We conducted supplementary analyses of the indicators of the self-efficacy construct (AASE scale, confidence and temptation subscales) to achieve additional insight into the drinker-group-self-efficacy connection. The mean scores on the two respective AASE subscales were compared (Tukey's honestly significant difference [HSD] test, $p < .05$) at 15 months. These paired comparisons of means showed that, for confidence to abstain, the abstainers scored as more self-efficacious than either the moderate or heavy drinkers, and the moderate drinkers were more self-efficacious than were the heavy drinkers. For temptation to drink, the abstainers and moderate drinkers were again more self-efficacious than the heavy drinkers, but the abstainers and the moderate drinkers did not differ. Therefore, the beneficial effects of complete abstinence from alcohol in the first year seem to be in part the result of a strengthening of two dimensions of self-efficacy, but, for moderate drinkers, the beneficial effects were more limited. Of course, it also is possible that moderate drinkers not scoring as high as the abstainers in self-efficacy in confidence to abstain may reflect moderate drinkers having nonabstinent drinking goals to begin with. Clearly, additional research is needed for a better understanding of this pattern of findings.

A major clinical implication of these findings is that it is crucial to work closely with clients and patients to keep alcohol consumption at a minimum in the first year after treatment, because that seems to be an important element of solidifying a personal resource (self-efficacy to abstain from alcohol in a variety of situations) that predicts longer term maintenance of changes in alcohol consumption. This may operate by providing a foundation for individuals building and strengthening non-alcohol-use coping skills that may be applied in everyday life, and, as success at application of such skills increases, self-efficacy to use them would tend to increase as well. In this regard, a premise of cognitive-behavioral approaches to treatment is that a primary way of increasing confidence in application of a skill is past success in applying it in real situations (e.g., Maisto et al., 2007b). Therefore, behavioral success at application of coping skills tends to promote confidence that they can be used effectively, and longer periods of abstinence from alcohol would give the individual more opportunities to use nonalcohol coping behaviors that individuals learn as part of their treatment.

More generally, this study's findings highlight the need to closely examine the interrelationship between alcohol use and self-efficacy *within* the first year, and there is some evidence to suggest that this is crucial to the long-term maintenance of changes in alcohol use (Connors et al., 2001).

Moreover, it seems crucial that clinicians monitor and clinical researchers investigate how other psychological and social/environmental factors, as well as treatment experiences, affect and are affected by changes in alcohol use within the first year.

Unfortunately, this study could not provide information on other psychological or social functioning variables because of the problems in the analyses of those variables, as described earlier. However, evidence from other research (Moos and Moos, 2007) suggests strongly that "psychosocial resources" at the end of the first year predict alcohol use and related functioning as long as 16 years later, implying that an understanding of the course of such resources in the first year is a clinically significant issue.

There are a few limitations in these data that are important to note. The suppressor effects observed in the three-factor model tests did not allow tests of indirect effects of alcohol use in Months 1-12 through psychosocial functioning. As a result, understanding of the components of the total influence of alcohol use in the first year following treatment initiation on longer term functioning may have been reduced considerably. Another limitation of this study, as with all analyses involving the core MATCH data set, is that more than 95% of the participants had a diagnosis of alcohol dependence. In addition, they all participated in a trial of interventions that emphasized abstinence from alcohol as the primary outcome goal. Therefore, the applicability of the results of this study to populations of individuals in treatment for less severe alcohol problems or whose treatment is receptive to alternative drinking outcome goals needs to be determined empirically.

It also is important to note that Project MATCH excluded individuals who met criteria for other substance-use dependence diagnoses (except for marijuana) or who were intravenous drug users. Therefore, the MATCH sample may have been less involved with drug use other than alcohol than is the case for individuals presenting for treatment in many clinical settings. This raises two questions, the first of which is the generalizability of these findings to more drug-involved AUD clinical populations.

The second question is related to the first and concerns the degree of importance for different clinical populations of whether first-year substance-use patterns can be operationalized as in this study or if they need to take into account both alcohol and other drug use. This currently is an important question for clinical research.

The results of this study warrant the conduct of an a priori, longitudinal study of posttreatment alcohol use and AUD clinical course. Such research would build on the results of this study, by providing a sensitive test of the model depicted in Figure 1 and choosing indicators that are best suited to measuring the constructs proposed and that are sensitive to change over time. Related to this point, future research should consider more frequent longitudinal assessment than

was used in Project MATCH, which would allow for a more sensitive and elaborate estimate of mediation effects of interest than was possible in this study. Such an approach would permit investigation of interrelationships among alcohol use, treatment experiences, and psychosocial factors within the first year, which seems crucial. It is important to note that Figure 1 captures major psychosocial constructs prevalent in current conceptualizations of the development and remission of AUDs (Moos, 2007), so that its further evaluation would aid theoretical as well as clinical developments.

In conclusion, the results of this study replicate and extend earlier research on the association of first-year alcohol use and longer term clinical course and implicate the importance of self-efficacy to abstain from alcohol in determining part of that association. A major priority for future research is more sensitive analyses of treatment experiences and psychosocial factors in addition to self-efficacy—both within the first year and following the first year—and their connections to alcohol consumption in determining long-term AUD clinical course.

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