Original Article

ADDICTIVE DISORDERS & THEIR TREATMENT

Volume 5, Number 4
December 2006

Psychosocial Predictors of Treatment Outcome, Dropout, and Change Processes in a Pharmacological Clinical Trial for Alcohol Dependence

Lara A. Ray, MA, Kent E. Hutchison, PhD, and Angela Bryan, PhD

Abstract

Objectives:
The purpose of this study was to examine psychosocial variables associated with treatment outcome, dropout, and the change process in a clinical trial that combines pharmacotherapy with a psychosocial intervention.

Methods:
Participants (N = 72) were men and women who enrolled in a 12-week clinical trial of olanzapine for alcohol dependence. All participants received 2 individual sessions of a motivation-based intervention.

Results:
Analysis revealed that higher motivation for change and higher problem severity were individually associated with lower rates of treatment dropout. The effects of problem severity on treatment dropout were found to be mediated by motivation for change. Regarding treatment outcome, baseline measures of craving for alcohol significantly predicted drinking outcomes during follow-up. Furthermore, changes in craving for alcohol before and after treatment were found to predict drinking outcomes at follow-up.

Conclusions:
Results are discussed in terms of their implications for the treatment of alcohol dependence, particularly regarding clinical trials that combine pharmacotherapy with a psychosocial intervention.

Key Words: treatment, dropout, predictors, alcohol craving, self-efficacy

(*Addict Disord Their Treatment* 2006;5:179–190)

Psychotherapy is thought to enhance pharmacological trials by improving medication compliance, decreasing patient dropout, and teaching skills that are compatible with the effects of the medication.[1] A host of psychosocial and clinical factors have been shown to predict pharmacological trial completion and outcome. Understanding those psychosocial determinants of treatment outcome, dropout, and change processes has the potential to improve patient retention, thus reducing the effect of attrition bias on effect–size estimates, and enhancing outcomes in clinical trials. Quantifying predictors of dropout and outcome also has applied implications for the clinical practice of psychosocial interventions delivered in conjunction with pharmacotherapy. As noted by Kranzler,[2] virtually all research on pharmacotherapies for alcoholism has focused on the main effects of medication, with little attention paid to the psychotherapy component. A large multisite study, Project Combine, seeks to address some of these important questions regarding the interaction between psychosocial and pharmacological interventions for alcohol dependence.[3]

In a review of methodological issues in clinical trials for alcohol dependence, Anton[4] highlighted the importance of systematically evaluating differences between treatment completers and noncompleters. Studies to date have examined predictors of treatment dropout within various treatment modalities and settings. Predictors of dropout in the alcohol dependence literature include demographic factors such as age,[5,6] educational level,[7] gender,[7] marital status,[8] and ethnicity.[9,10] Interestingly, the

From the Department of Psychology, University of Colorado, Boulder, Colorado.

Reprints: Lara A. Ray, MA, University of Colorado, Department of Psychology, Muenzinger Psychology Building, Campus Box 345, Boulder, CO 80309-0345 (e-mail: lara@psych.colorado.edu).

direction of these relationships may vary as a function of treatment setting or modality. For example, client's age was found to be negatively associated with dropout rate in an outpatient substance abuse setting,[6] but positively associated with dropout and readmission to a detoxification facility.[5]

Although most of the literature on treatment dropout has focused on demographic factors, a few studies have identified psychological and substance use variables as independent predictors of treatment dropout. Examples of such variables include the therapist's interpersonal functioning, [6] multiple substance use,[5] supportiveness of the treatment environment,[9] and motivation for change.[9] Interestingly, several factors associated with treatment dropout may also increase the potential for the iatrogenic effects of interventions for substance use disorders.[11] This paper will focus on variables that are both clinically and empirically relevant, such as motivation for change, problem severity, alcohol craving, and abstinence self-efficacy.

Prognostic factors for treatment outcome have also been identified in the alcoholism literature. Psychosocial predictors of outcome include positive life events,[12] self-efficacy,[13] psychiatric severity,[13,14] and motivation for change.[15,16] Additionally, results from a large treatment trial, Project MATCH, revealed that several of the client attributes used in the matching hypotheses were also predictors of treatment outcome.[17–19] Prognostic variables found in Project MATCH included motivation for change, drinking severity, and self-efficacy.[17–19] The predictive utility of several psychosocial variables, however, was shown to vary as a function of sample characteristics (outpatient vs. aftercare) and time at follow-up.[17–19] The aforementioned studies included various settings, such as outpatient,[6,7] intensive outpatient,[12] 12-step self-help,[9] and detoxification programs.[5] The results briefly reviewed here suggest that constructs such as self-efficacy, drinking severity and motivation for change constitute important predictors of outcome in various treatment settings.

In addition to understanding variables that predict treatment outcome and dropout, it is important to examine the mechanisms of change of a given intervention. Anton[4] recommended that measures of outcome go beyond drinking variables and include the assessment of important intermediary outcomes, such as changes in alcohol craving, for example. A specific measurement, the Obsessive Compulsive Drinking Scale, was developed to assess cognitive aspects of alcohol craving which in turn is a strong predictor of drinking outcomes, such as relapse into heavy drinking.[4,20,21] This recommendation has important implications for the understanding of psychotherapy and pharmacotherapy processes that may ultimately determine who is most likely to respond to certain interventions. In accordance with the above recommendation, 2 nondrinking outcome measures were examined in this study, namely craving for alcohol (ie, measured by the OCDS and a cue-exposure paradigm) and abstinence self-efficacy. These psychosocial variables have been chosen on the basis of their empirical and clinical relevance,[15,20–23] and the expectation is that treatment-induced increases in self-efficacy and decreases in craving will in turn lead to decreased drinking behavior. In summary, the benefits of better understanding psychosocial determinants of treatment response, dropout, and change processes in the context of a clinical trial that combines pharmacotherapy with a psychosocial intervention are numerous. These include the potential to improve patient retention and outcome in clinical trials, thereby reducing biases in treatment effect estimates due to attrition. Moreover, a better understanding of treatments that combine psychosocial interventions with pharmacotherapy is becoming increasingly important as new medications for alcohol dependence become available.[24,25]

ADDICTIVE DISORDERS & THEIR TREATMENT
Volume 5, Number 4
December 2006

The purpose of this study was to examine the role of 4 empirically driven and clinically relevant psychosocial variables (ie, alcohol craving, abstinence self-efficacy, motivation for change, and drinking severity) in predicting treatment outcome, dropout, and change processes with respect to a clinical trial that combines a medication (ie, olanzapine) with a brief psychosocial intervention.[26] The specific aims of this study are 3-fold. First, it will examine the predictive utility of the 4 variables of interest with regard to treatment dropout. Second, it will test the 4 psychosocial constructs as predictors of response to the combined treatment. Third, it will examine changes in alcohol craving and abstinence self-efficacy, measured pre- and posttreatment, and will use these change scores as predictors of drinking outcomes. It is expected that alcohol craving and drinking severity will be *positively* associated with treatment dropout and *negatively* related to treatment outcome. Abstinence self-efficacy and motivation for change are expected to be *negatively* associated with dropout and *positively* related to outcome. Finally, it is hypothesized that *increases* in abstinence self-efficacy and *decreases* in alcohol craving, associated with participation in the trial, will predict better drinking outcomes.

METHODS

Participants

The present study was approved by the University of Colorado Human Research Committee, and all subjects provided written informed consent after receiving a full explanation of the study. Participants were recruited by newspaper and radio advertisements. All female subjects tested negative for pregnancy before participation, all subjects were required to have a blood alcohol concentration of zero before each session, and all subjects were required to be in good physical health, as indicated by a medical screening designed to ensure that there were no contraindications for the use of the study medication. Subjects were excluded if they met criteria for certain psychiatric diagnoses (ie, bipolar disorder, psychotic disorder, bulimia or anorexia nervosa), reported a psychological disorder requiring pharmacotherapy, endorsed current use of illicit drugs other than marijuana, or tested positive for the use of illicit drugs other than marijuana. Furthermore, there was a minimum drinking requirement of 14 drinks (females) or 21 drinks (males) on average per week for 4 consecutive weeks. Participants also had to be within 21 days of their last drink to be included in the study. A total of 154 subjects were assessed for eligibility, 80 of whom met full criteria for participation in the study. Of these 80 cases, 8 did not start the trial within 21 days of their last drink and therefore were excluded from the analysis. Of the 72 remaining participants, 7 did not return after the first therapy session and were classified as treatment dropouts (ie, completers, n = 65, noncompleters, n = 7). Consequently, data from a total of 72 participants (23 females) were available for analyses of treatment dropout, 65 of whom (22 females) were available for analyses of treatment outcome and change processes. Most participants in this study (N = 72) were married (59%) and the average level of education was 14.5 years. The participants' age ranged from 22 to 55, with a mean age of 43.8. The ethnic breakdown of the sample was: 82% white, 17% Hispanic, and 1% African American.

Procedures

Individuals interested in the study called the laboratory and completed a telephone-screening questionnaire. Eligible participants were invited to a secondary screening visit, which consisted of the Structured Clinical Interview for DSM IV – SCID Clinician Version, assessing alcohol dependence and concurrent psychiatric diagnoses.[27] In addition to the clinical interview, participants completed the medical

screening visit during the initial appointment.

Eligible participants were invited back to the laboratory for a baseline session (session 1), during which they completed measures of demographics, alcohol problem severity, abstinence self-efficacy, alcohol craving, and motivation for change. At this time, participants also met with a therapist for the first session of the psychosocial component of the trial (described in detail below). At the end of session 1, participants were randomized to receive either olanzapine (5 mg) or placebo. Participants, therapists, and research assistants were blind to medication condition.

The cue reactivity session (session 2) took place 2 weeks after session 1. Following standardized procedures previously reported in the literature,[28] participants completed a cue-exposure paradigm. In general, this procedure involves comparing reactivity between control cues (eg, a nonalcoholic beverage) versus an alcohol-related cue (eg, the preferred alcoholic beverage). At the end of the cue-exposure session, participants met with a therapist to process their reactivity to the cues, discuss urge coping strategies, and follow-up on their treatment goals. Participants were assessed for drinking and nondrinking outcomes (ie, alcohol craving and abstinence self-efficacy) at 3 follow-ups taking place during weeks 4, 8 and 12.

Psychosocial Intervention

All participants received 2 sessions of a brief motivation-based psychosocial intervention. These sessions took place at the end of the baseline session (session 1) and the cue reactivity session (session 2). Each session lasted between 35 and 50 minutes and consisted of providing feedback on clients' drinking behavior (measured by study questionnaires), eliciting pros and cons about drinking alcohol, setting treatment goals, and eliciting coping strategies for achieving treatment goals. The therapists in the study were 3 female doctoral students in clinical psychology at the University of Colorado at Boulder. Individual therapists were crossed with treatment condition such that each therapist worked with equal numbers of participants in each of the medication conditions.

Measures

During the baseline session, participants provided demographic information and completed measures of drinking problem severity, abstinence self-efficacy, craving for alcohol, and motivation for change.

TABLE 1. Intercorrelations, Means, Standard Deviations, and Scale Range for the Psychosocial Variables of Interest

Measure	1	2	3	4	5	6	7	M	SD	Range
1. Steps (SOCRATES)	—	—	—	—	—	—	—	26.47	6.67	8–40
2. Recognition (SOCRATES)	0.50§	—	—	—	—	—	—	28.07	5.51	7–35
3. Ambivalence (SOCRATES)	0.33‡	0.52§	—	—	—	—	—	15.74	3.36	4–20
4. Craving (OCDS)	0.04	0.33‡	0.12	—	—	—	—	24.79	6.53	0–58
5. Severity (ADS)	0.29†	0.55§	0.15	0.48§	—	—	—	14.75	6.81	0–47
6. Self-efficacy (AASE)	0.17	−0.07	−0.05	−0.43§	−0.11	—	—	53.47	12.57	20–100
7. Cue-elicited Craving (AUQ)¶	−0.08	0.09	−0.22*	−0.01	0.17	0.06	—	0.67	1.18	−2.5–4.0

N = 72.
*$P = 0.08$.
†$P < 0.05$.
‡$P < 0.01$.
§$P < 0.001$.
¶Cue-elicited craving was measured at the second session, therefore only 65 participants, classified as treatment completers, provided cue-elicited craving data.

ADDICTIVE DISORDERS & THEIR TREATMENT
Volume 5, Number 4
December 2006

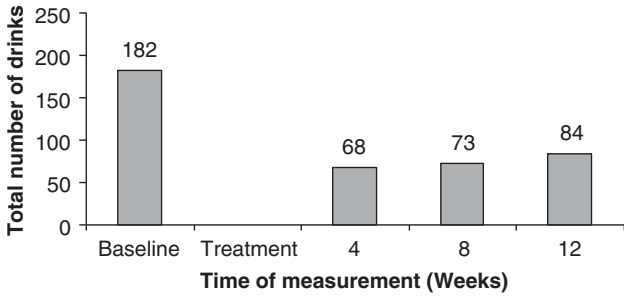

FIGURE 1. Mean total number of drinks over the past 4 weeks, assessed at baseline and at each point in follow-up.

See Table 1 for means, standard deviation, and range for all variables of interest. The following measures were utilized in this study:

Time Line Follow Back

This measure was used to assess the quantity and frequency of drinking in the 30 days before enrollment in the study and at each time in follow-up.[29] Consistent with previous outcome studies,[19,30,31] the primary drinking outcome variables in this study were percent days abstinent and total number of drinks. Figures 1 and 2 present mean scores on drinking variables at baseline and at each time point in follow-up.

Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES)

This is a 19-item measure of motivational processes associated with the Transtheoretical Model.[16] Specifically, the stages of change readiness and treatment eagerness scale (SOCRATES) consists of 3 subscales assessing recognition of alcohol-related problems (Recognition subscale), uncertainty about drinking (Ambivalence subscale), and taking action to change drinking behavior (Taking steps subscale). The SOCRATES has been shown to be a valid and reliable measure of readiness for change.[32] For the purpose of this study, and consistent with prior research, each subscale of the SOCRATES was examined individually (ie, Ambivalence, $\alpha = 0.61$; Recognition, $\alpha = 0.84$; and Steps, $\alpha = 0.92$).

Alcohol Abstinence Self-efficacy Scale (AASE)

The alcohol abstinence self-efficacy scale (AASE) consists of 20 items assessing self-efficacy beliefs applied to alcohol abstinence. The AASE is composed of 4 subscales (negative affect; social/positive; physical and

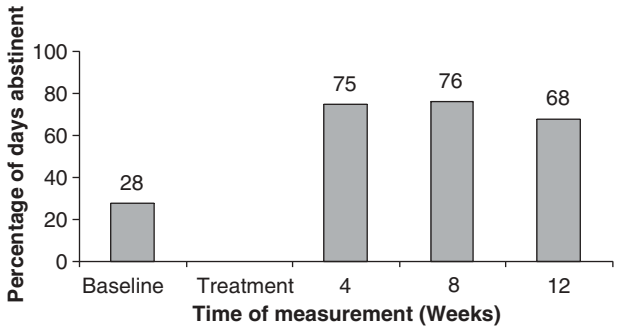

FIGURE 2. Mean percentage of days abstinent over the past 4 weeks, assessed at baseline and at each point in follow-up.

other concerns; and withdrawal and urges) and a total scale score, which was used in this study ($\alpha = 0.92$). The AASE has been shown to have good psychometric properties and is not influenced by gender differences.[33]

Obsessive Compulsive Drinking Scale (OCDS)

The OCDS is a 14-item scale assessing cognitive aspects of alcohol craving. The OCDS has been shown to be a valid and reliable self-report instrument that is sensitive to change during periods of abstinence and relapse into drinking ($\alpha = 0.80$).[20,21] In this study alcohol craving was assessed through the OCDS, which is more cognitively based, and the Alcohol Urge Questionnaire (AUQ; see subsequent text), which was administered during the cue-exposure paradigm.

Alcohol Urge Questionnaire (AUQ)

As described in the preceding text, participants completed a cue-exposure paradigm in the laboratory. During the cue-exposure, participants rated their craving for alcohol, measured by the AUQ, upon exposure to a control cue and an alcohol cue. The AUQ asks participants to rate their agreement to craving statements, such as ''Nothing would be better than having a drink right now'', on a 7-point scale ranging from ''strongly disagree'' to ''strongly agree.'' A difference score was computed by subtracting the AUQ score for the control cue from the AUQ score for the alcohol cue. Cue-elicited craving data are not available for treatment noncompleters given that the paradigm took place during the second treatment session. Reliability of the AUQ in this study was adequate, $\alpha = 0.92$.

Alcohol Dependence Scale (ADS)

The alcohol dependence scale (ADS) is a 25-item scale assessing severity of alcohol dependence. It surveys symptoms present over the past 12 months, such as alcohol tolerance and withdrawal, impaired control over drinking, and compulsion to drink ($\alpha = 0.83$). A score of 9 or above on the ADS is highly predictive of the DSM diagnosis of alcohol dependence.[34,35]

RESULTS

Means, standard deviations, and correlations among the psychosocial variables of interest are presented in Table 1. Given that the constructs of interest are intercorrelated, analyses of predictor variables were performed individually. The following are the results for each of the 3 study objectives which consist of: (1) examining the 4 psychosocial variables of interest (ie, alcohol craving, problem severity, motivation for change, and self-efficacy) as predictors of treatment dropout, (2) examining the 4 psychosocial variables as predictors of outcome, and (3) testing alcohol craving and self-efficacy as putative mechanisms of change in this intervention.

Psychosocial Predictors of Treatment Completion

To address the first study hypothesis regarding the prediction of treatment dropout, a series of logistic regression analyses were conducted. For the purpose of this study, treatment noncompleters were those individuals who attended the first treatment session but failed to return for session 2 and were lost to follow-up (completers, n = 65; noncompleters, n = 7). Demographic variables such as age and gender were not associated with treatment completion in this sample ($P > 0.05$), and neither was medication condition (ie, olanzapine vs. placebo) ($P > 0.05$). As can be seen in Table 2, the results revealed that motivational factors were predictive of treatment completion, such that individuals who scored lower on recognition of alcohol problems and reported lesser efforts to control their drinking were more likely to drop out of treatment. There was a negative relationship

ADDICTIVE DISORDERS & THEIR TREATMENT
Volume 5, Number 4
December 2006

TABLE 2. Summary of Individual Logistic Regression Analyses Predicting Treatment Dropout

Variable	β	SE	Odds Ratio	95% CI	Wald Statistic
Taking steps to quit (SOCRATES)	−0.15	0.06	0.86	0.77 to 0.97	5.77†
Recognition of problem (SOCRATES)	−0.15	0.07	0.86	0.75 to 1.00	3.80†
Ambivalence (SOCRATES)	−0.16	0.11	0.85	0.69 to 1.06	1.98
Alcohol craving (OCDS)	−0.11	0.07	0.89	0.79 to 1.01	3.03*
Alcohol problem severity (ADS)‡	−0.19	0.10	0.82	0.68 to 1.00	3.68†
Abstinence self-efficacy (AASE)	−0.00	0.03	1.0	0.94 to 1.06	0.00

N = 72.
*$P = 0.08$.
†$P < 0.05$.
‡Given the association between problem severity and age, analysis of the relationship between severity and treatment dropout were conducted controlling for age.

between treatment dropout and problem severity such that participants who scored higher on severity of alcohol problems were less likely to drop out of treatment, after controlling for age. Additionally, a trend was observed with regard to alcohol craving, measured by the OCDS, such that lower alcohol craving scores were associated with a greater likelihood of dropout. There were no significant predictors by medication interactions with regard to treatment dropout ($P > 0.05$), suggesting that the predictive utility of the psychosocial variables of interest did not differ across medication condition. Complete results of logistic regression analyses predicting treatment dropout are presented in Table 2.

Psychosocial Predictors of Treatment Outcome

The second study hypothesis, pertaining to predictors of treatment outcome, was examined using the general liner model (GLM) in a repeated trial fashion, such that the continuous variables of interest (ie, craving, self-efficacy, severity, and motivation) were used to predict drinking outcomes (ie, total number of drinks and percentage of days abstinent) across the 3 levels of follow-up (ie, 4, 8, and 12 weeks) and controlling for baseline drinking scores (ie, total number of drinks or percentage of days abstinent). Moreover, considering that the analyses of the main effects of the study medication revealed that olanzapine was not associated with drinking outcomes, except for a subset of individuals with a certain variant of the D4 dopamine receptor gene (DRD4), all treatment outcome analyses were performed controlling for the effects of the DRD4 genotype (for details on the effects of the medication see Hutchison, Ray et al in press).[22] Figures 1 and 2 present means for the drinking variables measured at baseline and at each follow-up.

Regarding the first outcome variable, *total number of drinks*, there was a main effect of cue-elicited craving such that higher craving scores were associated with higher total number of drinks during follow-up ($F(1.61) = 7.14$, $P < 0.01$). There was also a main effect of craving scores, measured by the OCDS, such that higher OCDS scores were associated with higher total number of drinks during follow-up ($F(1.61) = 4.66$, $P < 0.05$). Moreover, when tested in conjunction with one another, both cue-elicited craving and OCDS score remained significant predictors of total number of drinks during follow-up ($P < 0.05$), suggesting that these different alcohol-craving variables capture unique qualities of treatment response. Motivational factors, problem severity, and abstinence self-efficacy, measured at baseline, were unrelated to total number of drinks during the trial ($P > 0.05$).

There was, however, a medication X recognition interaction ($F(1.59) = 5.50$, $P < 0.05$). Two additional repeated measures GLM analyses were calculated to

probe this interaction, 1 for the effect of problem recognition on total number of drinks across follow-up in the olanzapine condition, and 1 for the effect of recognition on total number of drinks at follow-up in the placebo condition. This approach resulted in significance tests for the regression coefficient of the relationship of problem recognition at each of the medication conditions. The relationship of problem recognition and total number of drinks during trial was negative and marginal ($F(1.29) = 3.38$, $P = 0.08$) for individuals in the olanzapine condition, but was not significant ($F(1.28) = 0.81$, $P = 0.38$) for individuals in the placebo condition. There were no other predictor X medication interactions, or predictor X trial interactions with regard to total number of drinks during follow-up.

Results regarding the second outcome variable, *percentage of days abstinent*, revealed a main effect of craving, measured by the OCDS, such that higher craving for alcohol was associated with a lower percentage of days abstinent during follow-up ($F(1.61) = 5.17$, $P<0.05$). In addition, there was a marginal craving X trial interaction, such that the negative association between OCDS scores and percentage of days abstinent became stronger across time points in follow-up ($F(2.122) = 3.00$, $P = 0.053$). Cue-elicited craving, motivational factors, and abstinence self-efficacy were unrelated to percentage days abstinent during follow-up ($P>0.05$). There were neither predictor X trial interactions, nor predictor X medication interactions ($P>0.05$) with regard to percentage of days abstinent.

Change Processes and Treatment Outcome

The third study hypothesis, regarding mechanisms of change, was tested using the general liner model in a repeated trial fashion, such that changes in alcohol craving (ie, OCDS scores) and self-efficacy after treatment (ie, scores after treatment minus baseline scores) were used to predict drinking outcomes (ie, total number of drinks and percentage of days abstinent) across the 3 levels of follow-up (ie, 4, 8, and 12 weeks) and controlling for baseline drinking scores (ie, total number of drinks or percentage of days abstinent). The mean change in abstinence self-efficacy, measured after psychosocial treatment, was + 11.28 (SD = 20.97), whereas the mean change in alcohol craving was −9.18 (SD = 7.45). As expected, participation in treatment was associated with increases in abstinence self-efficacy and decreases in alcohol craving. Analysis revealed a main effect of changes in craving, such that greater decreases in alcohol craving were associated with a lower total number of drinks ($F(1.50) = 10.12$, $P<0.01$) and a higher percentage of days abstinent ($F(1.50) = 12.05$, $P<0.01$). Change in abstinence self-efficacy, however, did not predict drinking outcomes ($P>0.05$) and there were no predictor X trial interactions.

Motivation, Severity, and Treatment Completion

As described in the preceding text, participants with higher problem severity were more likely to drop out of treatment, after controlling for age. Researchers from Project MATCH have hypothesized that better outcomes among clients with more severe alcohol problems may be due to the fact that such clients are more motivated for treatment.[19] Based on this hypothesis, *a post-hoc mediational model* was tested to examine whether the association between severity and treatment completion was mediated by motivation for change. To test the mediational hypothesis, the 2 subscales of the SOCRATES, recognition of problems and taking steps to quit, were added to form an index of readiness for change.[32] These subscales were shown to individually predict dropout (see preceding text) and were combined in efforts to provide a more parsimonious model, rather than testing separate models for each subscale.

The test for the mediation was conducted following Baron and Kenny.[36] Thus,

ADDICTIVE DISORDERS & THEIR TREATMENT
Volume 5, Number 4
December 2006

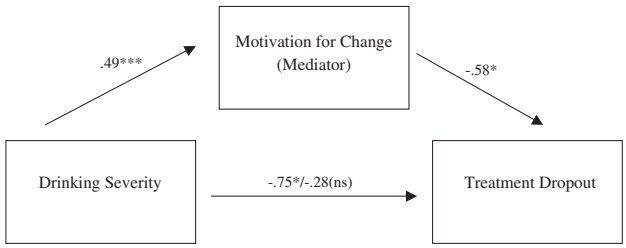

FIGURE 3. Mediation model predicting treatment dropout. Standardized path coefficients are presented for each path in the model. *P<0.05, ***P<0.0001. Sobel Test: −2.22, P<0.05.

the first step consisted of testing the effects of drinking severity (the IV) on motivation for change (the mediator). Results revealed that drinking severity was significantly associated with motivation for change (r = 0.49, P<0.0001). The second step tested the effects of drinking severity on treatment dropout (the DV) and found that there was a marginally significant negative association between treatment severity and dropout [Odds ratio = 0.82, 95% CI = (0.68–1.00), P = 0.05]. In the third step, the relationship between motivation for change and treatment dropout (the DV) was examined. Results of logistic regression analysis revealed a negative relationship, such that higher motivation for change predicted lower treatment dropout [Odds ratio = 0.50, 95% CI = (0.29–0.86), P<0.05]. During the fourth step treatment, dropout was regressed on both drinking severity and motivation for change. Results revealed that the effect of severity on treatment dropout was no longer significant (P>0.05) when motivation for change was added to the model, whereas the relationship between motivation and dropout remained statistically significant. Finally, a Sobel Test was conducted to formally test the significance of the mediated effect.[36–38] The Sobel Test was statistically significant (Sobel Test: −2.22, P<0.05), supporting the hypothesis that the effects of problem severity on treatment completion are significantly mediated by motivation for change. Figure 3 provides a visual representation of the mediational model along with standardized path coefficients.

DISCUSSION

The purpose of this study was to examine the role of 4 empirically driven and clinically relevant psychosocial variables (ie, alcohol craving, abstinence self-efficacy, motivation for change, and drinking severity) in predicting treatment outcome, dropout, and change processes with respect to a clinical trial that combines a medication (ie, olanzapine) with a brief psychosocial intervention.[26]

Regarding the analysis of predictors of dropout, results revealed that motivation for change and drinking problem severity were important predictors of treatment completion, such that individuals who were higher on motivation for change (ie, had higher recognition of problems and were taking more steps to quit drinking) and higher on problem severity, were less likely to drop out of treatment. Previous findings regarding the role of treatment severity and drinking outcomes are rather inconsistent in the literature, such that some studies suggest that drinking severity predicts worse outcomes,[13] while other studies have reported opposite results.[19]

Researchers from Project MATCH have hypothesized that better outcomes among clients with more severe alcohol problems may be due to the fact that such clients are more motivated for treatment.[19] In light of those findings, a mediational model was tested to examine whether the effects of severity on treatment completion are accounted for by motivation for change. Results revealed that the effect of problem

severity on treatment dropout, in our sample, was accounted for by readiness for change. Specifically, individuals who had higher drinking severity were also more motivated for change, as demonstrated by higher scores on recognition of problems and steps to change. Readiness for change, in turn, was a significant predictor of treatment completion such that individuals higher on readiness for change were less likely to dropout of the trial.

Support for the mediational model represents an important and novel finding, which has implications for addictions treatment and clinical trials alike. Specifically, these findings suggest that treatment completion prognosis based on problem severity must also take into account clients' motivation for change. Although the mediation concerning problem severity and motivation for change with regard to treatment completion has wide intuitive and clinical appeal, this is the first study to provide empirical support for this model.

The second objective of the present paper was to examine predictors of treatment outcome. Craving for alcohol emerged as an important predictor of drinking outcomes in this trial. Cue-elicited craving was positively associated with total number of drinks at follow-up, such that higher cue-elicited craving scores, measured in the laboratory, predicted higher total number of drinks during follow-up. Alcohol craving, measured by the OCDS, was positively associated with total number of drinks during follow-up and negatively related to percentage of days abstinent over the course of follow-up.

An important advantage of this study is that a self-report measure of alcohol craving (ie, the OCDS) was augmented by a laboratory-based cue-exposure paradigm. The study's methodological design allowed us to examine the predictive utility of 2 measures of alcohol craving, 1 that was based on the laboratory cue-exposure paradigm, and 1 self-rating scale, the OCDS.[20,21] Results revealed that while OCDS scores predicted total number of drinks and percentage of days abstinent, cue-elicited craving predicted higher total number of drinks during follow-up but was unrelated to percentage days abstinent. Theoretically, it is possible that cue-elicited craving is uniquely associated with loss of control over drinking, which is captured by the variable of total number of drinks. Clients who demonstrated high cue-elicited craving for alcohol may be particularly vulnerable to experience a loss of control during drinking episodes. Additionally, the OCDS is thought to capture an independent quality of alcohol dependence, such as more cognitive aspects of alcohol craving,[4,21] which in turn may explain why its predictive utility was not restricted to total number of drinks. This hypothesis is consistent with the nonsignificant correlation between the 2 measures.

In addition to the main effect of alcohol craving on drinking outcome measures, there was a significant medication by predictor interaction with regard to recognition of problems. Specifically, recognition of problems was marginally positively associated with drinking outcomes in the medication condition, while being unrelated to outcome in the placebo condition. These findings highlight the synergistic effects of treatments that combine pharmacotherapy with psychosocial interventions, while suggesting that medication trials should take into account psychosocial variables when attempting to identify treatment responders to a given pharmacotherapy.

The last objective of this study was to examine processes of change during the course of trial. Results revealed that on average, participants experienced increases in self-efficacy for alcohol abstinence and decreases in alcohol associated with participation in the trial. Changes in abstinence self-efficacy were unrelated to drinking outcomes at follow-up, whereas greater decreases in alcohol craving predicted better drinking outcomes at follow-up. In summary, these results highlight the role of alcohol craving as an important psychosocial

ADDICTIVE DISORDERS & THEIR TREATMENT
Volume 5, Number 4
December 2006

variable that may function as a mechanism of change during the course of treatment and recovery. One of the clinical implications of these findings is that treatments that are effective in reducing alcohol craving are more likely to succeed in reducing alcohol consumption per se. Additionally, the results suggest that baseline scores on important psychosocial variables are not sufficient to capture the complexity of treatment outcomes for alcohol dependence and that change scores can be valuable predictors of outcome and can inform us about processes of change. Lastly, the analyses of change processes underscore the importance of assessing outcomes that go beyond measuring alcohol consumption.[4]

This study was limited by the use of a small sample size and the lack of a no-treatment control to compare to the psychosocial aspect of the intervention. Specifically, the absence of a no-treatment condition precludes us from attributing changes in craving and self-efficacy to the treatment per se, given that we cannot rule out a third variable confound. The exclusion of individuals with certain Axis I comorbid disorders also limits the generalizability of these findings to certain dually diagnosed clinical populations. Nonetheless, this study makes a contribution to the understanding of treatment completion, outcome, and change processes in the context of treatment trials that combine medication with a psychosocial intervention. Lastly, as pharmacotherapy for alcohol dependence becomes more widely disseminated, understanding predictors of response to combined treatments will become increasingly relevant.

ACKNOWLEDGMENTS

The authors would like to thank Marie-Christine Rutter and Erica Sandman for their assistance with participant recruitment and data collection in this project. In addition, we thank Annie Peters and Vyga Kaufmann who served as therapists in the project along with the first author.

This research was supported by grants from the National Institute on Alcoholism and Alcohol Abuse to Kent Hutchison (R01AA11473) and Lara Ray (F31AA14847). Additional support was provided by the General Clinical Research Center Program of the National Center for Research Resources, National Institutes of Health (M01-RR00051), and a grant from Eli Lilly and Company.

REFERENCES

1. O'Malley SS, Carroll KM. Psychotherapeutic considerations in pharmacological trails. *Alcohol Clin Exp Res.* 1996;20:17–22.
2. Kranzler HR. Pharmacotherapy of alcoholism: gaps in knowledge and opportunities for research. *Alcohol.* 2000;35:537–547.
3. COMBINE Research Group. Testing combined pharmacotherapies and behavioral interventions in alcohol dependence: rationale and methods. *Alcohol Clin Exp Res.* 2003;27:1107–1122.
4. Anton RF. New methodologies for pharmacological treatment trials for alcohol dependence. *Alcohol Clin Exp Res.* 1996;20:3–9.
5. Callaghan RC, Cunningham JA. Gender differences in detoxification: predictors of completion and re-admission. *J Subst Abuse Treat.* 2002;23:399–407.
6. Saarnio P. Factors associated with dropping out from outpatient treatment of alcohol-other drug abuse. *Alcohol Treat Q.* 2002;20:17–33.
7. King AC, Canada SA. Client-related predictors of early treatment drop-out in a substance abuse clinic exclusively employing individual therapy. *J Subst Abuse Treat.* 2004;26:189–195.
8. Simpson DD, Joe GW. Motivation as a predictor of early dropout from drug abuse treatment. *Psychotherapy: Theory, Research, Practice, Training.* 1993;30:357–368.
9. Kelly JF, Moos R. Dropout from 12-step self-help groups: prevalence, predictors, and counteracting treatment influences. *J Subst Abuse Treat.* 2003; 24:241–250.
10. Wickizer T, Maynard C, Atherly A, et al. Completion rates of clients discharged from drug and alcohol treatment programs in Washington State. *Am J Public Health.* 1994;84:215–221.
11. Moos RH. Iatrogenic effects of psychosocial interventions for substance use disorders: prevalence, predictors, prevention. *Addiction.* 2005;100: 595–604.
12. Bottlender M, Soyka M. Outpatient alcoholism treatment: predictors of outcome after 3 years. *Drug Alcohol Depend.* 2005;80:83–89.
13. Walton MA, Blow FC, Bingham CR, et al. Individual and social/environmental predictors of alcohol and

drug use 2 years following substance abuse treatment. *Addict Behav.* 2003;28:627–642.

14. McLellan AT, Luborsky L, Woody GE, et al. Predicting response to alcohol and drug abuse treatments: role of psychiatric severity. *Arch Gen Psychiatry.* 1983;40:620–625.
15. DiClemente CC, Bellino LE, Neavins TM. Motivation for change and alcoholism treatment. *Alcohol Res Health.* 1999;23:86–92.
16. Prochaska JO, DiClemente CC. Transtheoretical therapy: toward a more integrative model of change. *Psychotherapy: Theory, Research, and Practice.* 1982;19:276–288.
17. Project MATCH Research Group. Matching alcoholism treatments to client hererogeneity: project match posttreatment drinking outcomes. *J Stud Alcohol*. 1997;58:7–29.
18. Project MATCH Research Group. Project match secondary a priori hypotheses. *Addiction*. 1997; 92:1671–1698.
19. Project MATCH Research Group. Matching alcoholism treatments to client heterogeneity: project match three-year drinking outcomes. *Alcohol Clin Exp Res*. 1998;22:1300–1311.
20. Anton RF, Moak DH, Lathan P. The obsessive compulsive drinking scale: a self-rate instrument for the quantification of thoughts about alcohol and drinking behavior. *Alcohol Clin Exp Res.* 1995;19:92–99.
21. Anton RF, Moak DH, Latham PK. The obsessive compulsive drinking scale: a new method of assessing outcome in alcoholism treatment studies. *Arch Gen Psychiatry.* 1996;53:225–231.
22. Bandura A. Health promotion from the perspective of social cognitive theory. *Psychol Health.* 1998;13:623–649.
23. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* 1977;84:191–215.
24. Kenna GA, McGeary JE, Swift RM. Pharmacotherapy, pharmacogenomics, and the future of alcohol dependence treatment, part 1. *Am J Health Syst Pharm.* 2004;61:2272–2279.
25. Kenna GA, McGeary JE, Swift RM. Pharmacotherapy, pharmacogenomics, and the future of alcohol dependence treatment, part 2. *Am J Health Syst Pharm.* 2004;61:2280–2288.
26. Hutchison KE, Ray LA, Sandman E, et al. The effect of olanzapine on craving and alcohol consumption. *Neuropsychopharmacology*. 2006;31:1310–1317.
27. First MB, Spitzer RL, Gibbon M, et al. *Structured Clinical Interview for DSM-IV Axis I Disorders: Clinician Version (SCID-CV)*. Washington, DC: American Psychiatric Press; 1997.
28. Rohsenow DJ, Monti PM, Hutchison KE, et al. Naltrexone's effects on reactivity to alcohol cues among alcoholic men. *J Abnorm Psychol.* 2000; 109:738–742.
29. Sobell LC, Sobell MB. Convergent validity: an approach to increasing confidence in treatment outcome conclusions with alcohol and drug abusers. In: Sobell LC, Sobell MB, Ward E, eds. *Evaluating Alcohol and Drug Abuse Treatment Effectiveness: Recent Advances*. New York: Pergamon Press; 1980:177–183.
30. Killeen TK, Brady KT, Gold PB, et al. Effectiveness of naltrexone in a community treatment program. *Alcohol Clin Exp Res.* 2004;28:1710–1717.
31. Monti PM, Rohsenow DJ, Swift RM, et al. Naltrexone and cue exposure with coping and communication skills training for alcoholics: treatment process and 1-year outcomes. *Alcohol Clin Exp Res.* 2001;25:1634–1647.
32. Miller WR, Tonigan JS. Assessing drinkers' motivation for change: the stages of change readiness and treatment eagerness scale (SOCRATES). *Psychol Addict Behav.* 1996;10:81–89.
33. DiClemente CC, Carbonari JP, Montgomery RP, et al. The alcohol abstinence self-efficacy scale. *J Stud Alcohol.* 1994;55:141–148.
34. Skinner HA, Allen BA. Alcohol dependence syndrome: measurement and validation. *J Abnorm Psychol.* 1982;91:199–209.
35. Skinner HA, Horn JL. *Alcohol Dependence Scale: Users Guide*. Toronto: Addiction Research Foundation; 1984.
36. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol.* 1986;51: 1173–1182.
37. Preacher KJ, Leonardelli GJ. Calculation for the sobel test: an interactive calculation tool for mediation tests [Computer software]. Available from http://www.unc.edu/~preacher/sobel/sobel.htm, Updated March 2001.
38. Sobel ME. Asymptotic intervals for indirect effects in structural equations models. In: Leinhart S, ed. *Sociological Methodology*. San Francisco, CA: Jossey-Bass; 1982:290–312.