**ASCERTAINING THE RELATIONSHIPS BETWEEN THE TRAJECTORIES OF
SPECIFIC CATEGORIES OF ALCOHOL-RELATED NEGATIVE
CONSEQUENCES AND SUBSEQUENT DRINKING BEHAVIOR**

by

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**A dissertation submitted to the
Graduate School of New Brunswick
Rutgers, The State University of New Jersey
In partial fulfillment of the requirements**

For the degree of

Doctor of Philosophy

Graduate Program in Education

Written under the direction of

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And approved by

New Brunswick, New Jersey

January, 2011

ABSTRACT OF THE DISSERTATION

Ascertaining the Relationships between the Trajectories of Specific Categories of Alcohol-Related Negative Consequences and Subsequent Drinking Behavior

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The overwhelming majority of people who drink alcohol do so non-problematically. Nevertheless, approximately 17.6 million Americans have been diagnosed with an alcohol use disorder (AUD), which can be severely debilitating and contribute to both increased morbidity and premature mortality. Irrespective of treatment approach, drinking behavior modifications are often short-lived and relapse is common. The first year following AUD treatment has been identified as a period of high risk for relapse, and thus an important timeframe for enquiry regarding alcohol-related behavior change and its maintenance. In addition, at least among individuals with a diagnosed AUD, alcohol use and negative consequences have been shown to be related reciprocally. A commonly used measure of alcohol-related negative consequences is the Drinker Inventory of Consequences (DrInC) which has been supported empirically in several studies, although investigations of specific categories of alcohol-related negative consequences and their trajectories have been lacking. Given this background, the purpose of this dissertation was to conduct secondary data analyses to: (1) confirm the previously reported factor structure of the DrInC; (2) follow the course of the five DrInC categories of alcohol-related negative consequences across the first year post AUD

treatment initiation; (3) investigate whether these trajectories vary by participant gender, age or assigned treatment condition; and (4) examine the relationships between these trajectories and subsequent drinking behavior. Data from the outpatient arm of Project MATCH ($n = 952$), to date the largest psychosocial alcohol treatment randomized clinical trial, were analyzed for this dissertation.

Study results confirmed the DrInC factor structure and the trajectory of each DrInC category was indicative of improved alcohol-related problems across the first year post-treatment initiation period. Specific DrInC categories varied as a function of participant gender, age, and assigned treatment condition and these trajectories were predictive of subsequent drinking behavior. Specifically, higher intercepts during the three-month treatment period were associated with poorer drinking behavior one year later. Alternatively, steeper slopes were associated with improved drinking behavior and some of these relationships were modified by gender, age, and treatment condition. It was concluded that assessing alcohol-related negative consequences during the first year post-treatment initiation can have clinical utility.

ACKNOWLEDGEMENT and DEDICATION

I would like to acknowledge and thank my dissertation committee for their guidance and support throughout this dissertation process. Specifically, my committee chair, Doug Penfield, thank you for your assistance, attention to detail, and good humor. To my committee members: Greg Camilli, thank you for your quantitative guidance and for staying on after your move to Colorado; Sharon Ryan, thank you for agreeing to be on my committee, for your time and effort and for providing moral support; and most especially, to Jon Morgenstern, thank you for agreeing, without hesitation, to step in as my outside committee member at the eleventh hour, for going *well* above and beyond the call of duty, and for making time for me when you had none.

This dissertation is dedicated to my family and friends for all their support and understanding throughout my undergraduate and graduate schooling. Especially to my children, who always understood when I had to say “Sorry, I can’t. I have to study” or “Sorry, I can’t. I have to work on my dissertation,” thank you. Most importantly, this dissertation is dedicated to Pat Clifford, my husband and mentor, without whose constant guidance, support (both financial and moral), enthusiasm, love and belief in my abilities none of this would have been possible. Thank you for believing in me and giving me the opportunity to realize my dreams!

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CHAPTER I. INTRODUCTION

Alcohol use is an integral part of American culture. Approximately 65% of the United States population drinks alcohol at least occasionally. Alcohol is used to celebrate, socialize with friends and family, at sporting events, restaurants, and clubs. One to two alcohol drinks per day has been shown to be beneficial in reducing the risks of developing cardiovascular diseases, diabetes, dementia, and other related health problems (Gunzerath, Faden, Zakhari & Warren, 2004). Although the overwhelming majority of people who drink alcohol do so non-problematically, approximately 17.6 million (~ 7%) Americans have been diagnosed with alcohol-related difficulties referred to as Alcohol Use Disorders (AUDs), which can be severely debilitating and contribute to both increased morbidity and premature mortality.

Alcohol-related problems are prevalent and constitute a major public health concern. Each year more than 100,000 people in the United States die from alcohol-related diseases and injuries (Stinson, Nephew, Dufour & Grant, 1996). In addition, about three in ten adults engage in some kind of risky drinking behavior that, for example, can range from occasional heavy drinking to daily heavy drinking. More than 50% of adults in the United States have a family history of problem drinking. The Centers for Disease Control (CDC) lists alcohol consumption as the 3rd most preventable cause of death in the United States, with tobacco use being #1, and poor diet/lack of physical activity listed as #2 (Mokdad, Marks, Stroup, & Gerberding, 2004). Additionally, heavy drinking (defined as five or more drinks per day for males, and four or more drinks per day for females) contributes to the three leading causes of death: heart disease, cancer and stroke. In 2006, approximately 32% of all traffic fatalities involved

alcohol (Research Society on Alcoholism, 2009). The estimated economic costs of alcohol abuse and alcoholism are staggering, almost \$185 billion per year, which includes the costs for health care (e.g., treatment and medical consequences; 15%), lost future earnings (~ 70%), and the remainder of these costs is attributed to lost workforce productivity, premature deaths, and the fiscal impacts of accidents, violence, and social welfare administration (RSA, 2009).

Alcohol Use Disorders (AUDs)

Alcohol use disorders are classified as either alcohol *abuse* or alcohol *dependence*. The Diagnostic Statistical Manual, fourth edition (DSM-IV), presents criteria for diagnosing both alcohol abuse and alcohol dependence. According to the DSM-IV, alcohol *abuse* is present when one or more of the following symptoms occur, at any time, in the same 12-month period: failure to fulfill major role obligations at work, school, or home because of recurrent drinking; recurrent drinking in hazardous situations; recurrent legal problems related to alcohol; or, continued use despite recurrent interpersonal or social problems. A diagnosis of alcohol *dependence* requires three or more of the following criteria to occur in the same 12-month period: increased tolerance; withdrawal syndrome or drinking to relieve withdrawal; impaired control; drinking more or longer than intended; neglect of activities; an increase in amount of time spent related to drinking or recovering; or, continued use despite recurrent psychological or physical problems (Spitzer and Williams, 1985).

Alcohol use disorders often are chronic and difficult to modify. Irrespective of intervention approach (e.g., personal resources, self-help groups, professional psychological and /or medical interventions), attempted modifications to drinking

behavior (i.e., cutting back or abstaining) are typically short-lived, and relapse (i.e., re-initiation of problematic alcohol use) is common. Indeed, the first year following treatment initiation is critical and has been identified clinically as a high risk period for relapse (Maisto, McKay & O'Farrell, 1998; McKay & Weiss, 2001; Clifford, Maisto, Stout, McKay, & Tonigan, 2006). In addition, Alcoholics Anonymous (AA), the largest and most familiar self-help organization assisting individuals with alcohol-related problems, also recognizes the first year as a high risk period for relapse and celebrates individuals maintaining sobriety for one full-year (i.e., often referred to as the one-year birthday). Furthermore, drinking behavior during this critical period has been shown to be predictive of longer-term functioning (e.g., alcohol use, alcohol-related negative consequences, psychosocial; Maisto, Clifford, Stout, & Davis, 2006; Maisto, Clifford, Stout, & Davis, 2007).

The Critical First Year Post-Treatment and Longer-Term Functioning

Individuals treated for AUDs who maintain complete abstinence during the immediate 12-month post-treatment period have been reported to use significantly less alcohol up to 18-months later (i.e., 30-months post treatment onset) relative to those who consumed any alcohol during the early post-treatment period (Maisto, McKay, & O'Farrell, 1998; Maisto, Clifford, Longabaugh, & Beattie, 2002). For example, in the Maisto, et al (2002) study, first-year abstainers reported 97% days abstinent, only 2% heavy drinking days, and an average of 1 drink per drinking day at the 24-month follow-up compared to 67% days abstinent, 17% heavy drinking days, and an average of 8 drinks per drinking day reported by the first-year drinker group. First-year abstainers also showed improved psychological and self-efficacy outcomes at 24 months post-

treatment initiation (Maisto et al, 2002), and fewer alcohol-related hospitalizations (9 for the drinker group versus 0 for the abstainer group, $\chi^2 = 5.23$, 1 df, $p < .05$) and greater marital functioning at the 30-month follow-up (Maisto et al, 1998).

More recently, Maisto and colleagues (2006; 2007), conducting secondary data analyses, classified subjects based on their self-reported drinking behavior during the first 12-months of study participation as either “abstinent”, “moderate”, or “heavy” drinkers. Individuals who reported no alcohol use during the 12-month post-treatment initiation period were classified as “abstainers.” Individuals who consumed alcohol but did not exceed five heavy drinking days (i.e., six or more drinks in a day for males and four or more drinks in a day for females) during the 12-month post-treatment initiation period were classified as “moderate” drinkers. “Heavy” drinkers reported drinking heavily on six or more days during the 12-month post-treatment initiation period. These drinker groups were found to be a significant predictor of alcohol use at the 3-year follow-up such that abstainers consumed significantly less alcohol than either the moderate or heavy drinker groups, who did not differ significantly from each other (Maisto et al, 2006). Specifically, the first-year abstainers reported drinking an average of 1.55 drinks per drinking day, compared to the moderate and heavy drinker groups who reported an average of 4.12 and 6.35 drinks per drinking day, respectively at follow-up ($F = 42.94$, 2/795 df, $p < .0001$, R^2 model = .112, ω^2 drinker group = .096). In addition, abstainers were abstinent 92% of the days compared to the moderate and heavy drinker groups who were abstinent 61% and 67% of the days, respectively ($F = 39.74$, 2/795 df, $p < .0001$, R^2 model = .190, ω^2 drinker group = .090).

In a subsequent analysis, Maisto and colleagues (2007) found that the first-year heavy drinkers had reported significantly higher rates of alcohol-related negative consequences at the three-year follow-up, than either the abstainers or moderate drinkers, who did not differ from each other (Wilks $\lambda = .88$; $F = 6.96$, 10/1030 df, $p < .0001$). Alternatively, the abstainers had significantly better outcomes (i.e., less alcohol use) at the three-year follow-up, than either the moderate or heavy drinker groups and the moderate drinkers had better outcomes than the heavy drinkers. Specifically, the abstainers had 92% days abstinent at follow-up compared to 79% and 62% for the moderate and heavy drinker groups, respectively ($F = 47.14$, 2/791 df, $p < .0001$, R^2 model = .17, ω^2 drinker group = .10), and averaged 1.60 drinks per drinking day compared to 4.00 and 6.77 drinks per drinking day for the moderate and heavy drinkers, respectively ($F = 50.06$, 2/791 df, $p < .0001$, R^2 model = .12, ω^2 drinker group = .11; Maisto et al, 2007).

Given this background, it is clear that the first-year post-treatment initiation is not only a well recognized high-risk period for AUD relapse, but patient alcohol use during this critical period is associated with much longer-term (i.e., years later) functioning that crosses multiple domains (e.g., alcohol use, alcohol-related negative consequences, psychosocial, marital, legal). Along these lines, it is well known among alcohol researchers and clinicians that alcohol use and alcohol-related negative consequences, at least among those seeking treatment for AUDs, have a reciprocal association. That is, individuals experience negative consequences as a result of their alcohol use but may also drink alcohol to diminish the effects of those consequences. For example, alcohol use can lead to marital problems and these resulting problems may contribute to one's

drinking behavior (i.e., increased consumption). Therefore, more in-depth understanding regarding the relationship between alcohol use behavior and related factors (e.g., categories of alcohol-related negative consequences), especially during this high-risk period, is highly significant and has the potential to inform future AUDs treatment service delivery.

Pathways to Behavior Change

With respect to the resolution of AUDs, success rates are similar among those individuals using professional services and those choosing to modify their drinking behavior without professional assistance (Clifford, Maisto, & Davis, 2007). Furthermore, success rates among various interventions targeting AUDs are fairly equivalent. Given this similarity of outcome rates across different treatment modalities, attention was shifted to the identification of patient-treatment matching studies (i.e., a patient attribute by treatment interaction effect), which contributed to the decline of the traditional “horse race” type studies (i.e., comparisons among treatments where one treatment is presumed to be superior to the other). Irrespective of the overall relatively low success rates associated with AUDs specialty treatments, all are effective, to some degree, for some people. The critical question is “which treatment works best for which patients, and under what conditions?” Along these lines, a fundamental assumption underlying patient-treatment matching studies is that treatment effectiveness can be improved if patient attributes are matched appropriately to treatment approach.

The importance of AUDs treatment matching studies was exemplified by an ambitious alcohol treatment outcomes research study known as Project MATCH (Matching Alcohol Treatment and Client Heterogeneity), which was funded by the

National Institute on Alcohol Abuse and Alcoholism (NIAAA). To date, Project MATCH is the largest psychosocial alcohol treatment randomized clinical trial conducted in the US with nine recruitment/treatment sites spanning eight states and an overall sample size of 1,726 subjects (Project MATCH Research Group, 1993). Study participants were randomized into one of three treatment conditions: Twelve Step Facilitation (TSF); Motivational Enhancement Therapy (MET), or Cognitive-Behavioral Coping Skills Therapy (CBT) and followed for 15-months (i.e., one-year post-treatment completion). It was hypothesized that patients with greater alcohol involvement, cognitive impairments, meaning seeking, sociopathy and support for drinking would have better outcomes when exposed to TSF. Patients experiencing higher alcohol involvement, cognitive impairment, greater psychiatric severity, sociopathy and support for drinking, as well as women, were hypothesized to have better outcomes when exposed to CBT treatment. Individuals high in conceptualization and low in motivation to change their alcohol use behaviors were hypothesized to have better outcomes when exposed to MET (Project MATCH Research Group, 1997).

Of the 16 primary outcomes tested in Project MATCH, however, only one was supported that was not time dependent (Project MATCH Research Group, 1997). Furthermore, alcohol use outcomes did not vary significantly across the three treatment conditions (i.e., TSF, MET, or CBT), although drinking levels were significantly reduced from the baseline period (pre-treatment) to the 15-month follow-up assessment (i.e., one year post-treatment), leading to the conclusion that despite the different philosophies underlying each of the three treatment approaches, they appeared to produce comparable, positive outcomes (Hester & Miller, 1995; Lambert & Bergin, 1994; in Project MATCH

Research Group, 1997). Following the failure of Project MATCH to demonstrate significant patient attribute by treatment matching effects, NIAAA began to shift their research focus toward the mechanisms of change (MOC) that underlie specific AUD treatments. To date, few AUDs treatment outcomes studies have provided empirical support for the treatment's purported MOC (Clifford, Maisto, Stout, McKay and Tonigan, 2006), although investigations are ongoing.

An alternative view is that the factors that influence behavior change are similar in and out of treatment and are largely non-specific (e.g., contextual). With respect to clinical interventions, for example, the extent to which an individual client likes or dislikes his/her therapist, or the treatment itself, may be important determinants of successful behavior change (Miller & Rollnick, 2002). An improved understanding of the common pathways to behavior change that underlie the initiation and maintenance of altered (i.e., improved) drinking behaviors may contribute to more effective interventions aimed at the resolution of AUDs.

Along these lines, Miller and Sanchez (1994) analyzed the content of brief clinical interventions and identified six elements that seem to be potential "active ingredients" necessary for behavior change. These elements are referred to by the acronym FRAMES: Feedback, Responsibility, Advice, Menu of options, Empathy and Self-efficacy. Although the presence of all six FRAMES elements does not appear to be a necessary condition for successful behavior change, successful interventions generally combine a number of them (Clifford & Maisto, 2000). These elements, along with the principles of self-regulation theory, provide the basis for the Motivational Interviewing

(MI) approach that has been found to be effective in enhancing an individual's motivation to change a targeted behavior.

Awareness of the consequences of one's alcohol use behavior also appears to be a requisite condition for motivating changes in drinking behavior (Miller & Rollnick, 2002). Along these lines, several studies have found that the greater the recent adverse consequences of alcohol use, such as important losses (Blume & Marlatt, 2000), greater frequency of losses (Blume & Schmalings, 1996), and more symptoms or symptom classes (e.g., withdrawal, job loss) experienced (Blume & Schmalings, 1997), the greater one's motivation to change. In addition, Blume, Schmalings and Marlatt (2006) investigated the relationship between specific categories of negative consequences, as measured by the Drinker Inventory of Consequences (DrInC) instrument (Miller, Tonigan, & Longabaugh, 1995) and motivation to change alcohol use as well as actual alcohol use over time. It was reported, among a sample of 120 young adults, that a greater number of intrapersonal consequences (e.g., changes in personality, self-esteem) predicted greater motivation to change drinking behavior. It also was reported that greater interpersonal and impulse control consequences were predictive of greater alcohol use at the three month follow-up. Furthermore, physical, and social responsibility related consequences were not significantly related to either motivation to change behavior or subsequent alcohol consumption. Therefore, it appears that specific categories of alcohol-related negative consequences may have varying effects on subsequent drinking behaviors, which has direct clinical relevance for AUDs specialty treatments/interventions, and is the focus of this dissertation.

Further support regarding common pathways of behavior change and the associations between alcohol-related negative consequences and alcohol use is provided by Clifford and colleagues. The typical alcohol treatment randomized clinical trial is characterized by comprehensive assessment batteries that are administered across an extensive period of time (e.g., one or more years). Recently, Clifford, Maisto and Davis (2007) conducted an experimental investigation of the effects of exposure to alcohol treatment research assessments (assessment reactivity) on clinical outcomes, and reported that research assessment exposure is clinically beneficial. More comprehensive and frequent assessment exposure (i.e., a frequency by comprehensive interaction effect) was associated with greater reductions in subsequent alcohol use and alcohol-related negative consequences (i.e., of the four research conditions resulting from the crossing of assessment exposure frequency and comprehensiveness, the infrequent-brief condition had the poorest outcomes and the remaining three conditions did not differ from each other). This interaction effect was found for all three measures of alcohol use (i.e., proportion of days abstinent, proportion of heavy drinking days, and mean number of drinks per drinking day) as well as for the DrInC total score and three (i.e., impulse control, interpersonal, and physical) of the five (i.e., impulse control, interpersonal, intrapersonal, social responsibility, and physical) DrInC subscale scores.

In summary, it appears that common pathways may underlie alcohol-related behavior change, and that the first year following AUDs treatment initiation is high risk for relapse and thus, an important timeframe for inquiry regarding alcohol-related behavior change and its maintenance, which is essential for successful interventions. In addition, the earlier work of Blume and colleagues and the more recent assessment

exposure reactivity research of Clifford, Maisto and Davis (2007) both provide empirical support for the associations between alcohol use and alcohol-related negative consequences. However, scientific investigations of the associations between specific categories of alcohol-related negative consequences and alcohol use have been lacking, particularly among clinical samples.

Purpose

Given this background, the purpose of the proposed dissertation is threefold. First, using the data collected from 952 individuals who participated in the outpatient arm of the Project MATCH randomized clinical trial, to confirm the previously reported factor structure of the DrInC instrument (Miller, Tonigan and Longabaugh, 1995), a commonly used instrument in alcohol treatment outcomes research, and to test (i.e., confirm) its psychometric properties (e.g., convergent, discriminant validity). This instrument was developed to measure five distinct areas (i.e., interpersonal, impulsivity, physical, intrapersonal, and social responsibility) of adverse consequences that may be experienced because of excessive alcohol use.

Second, to follow the course of these five categories of alcohol-related negative consequences over the first 12 months of study participation (first 12 months post-treatment initiation) using linear growth modeling, and to investigate whether these trajectories vary as a function of participant gender, age, or assigned treatment condition.

Third, to examine the relationships between the trajectories of the five DrInC categories (subscales) of negative consequences, over the first 12 months of study participation, and subsequent drinking behavior (i.e., drinks per drinking day (DDD), proportion of heavy drinking days (HDD) and proportion of days abstinent (PDA))

reported at the 15-month follow-up interview (i.e., one year post-treatment completion), and to investigate whether these relationships vary as a function of participant gender, age, or assigned treatment condition.

Significance

Alcohol problems reflect significant public health concerns. Treatments for AUDs have been shown to have small-to-moderate effects that are often short-lived (i.e., relapse is common). Better understanding of the factors that contribute to behavior change and its maintenance, particularly during the critical high-risk period (i.e., first-year) following AUDs treatment, the focus of this dissertation, may facilitate the development of more successful interventions. Although alcohol use and related consequences have been shown to be reciprocally related, little is known about the trajectories of specific types of negative consequences during the post-treatment initiation high-risk period and: 1) how they are affected by gender, treatment modality, or age; and 2) their relationship with subsequent alcohol use, both of which may have important implications for AUDs prevention and treatment. In addition, confirmation of the factor structure of a widely-used alcohol research assessment tool (i.e., the Drinker Inventory of Consequences (DrInC) instrument) is important because valid data collection instrumentation is a necessary condition for conducting high quality research.

Research Questions and Related Hypotheses

Given the absence of prior research examining the trajectories of specific categories of alcohol-related negative consequences during the first year post-treatment initiation period, research hypotheses were based on either closely related prior empirical research (e.g., Blume et al, 2006) or investigator speculation regarding the relationships

between alcohol-related problems and treatment outcomes (e.g., Clifford et al, 2006). More specifically, Blume and colleagues have reported associations between specific categories of alcohol-related consequences (i.e., impulse control and interpersonal) at baseline and subsequent alcohol use (i.e., alcohol use three months later). Clifford et al. (2006) as well as others (e.g., Maisto et al. 2002) on the other hand, have suggested that the post-treatment period may be more important than the baseline period with respect to the prediction of AUDs treatment outcomes because treatment often alters factors that affect baseline functioning. This dissertation will investigate the following five research questions and related hypotheses:

1. Does the DrInC have the dimensional structure (i.e., subscale structure) evidenced in the instrument specifications?

Hypothesis 1. Confirmatory factor analysis will provide evidence supportive of the DrInC instrument's five original subscales (i.e., categories of alcohol-related negative consequences: physical, interpersonal, intrapersonal, impulse control and social responsibility).

2. Is there evidence of systematic change and individual variability in change across the five categories of alcohol-related negative consequences, as measured by the DrInC, during the first 12 months of study participation?

Hypothesis 2. The intercept and slope factors associated with each of the five DrInC categories will have means and variances that are significantly different than zero.

3. Does treatment condition, gender, or age predict the trajectories (i.e., intercept and slope) of the DrInC instrument's five categories of alcohol-related negative consequences across the first 12 months of study participation?

Hypothesis 3a. Women will experience more intrapersonal and physical alcohol-related negative consequences than men as evidenced by significantly higher intrapersonal and physical DrInC scores at Time 1 (i.e., intercepts).

Hypothesis 3b. Older age participants will experience fewer impulse control alcohol-related consequences than their younger counterparts as evidenced by a significantly lower impulse control DrInC score at Time 1 (i.e., intercept).

In addition, older participants are predicted to resolve impulse control problems more quickly than younger participants as evidenced by a steeper slope.

Hypothesis 3c. Individuals assigned to the Cognitive-Behavioral Coping Skills (CBT) treatment condition will report significantly greater improvements in both the interpersonal and intrapersonal categories of alcohol-related consequences relative to individuals assigned to the other treatment conditions (i.e., Twelve Step Facilitation (TSF) and Motivational Enhancement Therapy (MET) as evidenced by significantly steeper slopes.

4. Do the trajectories of specific categories of alcohol-related negative consequences predict subsequent drinking behavior at 15 months post-treatment initiation?

Hypothesis 4a. The trajectory (i.e., intercept and slope) of the impulse control DrInC category will be predictive of alcohol consumption at the 15-month follow-up. Higher initial levels of impulse control related problems (i.e.,

higher intercept) will be predictive of greater alcohol use at the 15-month follow-up. Early resolution of such problems that are sustained throughout the follow-up period, as evidenced by a steeper slope, however, will be predictive of less alcohol consumption (i.e., fewer DDD, less frequent HDD, and fewer PDA).

Hypothesis 4b. Identical to the impulse control related hypothesis (i.e., Hypothesis 4a) the trajectory (i.e., intercept and slope) of the interpersonal DrInC category will be predictive of alcohol consumption at the 15-month follow-up. Higher initial levels of interpersonal alcohol-related problems (i.e., higher intercept) will be predictive of greater alcohol use at the 15-month follow-up. Early resolution of such problems that are sustained throughout the follow-up period, as evidenced by a steeper slope, however, will be predictive of less alcohol consumption (i.e., fewer DDD, less frequent HDD, and fewer PDA).

Hypothesis 4c. The trajectory (i.e., intercept and slope) of the intrapersonal DrInC category will be predictive of alcohol consumption at the 15-month follow-up. Higher initial levels of intrapersonal related problems (i.e., higher intercept) will be predictive of lesser alcohol use at the 15-month follow-up. Early resolution of such problems that are sustained throughout the follow-up period, as evidenced by a steeper slope, however, will be predictive of less alcohol consumption (i.e., fewer DDD, less frequent HDD, and fewer PDA).

5. Does gender, age, or treatment condition moderate the relationship between specific categories of alcohol-related negative consequences and subsequent drinking behavior?

Hypothesis 5a. Gender will moderate the relationships between the physical, interpersonal, and intrapersonal DrInC category trajectories and DDD, such that women will show stronger associations across these categories and DDD relative to men.

Hypothesis 5b. Age will moderate the relationships between the physical, interpersonal, and intrapersonal DrInC category trajectories and DDD, such that older-aged individuals will show stronger associations across these categories and DDD relative to younger-aged individuals.

Hypothesis 5c. Treatment condition will moderate the relationship between all DrInC category trajectories and subsequent drinking, such that the TSF treatment condition will show stronger associations across these categories and PDA, relative to either the MET or CBT treatment conditions.

CHAPTER II. LITERATURE REVIEW

There are a number of theoretical frameworks upon which addiction (e.g., alcohol, drugs, gambling) treatments commonly are based: cognitive-behavioral, harm reduction, the disease model, and stages of change, to name just a few. One cognitive-behavioral model consistent with psychosocial addictions treatment, as well as self-induced behavior change, is self-regulation theory (SRT). Therefore, SRT has direct relevance to the proposed dissertation which centers on an investigation of the trajectories of specific types of alcohol related negative consequences and subsequent alcohol use, among a sample of individuals exposed to one of three AUDs treatments (i.e., cognitive behavioral, MET, or 12-step facilitation).

Self-Regulation Theory (SRT)

SRT and alcohol use. The relevance of self-regulation theory to alcohol use has been supported empirically by numerous studies. For example, Carey, Carey, Carnrike, & Meisler (1990) reported a significant association ($p < .001$) between drinking status and self-control in a sample of young adults such that those individuals who were drinking heavily had lower scores of self-control ($M = 17.0$) compared to those who were light/moderate drinkers ($M = 24.8$) who, in turn, were lower than the infrequent/abstainer drinkers ($M = 28.0$). Similarly, Brown, Miller and Lewandowski (1999), in a review of several studies, reported a negative relationship between self-regulation and alcohol use and related problems. Specifically, binge drinkers had lower self-regulation scores when compared to non-binge drinkers; and, lower self-regulation scores were associated with heavier and more frequent drinking.

More recently, Carey, Neal & Collins (2004) found, in a sample of 391 undergraduate students, that higher scores on the Short Self-Regulation Questionnaire (SSRQ) were associated significantly ($r = .25, p < .0001$) with lower scores on the Rutgers Alcohol Problem Index (RAPI). However, there were no significant relationships observed between the SSRQ scores and seven measures of alcohol use. It was concluded that self-regulation may influence situations in which students choose to drink, but not the quantity of alcohol consumed. Other studies also have found relationships between self-regulation and alcohol-related problems, but no relationship between self-regulation and actual consumption. For example, Nagoshi (1999) found a significant association ($R = .73$, $Beta$ for final equation = $-.23, p < .01$) between impaired control and alcohol-related problems (but not consumption). Additionally, Simons and Carey (2002) reported a relationship between affect regulation and marijuana-related problems, but not with marijuana use. Despite varying results it appears that SRT is relevant to the study of AUDs for both alcohol consumption and alcohol-related harm.

Kanfer's three-stage model of SRT. Self-regulation can be viewed as the ability to plan, guide, and monitor one's behavior in response to changing environmental demands or circumstances, and is achieved through an integration of comparison processes. These processes are intensified by self-focused attention (Carver, 1979; Carver & Scheier, 1981; Miller & Brown, 1991). Major contributions to the fundamentals of self-regulation theory were made by Kanfer in the 1970's and 1980's (Brown, 1998; Kanfer, 1970; Kanfer & Gaelick, 1986). As part of the self-regulation theoretical framework, Kanfer distinguished between *automatic* processing (i.e., the cognitive processing associated with well-learned activities that do not require continuous decision-making) and

controlled processing wherein a new behavior needs to be learned. Controlled processing requires attention and continuous decision-making and “marks the onset of self-regulation” (Kanfer & Gaelick, 1986).

Kanfer (1970) proposed a three-stage model of self-regulation. The first stage of which is *self-monitoring*. Self-monitoring involves careful and deliberate attention to one’s behavior. For example, an individual suffering an AUD might monitor his/her daily alcohol consumption for some period of time. Based on past experiences and social values, the individual has established certain rules (i.e., performance criteria or standards) by which s/he judges self-behavior (e.g., defining his/her drinking levels as normal or pathological).

The second stage of Kanfer’s model evolves from the individual’s comparison of current behavior, as determined from self-monitoring, and his/her personal standard or criterion for the behavior. This *self-evaluation* process may yield a discrepancy between what the individual is doing and what the individual believes s/he should be doing. However, this discrepancy may fail to occur if self-monitoring has been lacking or faulty, or if personal standards are vague or unrealistic. For example, if an individual suffering AUD has a faulty standard for problematic drinking and thus, fails to recognize his/her alcohol consumption as excessive, despite consuming relatively large amounts of alcohol on a fairly regular basis, a discrepancy between actual behavior (e.g., excessive alcohol use) and desired states (e.g., normal drinking) will not be recognized, and attempts at behavior change will not be initiated (i.e., current behaviors will be maintained).

Self-reinforcement, Kanfer’s third stage, refers to the individual’s reaction (i.e., satisfaction or dissatisfaction) to the previous process of self-evaluation. Motivation is

the major function of the self-reinforcement stage. If little or no status or goal discrepancy is noted, motivation favors maintenance of the current behavior(s). For example, if an individual determines that his/her alcohol consumption is consistent with a personal standard of recreational or social use (i.e., little or no discrepancy), s/he is not likely to engage in processes of behavior change (i.e., motivation favors behavior maintenance). On the other hand, if an individual determines that his/her alcohol consumption far exceeds his/her personal standards regarding recreational and/or social drinking (i.e., large discrepancy), the likelihood of behavior change is increased (i.e., motivation favors behavior change). Therefore, the degree of motivation favoring behavior change is dependent, at least in part, on the magnitude of the resulting discrepancy between actual and desired states.

Miller and Brown's self-regulation model. Miller and Brown (1991) expanded Kanfer's three-stage model of self-regulation and proposed that successful behavior change is contingent upon seven components of self-regulation. The first of these components is *informational input*, wherein self-monitoring and self-focused attention, as well as external cues, provides information to the individual. The ability to integrate information from various sources and make use of previous experience is essential for initiating effective self-regulatory control.

The next component is *self-evaluation*. As with Kanfer's model, a comparison is performed involving a standard of behavior (e.g., abstinence goal) and a current behavior (e.g., problematic drinking). This self-evaluation process must produce a sufficient discrepancy if behavior change is to be initiated. If the magnitude of the discrepancy produced via this comparison process is insufficient to initiate an instigation to change,

the current behavior is maintained. Alternatively, a perceived discrepancy sufficient to cause an *instigation to change* behavior (i.e., the third process) triggers a response to *search for alternatives* in an attempt to reduce the discrepancy. This process also involves self-efficacy (Bandura, 1982; Brown, 1998). For example, if an individual finds an alternative that is thought to be both feasible and efficacious (high self-efficacy), the self-regulatory process proceeds to the *planning* phase, in which the best course of action is decided upon. If, on the other hand, the individual deems the available alternatives to be of low self-efficacy (i.e., neither feasible nor efficacious, or both) the self-regulatory process may stall and behavior change is less likely to be initiated. Additionally, cognitive defense mechanisms may be employed in an attempt to reduce cognitive dissonance, thereby further reducing the likelihood of engaging in behavior change.

In addition to the search for alternative options and decisions regarding the best course of action to pursue, the planning phase includes the formulation of coping strategies, rules for adopting behaviors, and plans for carrying out the selected actions. However, having a plan, even a well-developed plan, does not ensure its enactment. *Implementation* may be dependent upon another set of behavioral actions that serve to enhance compliance and adherence to the newly developed plan of action. With respect to these other prerequisite/co-requisite behaviors, Miller and Brown (1991) refer to Kanfer and Gaelick's (1986) conceptualization of self-regulation in which specific "controlling" behaviors exert influence on the occurrence of other "target" behaviors. For example, individuals suffering AUDs may need to remove all sources of alcohol from their home (i.e., controlling behavior) prior to implementing a plan to remain abstinent (i.e., target behavior). Failure to successfully execute a set of requisite controlling

behaviors may serve to undermine the successful implementation of the target behaviors, resulting in either a failed, or an avoided attempt to change drinking behaviors.

Kanfer and Gaelick's (1986) conceptualization applies to the general case of self-regulation in which individuals direct their own behavior. The behavior implemented may represent learning a new skill (e.g., riding a bicycle) and not be very conflictual for the individual. However, when self-regulatory processes center on behavior(s) that is/are very conflictual for the individual, as is typical in clinical situations, self-regulatory processes center on redirection, a special case of self-regulation in which self-management methods frequently are applied. Individuals who present for AUDs treatment characteristically are ambivalent (i.e., conflicted) about their drinking behaviors. More specifically, it is quite common that these individuals, despite recognition of their drinking-related difficulties, may want to continue to be able to consume alcohol, albeit non-problematically. Given that these individuals perceive both positive (e.g., social effects) and negative effects (e.g., health problems) associated with their drinking, the magnitude of their derived discrepancies may vary from moment to moment, and, consequently, the likelihood of initiating and/or maintaining behavior change diminished. In these types of situations, the successful implementation of target behaviors (e.g., abstinence) is likely to be heavily dependent on the successful execution of the prerequisite/co-requisite controlling behaviors (e.g., removal of alcohol from the home). This process is considered cyclical and ongoing as the individual assesses progress toward goal achievement via *plan evaluation*. Feedback (i.e., information input) is continually received and comparisons regarding current behaviors and a standard (self-

evaluation) are made repeatedly. A graphic representation of the Miller and Brown SRT model is presented in Figure 1:

Figure 1. Miller and Brown's Model of Self-Regulation

Self-Awareness

According to Hull & Levy (1979, p.757) “self-awareness corresponds to the encoding of information in terms of its relevance for the self” and entails a heightened sensitivity to self-relevant information in the environment. Alcohol ingestion interferes with information encoding in terms of its self-relevance by inhibiting higher-order

cognitive processes. Alcohol consumption contributes to a diminished sensitivity regarding self-relevant information, which in turn leads to decreased self-awareness. Individuals suffering from AUDs, for example, may continue to consume alcohol in order to interrupt higher-order encoding processes and avoid self-awareness regarding their drinking-related problems.

Conversely, not ingesting alcohol would be expected to have the exact opposite effect and contribute to the improvement of self-relevant encoding processes, a heightened sensitivity regarding self-relevant information (e.g., assessment of alcohol related negative consequences), increased self-awareness, and improved self-regulation. A necessary condition for engaging in therapeutic treatment sessions with clients suffering AUDs, as well as collecting treatment research data, is that they be alcohol free at the time of the treatment and/or data collection session. As previously noted, one consequence of being alcohol-free is heightened sensitivity to environmental stimuli. The construct self-awareness is particularly relevant to self-regulatory processes and as noted by Clifford and Maisto (2000), self-regulated behaviors are, at least partially, dependent upon adequate self-awareness.

Motivating Behavior Change

Awareness of consequences and motivation. Miller and Rollnick (2002) have stated that awareness of the consequences of alcohol consumption is an integral part of motivating change in drinking behaviors. Indeed, a primary goal of motivational interviewing (MI) is to “increase the individual’s personal, salient awareness of his or her problems and risk” (Miller, 2003, p. 137). An awareness of how one’s current behavior impacts his/her important personal goals and values is requisite for developing a

discrepancy between actual behavior and desired goals, which, according to the principles of MI and SRT, is necessary to motivate the individual toward behavior change. Similarly, the Transtheoretical Stages of Change Model (Perz, DiClemente, & Carbonari, 1996; Prochaska & DiClemente, 1982; Prochaska, DiClemente, & Norcross, 1992) implies that the exploration of the consequences of behaviors can be an effective strategy for enhancing motivation and promoting actual behavior change. Specifically, individuals in the *precontemplation* stage (i.e., change is not being considered) may move to the *contemplation* stage (i.e., change is being considered) by having his/her awareness raised in regard to potential problems and negative consequences that might result from their current behavior.

Motivational Enhancement Therapy (MET). Motivational enhancement therapy (Miller, Zweben, DiClemente, & Rychtarik, 1992) is a particular application of MI in which personal feedback from clinical assessments is combined with the MI approach. Assessment feedback is presented to the client in an empathetic, non-judgmental, non-confrontational manner and the client is asked what s/he thinks of it. Employed as a brief intervention MET has been found to reduce drinking significantly in one or two sessions, and one session added at the intake assessment has been shown to increase treatment adherence. As discussed in Chapter I, four sessions of MET yielded results comparable to those of 12 sessions of CBT or TSF (Project MATCH Research Group, 1997). Along these lines, Miller and Sanchez (1994) identified six potentially active ingredients that underlie brief interventions, which are represented by the acronym “FRAMES.” In addition, Clifford and Maisto (2000) have suggested that alcohol treatment research

assessment (e.g., DrInC instrument) exposure related behavior change also may be explained by the acronym FRAMES.

FRAMES. In the field of alcohol treatment, brief interventions have become common and have been shown to be effective for motivating people to change their behavior. The content of over 100 effective brief clinical interventions was analyzed (Bien, Miller & Tonigan, 1993; Miller and Sanchez, 1994) and six elements that appeared to be common across these interventions were identified as potential “active ingredients” necessary for behavior change. As noted above, these elements are known by the acronym “FRAMES:” Feedback, Responsibility, Advice, Menu, Empathy, and Self-efficacy. FRAMES elements are readily incorporated into SRT, which provides a cohesive foundation for explaining behavioral changes. The presence of all six FRAMES elements does not appear to be necessary to effect behavior change, although successful interventions generally combine a number of them (Clifford & Maisto, 2000).

By giving direct and objective *feedback* regarding risk or harm, the therapist assists the client in recognizing a discrepancy between current behavior patterns and his/her personal goals, as well as enhancing the client’s awareness of the consequences of his/her drinking behaviors. This kind of feedback can be a potent motivator for behavior change (Miller & Rollnick, 2002).

Responsibility for changing one’s behaviors can be communicated in several ways and may be implicit or explicit. For example, solicitation of the therapist’s opinion (e.g. which behavior change strategy to adopt) during the course of a therapeutic session is not uncommon. Given that there is no one universally accepted approach to the treatment of AUDs, the therapist may choose to discuss alternative strategies with the client and

emphasize that the final choice rests with the client. Such an approach fosters client responsibility. During this process the therapist may assist the client with his/her decision-making by providing some clinically relevant information (e.g., the therapist might indicate that a period of complete abstinence from alcohol may be very beneficial). Based on this type of interaction/exchange, the client may perceive that s/he has been provided with some *advice*, and simultaneously, options (i.e., a *menu*) from which to choose, while reinforcing the notion that the particular course of action selected is the client's *responsibility*.

A therapeutic atmosphere in which the client perceives himself/herself as having some degree of control over his/her treatment regimen fosters a sense of respect and an attitude of acceptance, which are necessary for communicating *empathy*. *Self-efficacy* may be engendered via feedback provided during the therapeutic session. Comparisons of past and current behavior, as well as the reinforcement of certain behavior changes (e.g., abstinence, improved marital functioning), may enhance *self-efficacy*.

FRAMES as a theoretical construct has been tested in a limited manner, although some elements (e.g., feedback and self-efficacy) of FRAMES have been studied extensively. Clifford and colleagues (Davis, Clifford, Maisto, & Hagman, 2006), for example, reviewed 10 audio-taped baseline research assessment interviews and coded the number of occurrences of the different FRAMES elements. Controlling for baseline drinking, correlational analyses were conducted using the baseline FRAMES and 6-month drinking data. Results indicated moderate associations between *the* number of occurrences of *feedback* and percent days abstinent (PDA; $r = .53$); mean drinks per drinking day (DDD; $r = -.33$); and percent heavy drinking days (HDD; $r = -.42$). The

number of occurrences of *self-efficacy* was related moderately with PDA ($r = .28$); DDD ($r = -.30$); and HDD ($r = -.52$). *Empathy* was related moderately with PDA at 6-months ($r = .36$), but only minimally with DDD ($r = -.11$). In addition, *empathy* and HDD ($r = -.02$) were essentially unrelated. It was concluded that although the stability of the correlations may be questioned because of the small sample size ($n = 10$), the magnitude of the correlations was considerable, thus providing empirical support regarding FRAMES as a potential mechanism of action underlying alcohol-related behavior changes.

Study Covariates/Predictors

Assigned Treatment Condition. Project MATCH study participants were randomized into one of three treatment conditions: Cognitive Behavioral Treatment (CBT), Motivational Enhancement Therapy (MET), or Twelve-Step Facilitation (TSF). These three treatment modalities were chosen based on evidence of their clinical effectiveness and theoretical differentiation, and are well-defined, widely-used treatment modalities. Although there were no statistically significant outcomes with respect to Project MATCH primary outcomes (i.e., percent days abstinent (PDA) and drinks per drinking day (DDD)), there was a small but significant treatment by linear time effect for both DDD ($p < .05$) and PDA ($p < .001$) when adjustments for matching attributes were added. Given that the proposed analyses will investigate the course of alcohol-related negative consequences over time, assigned treatment condition will be included as a covariate. This will be accomplished by creating two dummy codes for assigned treatment condition: one, comparing CBT to the other two treatment conditions and the other, comparing MET to the other two treatment conditions. These dummy-coded

variables, along with the subscale baseline score, gender and age, will be added to the model and the growth factors (i.e., intercept and slope) will be regressed on them.

Gender. The inclusion of gender as a predictor, or moderator, for the proposed analyses was based on literature that shows gender is associated with self-regulation and levels of alcohol use, as well as categories and levels of negative consequences. Females typically make up approximately 1/3 of AUDs treatment samples and tend to drink lesser quantities of alcohol and have fewer heavy drinking days than males. In this regard, Brown et al (1999) reported a negative relationship between binge drinking and self-regulation scores, but cautioned that their findings may have been moderated by gender. Patock-Peckham, Cheong, Balhorn, and Nagoshi (2001) reported, in a study of the relationship between parenting styles, self-regulation, and drinking, that the association between parenting styles and self-regulation was not the same for males and females in a sample of undergraduate students. Alternatively, Carey et al (2004) found, also in a sample of undergraduates, that the relationship between self-regulation and alcohol-related problems did not vary by gender.

Miller, Tonigan & Longabaugh (1995) found gender differences of 10% or more on approximately 1/3 of the 45 consequence items of the DrInC. Women exceeded men only on one item: problems sleeping after drinking. Otherwise, men were more likely than women to endorse consequences related to Social Responsibility: job loss, money problems, and getting into trouble; Impulse Control: driving after drinking, risk-taking, trouble with the law, accidents, and damage to property; and lifetime harm to marital/love relationship and alcohol-related sexual difficulties. Given the frequently observed gender

differences among clinical AUD samples, gender will be included as a covariate in all proposed analyses.

Age. Older individuals with AUDs often tend to have more severe problems associated with their drinking and higher levels and frequencies of alcohol use than their younger counterparts. Therefore, age will be included as a covariate in analyses of alcohol use and related problems.

Summary

Treatments for AUDs typically provide clients with an environment of reduced distractions. Additionally, the entire treatment session(s), at least ostensibly, centers on information that is highly relevant to the individual and his/her behavior change. Being alcohol-free increases the likelihood that relevant information (e.g., negative consequences of alcohol use) regarding behavior will be encoded, which in turn should contribute to enhanced self-awareness, thereby fostering the self-regulation process, leading to greater responsiveness to the intervention. Thus, potential discrepancies between actual behaviors and personal goals are likely to be recognized and motivation to change behavior established. A graphical representation of this process showing how feedback of alcohol related negative consequences motivates changes in alcohol use is presented in Figure 2.

Figure 2. Conceptual Framework of the negative consequences of the DrInC and how they may motivate behavior change.

Furthermore, as treatment progresses, it is very likely that the individual will be exposed repeatedly to elements of FRAMES. Repeated exposure to elements of FRAMES, such as *feedback* and enhanced *self-efficacy*, in conjunction with diminished discrepancies between actual behaviors (e.g., not drinking alcohol) and personal goals (e.g., reduced alcohol-related problems) serves to reinforce *self-regulatory* processes and thus is likely to contribute to sustained improvements in drinking behaviors.

The DrInC, a measure of the negative consequences of alcohol consumption, provides *feedback* to the respondent and enhances his/her *awareness* of alcohol-related harms, both of which are necessary elements for motivating behavior change. Thus, the DrInC may be clinically efficacious and has utility both in and out of treatment. The different categories of negative consequences as measured by the DrInC, studied only limitedly, may have different effects and, therefore, are the focus of this dissertation.

CHAPTER III. METHODS

Parent Study

Project MATCH (Matching Alcohol Treatment and Client Heterogeneity), to date the largest psychosocial alcohol treatment randomized clinical trial conducted in the US, was funded by The National Institutes of Health (NIH) National Institute of Alcohol Abuse and Alcoholism (NIAAA). The primary study, which was conducted from 1990 – 1994, included nine different treatment sites located in eight states and was designed as two independent study arms: (1) outpatient (i.e., participants recruited from outpatient centers or directly from the community) and (2) aftercare (i.e., participants recruited from inpatient or day-hospital treatment setting; Project MATCH Research Group, 1993). Participants in both study arms were randomized into one of three treatment conditions: Twelve Step Facilitation (TSF); Motivational Enhancement Therapy (MET), or Cognitive-Behavioral Coping Skills Therapy (CBT). All procedures including randomization, scheduling, and assessment batteries were identical for both study arms. Due to significant baseline subject characteristic differences between the participants recruited from the outpatient setting and those entering the study from the more intensive inpatient treatment aftercare arm (i.e., the outpatient sample was younger, more residentially stable, had fewer alcohol dependence symptoms and reported fewer prior alcohol treatment experiences), participants were not collapsed across the two settings for any of the Project MATCH data analyses (Project MATCH Research Group, 1997). Therefore, this dissertation will use data from the larger outpatient sample only, which may have greater generalizability given that the typical alcohol treatment program offered in community settings is outpatient care.

Treatment Conditions

The three treatment modalities used in Project MATCH were chosen based on evidence of clinical effectiveness, theoretical differentiation, implementation feasibility, and fit within existing treatment systems. All three treatments were delivered on an individual level (versus group format) over a 12-week period. Both CBT and TSF consisted of 12 weekly treatment sessions, while MET was limited to four sessions: weeks one, two, six and 12 (Project MATCH Research Group, 1997).

Cognitive-Behavioral Coping Skills Therapy (CBT). CBT is based on social learning theory. Drinking behavior is considered as “functionally related to major problems in an individual’s life with emphasis placed on overcoming skills deficits and increasing the ability to cope with situations that commonly precipitate relapse” (Project MATCH Research Group, 1997, p.13).

Twelve Step Facilitation (TSF). The TSF condition was “grounded in the concept of alcoholism as a spiritual and medical disease with stated objectives of fostering acceptance of the disease of alcoholism, developing a commitment to participate in AA and beginning to work through the 12 steps” (Project MATCH Research Group, 1997, p.13). The TSF condition was not intended to test Alcoholics Anonymous (AA) as a treatment intervention. Rather, TSF was designed to foster the client’s involvement with AA activities and assist him/her in beginning to work through the 12 steps (Project MATCH Research Group, 1997).

Motivational Enhancement Therapy (MET). Based on the principles of motivational psychology, MET focused on producing, or enhancing, internally motivated change. Motivational strategies were used to “mobilize the individual’s own resources”

as opposed to guiding the client, step by step, through recovery (Project MATCH Research Group, 1997, p.13).

Participants

From a potential 2,144 outpatient participants, 952 were randomized into the outpatient arm of Project MATCH. The primary reasons for exclusion were: failure to complete the baseline assessment battery, or not satisfying inclusion or exclusion criteria after the initial screening. Logistical reasons, as opposed to personal reasons such as motivation, were cited by those individuals found study eligible but refused study participation (Project MATCH Research Group, 1997). The data collected from the 952 outpatient study arm participants are analyzed in this dissertation.

The majority of the study participants were male, white, had completed approximately 13 years of education and met criteria for alcohol dependence as assessed by the DSM-III-R. The demographic characteristics of the outpatient sample were compiled previously by the Project MATCH Research Group (1997) and are presented in Table 1.

Eligibility criteria. Study participation eligibility criteria were such that potential study participants had to have a current DSM-III-R alcohol abuse or alcohol dependence diagnosis, be at least 18 years of age, able to read at a sixth grade level, and agree to be randomized into any of the three treatment conditions. Potential study participants who met any other current DSM-III-R substance dependence criteria (excluding marijuana), used IV drugs within the previous six-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 participant

became lost to follow-up, were excluded from study participation (Project MATCH Research Group, 1993).

Table 1

Outpatient Arm Subject Personal and Demographic Characteristics

Variable	Outpatient Arm		
	Men	Women	Total
Gender	688 (72%)	264 (28%)	952
Mean Age (SD)	38.7 (10.5)	39.3 (11.2)	38.9 (10.7)
Ethnicity (%)			
White	81	78	80
Black	4	9	6
Hispanic	13	10	12
Other	2	3	2
Mean years of education (SD)	13.4 (2.2)	13.6 (2.1)	13.4 (2.2)
Married/cohabiting (%)	38	29	36
Employed (%)	56	38	51
Prior alcohol treatment – yes (%)	48	39	45
Alcohol dependence symptoms	5.8 (1.9)	5.6 (1.9)	5.8 (1.9)
ASI psychiatric severity	.18 (.19)	.22 (.19)	.19 (.19)
Percent days abstinent			.34 (.30)
Mean drinks per drinking day			13.49 (7.99)

Procedures

Participants were recruited over a two-year period. Individuals who screened study eligible and provided informed consent, participated in three intake assessment sessions, which took approximately 8 hours to complete. Participants were randomized into one of the three treatment conditions via an urn randomization procedure. The outpatient sample ($n = 952$) was randomized as follows: 301 into CBT, 316 into MET, and 335 into TSF. Treatment duration was 12 weeks following randomization, although

the CBT and TSF sessions were held weekly (12 sessions) and MET sessions only four times. Research follow-up sessions were scheduled at 3 months (end of treatment), and 6, 9, 12, and 15 months after the first treatment session. Subject collateral reports regarding the subject's substance use as well as blood and urine samples were used to corroborate subject self-reported alcohol and other drug use (Project MATCH Research Group, 1997). Detailed rationale and methods for the Project MATCH study are presented in two published Project MATCH articles (Project MATCH Research Group 1993 and Project MATCH Research Group 1997).

Measures

The Drinker Inventory of Consequences (DrInC). The DrInC was developed for Project MATCH to measure negative consequences of alcohol use. It is a self-administered, 50-item questionnaire by which subjects are queried about different alcohol-related negative consequences that may have occurred in their lifetime (administered at the baseline assessment only) and in the 90-day period preceding each assessment session (baseline and follow-up assessments). The DrInC measures adverse consequences in five areas of functioning and behavior: physical, interpersonal, intrapersonal, impulse control, and social responsibility.

- *Physical Consequences* (8 items): acute and chronic physical effects of overdrinking, such as sickness, hangovers, detriments to health and appearance, and injuries incurred while drinking.
- *Interpersonal Consequences* (10 items): the adverse effects of drinking on the respondent's relationships--loss of, or damage to, a love relationship or friendship; parenting impairment; harm to family, friends' and their concern

about the respondent's drinking; and embarrassing or cruel actions while drinking.

- *Intrapersonal Consequences* (8 items): respondents' perceptions and feelings about their drinking, such as guilt, unhappiness, feeling bad; interference of drinking with personal growth, spiritual/moral life, and activities; and, personality change.
- *Impulse Control Consequences* (12 items): negative effects of excessive alcohol consumption such as risk-taking, impulsive acts, increased use of other drugs, smoking, drinking and driving, getting into fights, inflicting injuries on others or damaging property, and getting in trouble with the law.
- *Social Responsibility* (7 items): consequences of non-performance of the respondent's various roles: missing days of work and/or school, deterioration in work quality, being suspended or fired, failure to meet expectations, and 'getting into trouble.'

Responses are constructed as 4-point Likert-type scales, ranging from 0 (*never*) to 3 (*daily/almost every day*) where a higher score reflects a greater level of negative consequences. Also included in the 50 items of the DrInC are five items, that reflect non-problem drinking, and make up a *Control* subscale. The five control items included questions that heavy or frequent drinkers would be expected to endorse, at least to some degree, for example, "I have enjoyed the taste of beer, wine, or liquor." A consistent score of "0" on this subscale may indicate a suspect response set (i.e., careless or negative responding). The DrInC has been shown to possess good internal consistency

(Cronbach's $\alpha = .91$) and test-retest Pearson correlation, $r = .93$ and intraclass correlation, $r = .89$ (Miller, Tonigan, & Longabaugh, 1995). In the Project MATCH study, the DrInC was administered at baseline, and at all follow-up sessions. The DrInC items and subscales are presented in Table 2.

Drinking measures. Drinking data in Project MATCH were collected using Form 90, a self-report of daily alcohol use administered by personal interview. Form 90 has been shown to possess good test-retest reliability ($r \geq .88$) and intraclass correlations (ICC) ranged from fair to excellent (.55 - .97) (Tonigan, Miller & Brown, 1997). Daily drinking was recorded as the number of standard drink (i.e., .5 oz. ethanol) units (SDU) per day. At each assessment interview participants reported their daily alcohol use for the prior 90-day period. A total of 540 days of drinking data were collected over the 15-month study duration.

Three measures of alcohol use commonly used in alcohol treatment outcomes research are: percent days abstinent (PDA), a measure of drinking frequency; mean number of drinks per drinking day (DDD), a measure of drinking intensity; and heavy drinking days (HDD), a measure that reflects both the frequency and intensity of alcohol use (i.e., frequency of heavy drinking). Measures of drinking frequency and intensity are conceptually orthogonal and, among clinical samples, tend to be empirically orthogonal as well (Longabaugh & Clifford, 1992). A measure of heavy drinking, although correlated with both frequency and intensity measures of alcohol use, is important because it provides a better measure of risk for negative consequences (Longabaugh & Clifford, 1992) than either a measure of drinking frequency or intensity, and it is clinically relevant.

Table 2

Drinker Inventory of Consequences (DrInC) Subscales and Items

Physical	1. I have had a hangover after drinking. 8. After drinking, I have had trouble sleeping, staying asleep, or nightmares. 11. I have been sick and vomited after drinking. 13. Because of my drinking, I have not eaten properly. 24. My physical health has been harmed by my drinking. 29. My physical appearance has been harmed by my drinking. 33. My sex life has suffered because of my drinking. 48. While drinking or intoxicated, I have been physically hurt, injured, or burned.
Interpersonal	4. My family or friends have worried or complained about my drinking. 7. My ability to be a good parent has been harmed by my drinking. 17. While drinking I have said or done embarrassing things. 21. While drinking, I have said harsh or cruel things to someone. 27. My marriage or love relationship has been harmed by my drinking. 30. My family has been hurt by my drinking. 31. A friendship or close relationship has been damaged by my drinking. 39. My drinking has damaged my social life, popularity, or reputation. 43. I have lost a marriage or a close love relationship because of my drinking. 46. I have lost a friend because of my drinking.
Intrapersonal	2. I have felt bad about myself because of my drinking. 12. I have been unhappy because of my drinking. 16. I have felt guilty or ashamed because of my drinking. 18. When drinking, my personality has changed for the worse. 34. I have lost interest in activities and hobbies because of my drinking. 36. My spiritual or moral life has been harmed by my drinking. 37. Because of my drinking I have not had the kind of life I want. 38. My drinking has gotten in the way of my growth as a person.
Impulse Control	9. I have driven a motor vehicle after having three drinks or more. 10. My drinking has caused me to use other drugs more. 19. I have taken foolish risks when I have been drinking. 22. When drinking, I have done impulsive things that I regretted later. 23. I have gotten into a physical fight while drinking. 28. I have smoked more when I am drinking. 32. I have been overweight because of my drinking. 41. I have been arrested for driving under the influence of alcohol. 42. I have had trouble with the law (other than DWI) because of my drinking. 47. I have had an accident while drinking or intoxicated. 49. While drinking or intoxicated, I have injured someone else. 50. I have broken things or damaged property while drinking or intoxicated.
Social Responsibility	3. I have missed days of work or school because of my drinking. 6. The quality of my work has suffered because of my drinking. 14. I have failed to do what is expected of me because of my drinking. 20. I have gotten into trouble because of drinking. 26. I have had money problems because of my drinking. 40. I have spent too much or lost a lot of money because of my drinking. 44. I have been suspended/fired from or left a job/school because of my drinking

Proportion of days abstinent (PDA), was operationalized as the number of reported non-drinking days in the assessment period divided by the total number of days in that period. The mean number of drinks per drinking day (DDD) variable was operationalized as the total number of SDUs consumed during the assessment period divided by the total number of days of reported drinking during that same period. Proportion of heavy drinking days (HDD) was operationalized as the number of reported days an individual consumed 5 or more drinks for males, or 3 or more drinks for females, divided by the total number of days in that period.

Given that the alcohol use variables were highly skewed and exhibited floor/ceiling effects, an arc sine and a square root transformation were applied to the PDA and DDD variables respectively, to improve their distributions. The HDD variable was not a primary outcome variable for Project MATCH. Therefore, the distributional analyses (e.g., measures of skewness and kurtosis) were performed and as a result of these analyses a square-root transformation was applied to this variable.

Data Analysis

As previously noted (Parent Study Section), Project MATCH was designed as two concurrent studies, and participants were not collapsed across study arms due to significant differences in some of the participant baseline characteristics. Therefore, for the purposes of this study, and to maintain sample homogeneity, only data from the larger outpatient sample ($N = 952$) were analyzed. To better understand the data, and to facilitate the interpretation of findings, initial data analyses focused on descriptive statistics (e.g., means, standard deviations, frequencies and distributions) pertaining to predictor and covariate variables by assessment period.

Psychometric testing of the DrInC. Given the results of prior psychometric testing of the DrInC, its widespread use, and to answer Research Question #1 (Does the DrInC have the dimensional structure (i.e., subscale structure) evidenced in the instrument specifications?), a confirmatory factor analysis for ordinal data was performed on the baseline DrInC data. Model fit, the relationship between factor indicators (items), and the resulting latent variables (factors) were assessed.

Convergent validity was determined by assessing the loadings of the indicators on their predicted factors. High loadings are an indicator of convergent validity. Discriminant validity (i.e., low conceptual overlap of the factors) was determined by the correlations between the factors, where correlations of $<.85$ indicate less conceptual overlap (Kline, 1998).

Linear growth modeling. Modeling longitudinal trajectories of individuals is a well-founded application and methodology in psychology and other social sciences. For example, models may be used to track individual change on a measured outcome variable, a latent outcome variable, or concurrent change in multiple domains. Change may be linear or nonlinear. The simplest and most fundamental model is the linear latent growth model which examines change in a single variable measured over time (Hancock & Choi, 2006). It is a multilevel, random effects model (Raudenbush & Bryk, 2002).

The object of linear growth modeling is to “capture information about interindividual differences in intraindividual change over time” (Nesselroade, 1991, as cited in Jung & Wickrama, 2008, p. 302). Linear growth modeling approaches such as structural equation modeling and regression are *variable-centered* approaches: the goal

is to identify significant predictors of outcomes, and describe how dependent and independent variables are related.

To answer Research Question #2 (Is there evidence of systematic change and individual variability in change across the five categories of alcohol-related negative consequences, as measured by the DrInC, during the first 12 months of study participation?), linear growth models were developed for each of the DrInC subscales across the four assessment periods (i.e., 3M, 6M, 9M and 12M). Unconditional models (i.e., no covariates) were developed first. Figure 3 depicts a conceptual path diagram of an unconditional growth model:

Figure 3. Path diagram of the unconditional linear growth model for four repeated measures.

With respect to Figure 3, $Y_1 - Y_4$ represent a DrInC subscale factor across the four time points (3, 6, 9, and 12 months); e is the error associated with each subscale. The intercept (α) is the mean of the DrInC subscale at the initial measurement; and the slope (β) is the mean rate of growth from time one to time four. The intercept (α) and slope (β) have estimated variances as well as a covariance, and are exogenous variables in the unconditional model.

The level 1 unconditional model defines the trajectory for person i on outcome Y , a continuous repeated measure, at time t . The value of time at assessment t is represented by λ and in this study is the same for all i individuals because all study participants were assessed at the same time points (i.e., a balanced longitudinal design). Thus, the observed score on measure y (e.g., a DrInC subscale) is an additive function of the intercept (α) of the trajectory of person i , the slope (β) of the trajectory of person i , multiplied by the value of time for person i at time t , and a person- and time-specific residual, or error ε . The error term ε is assumed to be normally distributed, with a mean of 0, and variance σ^2 . This is indicated in Equation 1:

$$\begin{aligned} Y_{it} &= \alpha_i + \beta_i \lambda_t + \varepsilon_{it} \\ \varepsilon_{it} &\sim N(0, \sigma^2). \end{aligned} \quad (1)$$

The level 2 model (unconditional) indicates that person i 's intercept α and slope β are an additive function of the mean intercept and mean slope plus person i 's deviations ζ from these means.

$$\begin{aligned} \alpha_i &= \mu_\alpha + \zeta_{\alpha i} \\ \beta_i &= \mu_\beta + \zeta_{\beta i}. \end{aligned} \quad (2)$$

The covariance matrix of the random components level is:

$$\xi \sim MVN(\mu, \Sigma),$$

where $\xi = \begin{pmatrix} \zeta_{\alpha i} \\ \zeta_{\beta i} \end{pmatrix},$

and $\mu = (\mu_{\alpha}, \mu_{\beta}).$

The level 1 and level 2 models may be combined by substituting the level 2 model values of α and β into the level 1 equation for y , and partitioning the person- and time-specific error terms (i.e., $\zeta_{\alpha i}, \zeta_{\beta i}, \varepsilon_{it}$), resulting in the following Equation 3:

$$Y_{it} = (\mu_{\alpha} + \lambda_{\tau} \mu_{\beta}) + (\zeta_{\alpha i} + \lambda_{\tau} \zeta_{\beta i} + \varepsilon_{it}). \quad (3)$$

The first set of parenthetical terms of Equation 3 is often referred to as the fixed-effects component of the model (i.e., mean intercept and slope) and the second, the random effects component (i.e., variability around these means). This combination of the level 1 and level 2 models is important because it allows for inferences to be made about the mean trajectory for the group, as well as for individual variability around these means (Curran, Bauer, & Willoughby, 2004).

To answer Research Question #3 (Do treatment condition, gender, and age predict the intercept and slope (i.e., the trajectories) of the DrInC instrument's five categories of alcohol-related negative consequences across the first 12 months of study participation?), conditional growth models were developed that included these predictors. Figure 4 depicts a conceptual path diagram of the conditional growth model.

Figure 4. Path diagram of a conditional linear growth model for four repeated measures and three exogenous predictor variables.

In this model, $X_1 - X_3$ represent the exogenous covariates (i.e., gender, age, and assigned treatment condition). The intercept and slope are now endogenous variables and are predicted by each of the covariates separately. The level 1 conditional model is the same as the level 1 unconditional model (1).

However, the level 2 conditional model differs from the level 2 unconditional model by taking into account the effects of the predictors. The intercept α and slope β are regressed on the three time-invariant exogenous variables $X_1 - X_3$. In Equation 4, γ (gamma) denotes the unit change in the expected values of the trajectory intercept and slope associated with a 1-unit change in the predictors $X_1 - X_3$. Thus, the level 2 conditional model indicates that person i 's intercept α and slope β are an additive function of the mean intercept and mean slope, plus the influence of predictors, as well as person i 's deviations ζ from the means μ_α and μ_β :

$$\begin{aligned}\alpha_i &= \mu_\alpha + \gamma_{\alpha 1}X_{1i} + \gamma_{\alpha 2}X_{2i} + \gamma_{\alpha 3}X_{3i} + \zeta_{\alpha i} \\ \beta_i &= \mu_\beta + \gamma_{\beta 1}X_{1i} + \gamma_{\beta 2}X_{2i} + \gamma_{\beta 3}X_{3i} + \zeta_{\beta i}.\end{aligned}\quad (4)$$

The combination of the level 1 and level 2 models results in Equation 5, for each of the three covariates. Equation 5 indicates that a 1-unit change in the predictor X is associated with a γ_1 -unit change in the expected value of the trajectory intercept and γ_2 -unit change in the expected value of the trajectory slope. Further, the degree to which X influences the prediction of Y depends on the specific point in time λ . Equation 5 is important because, as with Equation 3, it allows for inferences to be made about the mean trajectory for the group, as well as for individual variability around these means. It also highlights the interaction of time with the predictor variables and allows for a more detailed examination of the nature of the relationship of the predictor variable and the slope of the trajectories (Curran, Bauer, & Willoughby, 2004).

$$Y_{it} = (\mu_\alpha + \mu_\beta\lambda_t + \gamma_1X_i + \gamma_2\lambda_tX_i) + (\zeta_{\alpha i} + \lambda_t\zeta_{\beta i} + a_{it}). \quad (5)$$

To answer Research Question #4 (Do the trajectories of specific categories of alcohol-related negative consequences predict subsequent drinking behavior at 15 months post-treatment initiation?) the drinking measures PDA, DDD, and HDD collected at the 15-month follow-up assessment (i.e., drinking behavior during months 13, 14, and 15 of study participation) were regressed onto each of the DrInC subscales' intercept and slope factors. Building on the model depicted in Figure 3, a conceptual path diagram of this regression is depicted in Figure 5, where $Z_1 - Z_3$ represent the dependent variables PDA, DDD, and HDD predicted by the intercept and slope, and $\gamma_{\alpha 1} - \gamma_{\alpha 3}$ and $\gamma_{\beta 1} - \gamma_{\beta 3}$ denote the regression coefficients for the intercept and slope, and δ is the error associated with the dependent variables.

The equations for this model are:

$$\begin{aligned} Z_1 &= \gamma_{10} + \gamma_{1\alpha}\alpha_1 + \gamma_{1\beta}\beta_1 + \delta_1 \\ Z_2 &= \gamma_{20} + \gamma_{2\alpha}\alpha_2 + \gamma_{2\beta}\beta_2 + \delta_2 \\ Z_3 &= \gamma_{30} + \gamma_{3\alpha}\alpha_3 + \gamma_{3\beta}\beta_3 + \delta_3 \end{aligned} \tag{6}$$

Figure 5. Path diagram of the unconditional model of the regression of three dependent variables on the intercept and slope factors.

The covariates (i.e., assigned treatment condition, gender, and age, along with the counterpart baseline drinking measure) were added to the model to answer Research Question #5 (Do gender, age, and treatment condition moderate the relationship between specific categories of alcohol-related negative consequences and subsequent drinking behavior?). Figure 6 depicts this model.

Figure 6. Path diagram of the conditional model of the regression of three dependent variables on the intercept and slope factors.

Gender, age, and assigned treatment condition are represented by $X_1 - X_3$ in Figure 6, and as in the previous model, the dependent variables PDA, DDD and HDD are

denoted by $Z_1 - Z_3$, the regression coefficients are $\gamma_{\alpha 1} - \gamma_{\alpha 3}$ and $\gamma_{\beta 1} - \gamma_{\beta 3}$, and δ is the error associated with the dependent variables.

The regression equations for this conditional model are:

$$\begin{aligned} Z_1 &= \gamma_0 + \gamma_{1\alpha} \alpha_1 X_1 + \gamma_{1\alpha} \alpha_2 X_2 + \gamma_{1\alpha} \alpha_3 X_3 + \gamma_{1\beta} \beta_1 X_1 + \gamma_{1\beta} \beta_2 X_2 + \gamma_{1\beta} \beta_3 X_3 + \delta_1 \\ Z_2 &= \gamma_0 + \gamma_{2\alpha} \alpha_1 X_1 + \gamma_{2\alpha} \alpha_2 X_2 + \gamma_{2\alpha} \alpha_3 X_3 + \gamma_{2\beta} \beta_1 X_1 + \gamma_{2\beta} \beta_2 X_2 + \gamma_{2\beta} \beta_3 X_3 + \delta_2 \\ Z_3 &= \gamma_0 + \gamma_{3\alpha} \alpha_1 X_1 + \gamma_{3\alpha} \alpha_2 X_2 + \gamma_{3\alpha} \alpha_3 X_3 + \gamma_{3\beta} \beta_1 X_1 + \gamma_{3\beta} \beta_2 X_2 + \gamma_{3\beta} \beta_3 X_3 + \delta_3 \end{aligned} \quad (7)$$

Mplus software (Muthen & Muthen, 1998-2005) was used for all of the aforementioned analyses and the Statistical Package for the Social Sciences (SPSS) software version 17.0 was used for all descriptive analyses.

CHAPTER IV. RESULTS

Data Preparation

The DrInC data. The range of possible responses for 40 of the 50 items of the DrInC instrument used at the follow-up assessments (i.e., 3, 6, 9 and 12 months) differed from the range of possible responses for each item of the DrInC instrument used at the baseline assessment. Items for the follow-up assessments had a 6-point scale (never to almost every day) compared to the 4-point scale (also, never to almost every day) used in the baseline instrument. To make the baseline and follow-up scores comparable, the 40 items of the follow-up instrument that differed were recoded into a 4-point scale: the two anchor items (never to almost every day) needed no recoding; the two pairs of adjacent intermediate responses “just once or twice” - “once or twice a month,” and “once a week” – “twice a week” were collapsed into the corresponding categories of the 4-point scale (i.e., “once or a few times” and “once or twice a week,” respectively) as was done in the original psychometric testing of the DrInC (Miller, et al, 1995). Item responses were then recoded from 1 - 4 to 0 - 3 in preparation for analyses conducted with the Mplus software program.

All participants were administered the DrInC at the baseline assessment. However, those participants who were 100% abstinent during a given follow-up assessment period did not have to complete the DrInC instrument for that period (no alcohol use, no alcohol-related negative consequences should be experienced). For those participants who were 100% abstinent during any of the follow-up periods, 0 scores were imputed for all of the DrInC items for that/those period(s) in order to provide as much information as possible on participants across the 12-month study period.

DrInC subscale scores. Sum scores for the five subscales, irrespective of assessment period (i.e., baseline, 3- 6- 9- and 12-months) were calculated following the scoring instructions provided in the DrInC manual (Miller, et al, 1995) for the baseline, 3-, 6-, 9-, and 12-month assessments. The distributional qualities of the mean scores for each subscale, at each time point were examined. Skewness ranged from -.12 to ~2, and kurtosis ranged from -.006 to ~6. DrInC scores in the later follow-ups, the 12-month follow-up in particular, were the most highly skewed and kurtotic, due to the preponderance of 0-scores. Several transformations were applied to the data (e.g., square root, natural log), but none improved the distributions of the data substantially, hence, the raw DrInC scores were used for all analyses.

Transformation of HDD variable. As previously mentioned, the proportion of heavy drinking days variable was operationalized as the number of reported days an individual consumed 5 or more drinks for males, or 3 or more drinks for females, divided by the total number of days in that period. An examination of its distributional qualities of HDD at 15 months indicated that the raw data for this variable was positively skewed (skewness = 1.71) and kurtotic (kurtosis = 1.90, due to greater than 50% of the sample having a score of zero. Several transformations (i.e., arc sine, natural log, and square root) were applied to the raw HDD data, with only the square root transformation resulting in a closer to normal distribution (skewness = .883 and kurtosis = -.517). The baseline HDD raw data were more normally distributed (skewness = -.206, kurtosis = -1.26) than the 15-month HDD, however, the square root transformation was applied to the baseline HDD data so that both variables would be on the same scale.

Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) for categorical data was conducted on the baseline DrInC data using Mplus software. The Mplus list-wise case deletion procedure resulted in 770 (81%) of the 952 outpatient study participants being retained (i.e., complete DrInC data were available for 770 study participants) for this analysis. This sub-sample of 770 participants, however, did not differ significantly with respect to select baseline demographic or personal characteristics when compared to the original outpatient sample of 952 participants. Detailed information regarding the baseline comparability of the full outpatient sample and the CFA sample is provided in Table 3.

Table 3.

Comparison of Full Outpatient Arm and CFA Sub-Sample Baseline Personal and Demographic Characteristics

	Outpatient Arm	CFA Sample
<i>N</i> =	952	770
Gender (Male)	72%	73%
Mean Age (SD)	38.9 (10.7)	39.0 (10.7)
Ethnicity (White)	80%	83%
Mean years of education (SD)	13.4 (2.2)	13.5 (2.1)
Married/cohabiting	36%	38%
Employed	51%	52%
Prior alcohol treatment – yes	45%	44%
Alcohol dependence symptoms (SD)	5.8 (1.9)	5.7 (2.0)
ASI psychiatric severity (SD)	.19 (.19)	.19 (.19)
Percent days abstinent (SD)	34 (30)	34 (30)
Mean drinks per drinking day (SD)	13.49 (7.99)	13.22 (7.66)
Percent heavy drinking days (SD)	59 (31)	60 (31)

The CFA model converged successfully using weighted least mean squares estimation. The tests of model fit indicated a less than adequate fit of the model to the data: $\chi^2 = 2,732.45$, 223 df, $p < .001$, CFI = .69, TLI = .89, and RMSEA = .12. However, each item, except one, loaded onto its respective factor at a significant level. Mplus computes a t -value (i.e., the estimate, or factor loading, divided by the standard error of the estimate) for each item: a t -value greater than 1.96 indicates a factor loading that is significantly different from zero. The item that did not load significantly onto its factor was question #32: “I have been overweight because of my drinking,” an item of the Impulse Control subscale. To set the metric of the factor, the factor loading for the first item of each factor is fixed to 1.00; model results are presented in Table 4.

Subscale reliability and validity. Internal consistency reliabilities were determined using Cronbach’s coefficient alpha. The coefficients of all but one subscale, Impulse Control, ranged from .72 - .86, above the generally accepted minimum of .70. The coefficient for the Impulse Control subscale was .67, and should not be too surprising given that this subscale was comprised of items that did not load onto other DrInC subscales (i.e., “leftover items”) when the instrument was originally developed. In addition, one of the Impulse Control items (i.e., item #32 “I have been overweight because of my drinking.”) did not load onto this factor successfully.

Convergent validity was indicated by the high factor loadings of the indicators on their predicted factors. The estimates of all but item #32 were greater than .75, and more than half were greater than 1.00. In addition, correlations were computed between baseline DrInC scores and baseline DDD and the DSM-IV alcohol dependence symptom count. DrInC scores were significantly ($p < .001$) associated with DDD (r ’s ranged from

Table 4

Estimates, Standard Errors and t-values (Est/SE) for the CFA Categorical Model

	<u>Estimate</u>	<u>S.E.</u>	<u>t-value</u>		<u>Estimate</u>	<u>S.E.</u>	<u>t-value</u>
PHYSICAL				INTRAPERSONAL			
Item 1	1.000	0.000	0.000	Item 2	1.000	0.000	0.000
Item 8	1.111	0.081	13.710	Item 12	1.015	0.023	44.257
Item 11	1.110	0.083	13.415	Item 16	0.972	0.024	39.934
Item 13	1.228	0.088	13.983	Item 18	0.970	0.033	29.789
Item 24	0.966	0.079	12.198	Item 34	0.877	0.032	27.549
Item 29	1.176	0.086	13.707	Item 36	0.817	0.034	23.738
Item 33	0.943	0.087	10.859	Item 37	1.010	0.026	38.410
Item 48	1.040	0.094	11.033	Item 38	0.969	0.026	37.830
INTERPERSONAL				SOCIAL RESPONSIBILITY			
Item 4	1.000	0.000	0.000	Item 3	1.000	0.000	0.000
Item 7	0.753	0.059	12.754	Item 6	1.096	0.063	17.532
Item 17	1.187	0.052	22.838	Item 14	1.343	0.074	18.110
Item 21	1.197	0.054	22.242	Item 20	1.201	0.074	16.341
Item 27	0.990	0.051	19.309	Item 26	1.272	0.071	18.036
Item 30	1.055	0.049	21.636	Item 40	1.274	0.073	17.507
Item 31	1.159	0.053	21.759	Item 44	1.021	0.087	11.781
Item 39	1.197	0.056	21.229				
Item 43	1.002	0.063	15.937				
Item 46	0.997	0.066	14.996				
IMPULSE CONTROL							
Item 9	1.000	0.000	0.000				
Item 10	0.747	0.122	6.109				
Item 19	1.708	0.119	14.295				
Item 22	1.950	0.146	13.341				
Item 23	1.359	0.129	10.504				
Item 28	0.923	0.107	8.638				
Item 32	0.164	0.094	1.744				
Item 41	0.947	0.113	8.354				
Item 42	1.210	0.131	9.237				
Item 47	1.143	0.125	9.121				
Item 49	1.298	0.144	9.034				
Item 50	1.519	0.130	11.687				

Note. **Bolded** item has a non-significant loading onto its factor.

.30 to .39), as well as with alcohol dependence (r 's ranged from .37 to .53). To test the independence and discriminant validity of the subscales scores, squared multiple

correlations were computed. Squared multiple correlations indicate subscale domain overlap, and in this case high squared multiple correlation coefficients (e.g., $>.70$) would be considered less than optimal. In general, the resulting squared multiple correlations indicated domain discrimination for the DrInC subscales. Further evidence of discriminant validity is indicated by intercorrelations of less than .85 among the factors (Kenny, 1998; Kline, 1998). Based on this criterion, the DrInC subscale intercorrelations provide evidence of the instrument's discriminant validity, albeit modest discrimination. Table 5 displays the DrInC subscale factor correlations.

Table 5

Estimated Correlation Matrix for the DrInC Subscale Factors

	Physical	Interpers.	Intrapers.	Impulse Control	Social Respons.	Cronbach's alpha	Multiple r^2
Physical	1.000					.723	.529
Interpersonal	0.719	1.000				.845	.603
Intrapersonal	0.766	0.758	1.000			.860	.600
Impulse Control	0.665	0.820	0.545	1.000		.665	.459
Social Respons.	0.795	0.790	0.705	0.772	1.000	.795	.581

Unconditional Linear Growth Models (LGM)

Sample. Of the 770 outpatient participants that had complete baseline data for the CFA, 705 had complete DrInC data at each time point (i.e., 3, 6, 9, and 12 months) for the period covering the first 12 months of study participation. This sample of 705 participants did not differ significantly from the original outpatient sample ($n = 952$)

when compared on baseline demographics, personal characteristics and measures of baseline drinking.

DrInC subscale scores. Mean scores were computed for each of the five DrInC subscales, at each assessment point, including baseline (i.e., the pre- treatment and follow-up assessment periods). Given that individual subscale scores were summed scores and the number of items per subscale differed (e.g., the Physical subscale has eight items and the Impulse Control subscale has twelve), a between subscales comparison of mean scores does not yield readily interpretable results. An examination of the means of each of the subscales across the 12-month period, as well as the subscale trajectories, however, is of interest. Descriptive statistics of the DrInC subscale scores are presented in Table 6.

As can be determined from Table 6, each of the subscales' slopes followed a similar, negative path. It should be noted, however, that although the Intrapersonal consequences subscale is made up of only eight items, its mean scores were consistently higher than the other subscale mean scores across the entire 12-month period. Graphical depiction of the DrInC subscale scores is displayed in Figure 7.

Time 1 data for all of the linear growth models was collected at the 3-month interview and covered the first three months of study participation, during which time study treatments (i.e., CBT, MET, and TSF) were administered. Times 2, 3, and 4 (post-treatment) data were collected at the 6-month, 9-month, and 12-month study assessments, respectively, and each covered the 90-day period prior to assessment (e.g., at the 6-month assessment interview, the participant reported on months 4, 5, and 6 of their study

participation). An unconditional LGM was performed for each of the five DrInC subscales.

Table 6

Descriptive Statistics of the DrInC Subscales

	Minimum	Maximum	Mean	Std. Deviation
Physical				
BI	0	23	8.10	4.60
3M	0	21	4.29	4.82
6M	0	19	3.47	4.40
9M	0	21	3.53	4.45
12M	0	20	2.90	4.17
Interpersonal				
BI	0	30	10.43	6.67
3M	0	30	5.63	6.76
6M	0	26	4.25	5.95
9M	0	28	4.20	5.80
12M	0	24	3.30	5.28
Intrapersonal				
BI	0	24	12.87	6.03
3M	0	24	7.33	7.15
6M	0	24	5.97	6.85
9M	0	24	5.75	6.69
12M	0	24	4.90	6.58
Impulse Control				
BI	0	30	7.98	4.88
3M	0	26	4.36	5.12
6M	0	23	3.43	4.35
9M	0	26	3.38	4.14
12M	0	29	2.69	3.70
Social Responsibility				
BI	0	21	6.23	4.40
3M	0	21	3.21	4.22
6M	0	18	2.38	3.61
9M	0	18	2.26	3.40
12M	0	18	1.76	3.10

Figure 7. Mean scores of the five DrInC subscales across months 1-12 of study participation.

Measures of model fit. The unconditional model estimations for each of the DrInC subscales converged normally. Chi-square tests of model fit were all significant, which likely was due to the sensitivity of chi-square tests to large sample sizes. Therefore, relative chi-squares were computed. Relative chi-square is calculated as the chi-square fit index divided by the degrees of freedom, and is used to make the obtained chi-square value less dependent on sample size. Recommendations regarding relative chi-square values indicative of good model fit are variable and range from less than 2.0 to as high as 5.0 (Garson, 1998). The resulting relative chi-squares from the five models ranged from 3.55, indicating an acceptable model fit, to 7.10, indicating poor model fit.

The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) for each subscale, however, were above .90, indicating good model fits. Additionally, root mean square errors of approximation (RMSEA) ranged from .06 to .09, above the recommended range. A RMSEA of approximately .05 with an upper limit 90%

confidence interval of .08 is considered to be a reliable indicator of good model fit.

Model fit statistics for the five subscales are presented in Table 7.

Table 7

Model Fit Statistics for the Unconditional Models

	Physical	Interpersonal	Intrapersonal	Impulse Control	Social Responsibility
Chi-square, 5 df	35.52	30.88	24.22	23.89	17.65
Relative chi-sq.*	7.10	6.18	4.84	4.78	3.55
CFI	.97	.97	.98	.98	.98
TLI	.97	.96	.98	.97	.98
RMSEA	.09	.09	.07	.07	.06
90% CI	(.07-.12)	(.06-.12)	(.05-.10)	(.04-.10)	(.03-.09)

* Relative chi-square equals the chi-square fit statistic divided by the degrees of freedom.

Component fit of models. Each of the five unconditional models had good component fits. Specifically, all parameter estimates (e.g., intercept and slope means, and variances) were significant. The coefficients were signed in the expected direction: the intercepts were positive and the slopes were negative for each subscale. There were no negative variances or correlations greater than 1.00. Correlations with absolute values greater than 1.00 may occur when using Mplus software if the estimated correlation between variables/factors equals one, rendering the variables/factors indistinguishable. This causes model estimation to be “thrown off” and correlation values >1.00 can occur (Muthen, 2006).

Overall results. All slope estimated means were significant, providing evidence of significant decreases in each of the categories of alcohol-related negative consequences. In addition, all intercept estimated means were significantly different from zero. The variance estimates of the intercept and slope factors indicated significant variation in individual differences regarding initial levels and trajectories for all DrInC subscale factors. The slope and intercept of each subscale model had negative correlations indicating that, on average, higher scores of alcohol-related negative consequences tended to be related to greater decreases in scores. The sample (i.e., actual) means and estimated means for each subscale are presented in Figure 8. Also displayed are random samplings of observed individual values ($n = 20$) for each subscale to highlight the variability in individual trajectories.

Results by subscale. The mean trajectory of the Physical negative consequences subscale began with a score of 4.15 at the initial level (intercept) and decreased linearly by -.404 points per assessment period over the first 12 months of study participation. For Interpersonal negative consequences, the mean trajectory began with a score of 5.35 and decreased linearly by -.680 points per assessment period. The Intrapersonal mean trajectory had the highest initial value with a score of 7.10, and the largest linear decrease of -.738 per time period. The mean trajectories for the Impulse Control and Social Responsibility subscales began with scores of 4.18 and 3.03, respectively, and decreased linearly by -.491 and -.427, respectively. The estimated means, variances and slope-intercept correlations for each of the DrInC subscale factors are shown in Table 8.

Figure 8. Sample and Estimated Means, and Random Samples of observed individual values (b) for DrInC subscales across the first 12 months of study participation.

Table 8

Factor Means, Variances and Slope-Intercept (S-I) Correlations for the Unconditional Growth Models

	Physical	Interpersonal	Intrapersonal	Impulse Control	Social Resp.
Factor Means					
Intercept (<i>SE</i>)	4.15 (.17)	5.35 (.24)	7.10 (.26)	4.18 (.18)	3.03 (.15)
Slope (<i>SE</i>)	-.40 (.06)	-.68 (.09)	-.74 (.09)	-0.49 (.06)	-.43 (.05)
Factor Variances					
Intercept (<i>SE</i>)	14.54 (1.15)	25.47 (2.21)	31.90 (2.61)	14.50 (1.23)	9.89 (.84)
Slope (<i>SE</i>)	1.16 (.17)	2.23 (.35)	2.82 (.41)	1.07 (.18)	.71 (.13)
S-I Correlations	-0.455	-0.579	-0.426	-0.638	-0.645

Note. All factor estimates are significant at $p < .01$.

Conditional Linear Growth Models

Model components. With respect to each DrInC subscale LGM, the relevant baseline DrInC subscale score was added to the model as a covariate (e.g., the baseline impulse control subscale score was included in the impulse control LGM) to account for pretreatment differences. The assigned treatment condition variable was recomputed as two dummy-coded variables: “dummy1,” comparing CBT with the combined TSF and MET treatment conditions, and “dummy2,” comparing MET with the combined CBT and TSF treatment conditions. Gender, age, and the dummy-coded treatment variables also were added to the LGM as predictor variables. The five LGMs were conducted, and model estimations terminated normally.

Measures of model fit. As with the unconditional models, the chi square measures of model fit all were significant, and a relative chi square was computed for each of the

subscale models. Relative chi-squares ranged from 2.17 to 2.83, indicating good model fits to the data. Overall, the conditional models fit the data better than the unconditional models, suggesting that the predictors/covariates accounted for variance that the unconditional models were unable to detect. Comparative Fit Indexes (CFI) were .98 or higher, the Tucker-Lewis Indexes (TLI), .96 or higher, and RMSEA ranged from .02 to .07, further indication of good model fit. Model fit statistics for the conditional models of the five DrInC subscales are presented in Table 9.

Table 9

Model Fit Statistics for the Conditional Linear Growth Models of the DrInC Subscales

	Physical	Interpersonal	Intrapersonal	Impulse Control	Social Resp.
Chi-square, 15 df	42.43	38.56	32.52	32.99	33.25
Relative chi-sq.*	2.83	2.57	2.17	2.20	2.22
CFI	.98	.98	.99	.98	.98
TLI	.96	.96	.98	.97	.97
RMSEA	.05	.05	.04	.04	.04
90% CI	(.03 -.07)	(.03 -.07)	(.02 -.06)	(.02-.06)	(.02-.06)

* Relative chi-square equals the chi-square fit statistic divided by the degrees of freedom.

Covariate and predictor results. Baseline DrInC subscale scores were related significantly to the intercept and slope factors of their respective DrInC subscale score trajectory. More specifically, in each case, higher baseline scores were associated with a higher initial status and steeper slopes than lower baseline scores. The only consistently significant predictor of the alcohol-related negative consequences subscale trajectories

was treatment condition (i.e., dummy-coded “MET versus CBT or TSF”). MET was a significant predictor of the intercept factors for all of the DrInC subscales such that individuals in the MET treatment condition had significantly higher initial post-treatment initiation (i.e., during the treatment months 1-3) levels for each category of negative consequences relative to either CBT or TSF. MET also was a significant predictor of the slope factors of the Impulse Control and Social Responsibility subscales. In both cases, individuals in the MET condition had significantly steeper negative slopes (i.e., decreases) for Impulse Control and Social Responsibility than those in the CBT or TSF treatment conditions.

To further explore this finding (i.e., MET treatment condition related effects), repeated measures ANOVAs were conducted on the five DrInC subscales. Controlling for baseline DrInC scores, the four time points (i.e., follow-up assessment periods) and treatment condition variables were analyzed to assess a time by treatment interaction effect. Tests of within-subject effects indicated significant ($p < .05$) time x treatment effects for all subscales, except the Interpersonal. Tests of between-subjects yielded significant ($p < .01$) effects for treatment condition. To follow-up on the significant between-subjects effects, Helmert contrasts were performed on each subscale, revealing a significant difference, in each case, between the MET and TSF treatment conditions. Although the TSF condition had the highest baseline scores for each category of alcohol-related negative consequences, these scores were consistently lower on each subscale at each follow-up point than those of either the CBT or MET conditions. A Bonferroni alpha correction was applied to the significance levels of the five repeated measures ANOVAs (i.e., $p < .01$ statistical cutoff) rendering the within-subjects results non-

significant. It is important, however, to point out that the Bonferroni correction procedure is a rather conservative approach to the control of Type I error inflation. In this regard it is interesting and clinically important to recognize that a significantly (Pearson $\chi^2 = 8.72$, 2 df, $p = .013$) larger proportion of individuals in the TSF condition were abstinent during this timeframe. For the purposes of this study, an individual was considered to be abstinent during study months one through twelve if alcohol use occurred on no more than 10 days during the 360 day post-treatment initiation follow-up period. Approximately 36% of those in the TSF condition were categorized as abstinent months 1-12, compared to approximately 29% and 24% of those in the CBT and MET treatment conditions, respectively. Graphs pertaining to the DrInC subscale mean scores by treatment condition, from baseline through month 12 of study participation, are presented in Figure 9.

Gender was significantly associated with only the intercept factor of the Physical consequences subscale. In this case, women had significantly higher initial levels of physical consequences attributable to alcohol use than men. The rate of change (i.e., slopes) among women and men, however, did not differ significantly for any DrInC subscale.

Age was a significant predictor of the intercept factor for the Impulse Control trajectory such that older individuals had lower initial levels of Impulse Control negative consequences (i.e., age and the impulse control trajectory were inversely related) than younger individuals. Age also was a significant predictor of the slopes of the trajectories of Physical, Interpersonal, and Intrapersonal negative consequences trajectories, such that older individuals were associated with less steep slopes, reflecting a slower rate of change

(i.e., less improvement) for these types of alcohol-related negative consequences across the timeframe.

Figure 9. DrInC negative consequences across the four time points during first 12 months of study participation by treatment condition.

Results by Subscale.

Physical: Higher baseline scores were related significantly to higher initial levels (.384) and greater decreases (-.040) in physical negative consequences. Women's initial levels (intercepts) of physical negative consequences were significantly higher than men's by 0.917 units. The intercept pertaining to individuals assigned to the MET treatment condition was 1.23 units higher than the intercepts associated with the CBT and TSF treatment conditions. Age was associated inversely with the intercept of the physical negative consequences subscale. In addition, age also was a significant predictor of the rate of change (i.e., slope) in physical negative consequences. More specifically, a one unit increase in age was associated with an expected .014 unit increase in slope, reflecting a slower rate of improvement in physical alcohol-related negative consequences among older individuals.

Interpersonal: Higher baseline scores were significantly related to higher initial levels (.366) and steeper (-.060) slopes in interpersonal negative consequences. Again, those in the MET condition had significantly higher (1.716 units) initial levels than those in either the CBT or TSF conditions. In addition, older age was associated significantly with a less steep interpersonal negative consequences slope: a one unit increase in age was associated with an expected .017 unit increase in slope. As with physical negative consequences, this smaller slope reflects a slower rate of improvement.

Intrapersonal: Higher baseline intrapersonal consequences scores were related significantly to a higher initial (Time 1) intrapersonal consequences level (.437) as well as a steeper (-.057) intrapersonal negative consequences slope. Study participants assigned to the MET treatment condition had significantly higher (1.839 units) initial

levels of intrapersonal negative consequences than those in either the CBT or TSF conditions. Similar to the physical and interpersonal subscale trajectories, age was a significant predictor of a less steep intrapersonal consequences slope such that one unit increase in age was associated with an expected .021 increase in slope.

Impulse Control: Higher baseline impulse control scores were significantly related to a higher initial level (.295) and steeper (-.064) impulse control negative consequences slope. Individuals assigned to the MET treatment condition had a significantly higher intercept (1.565 units) and a steeper slope (-.396) when compared to those individuals assigned to either the CBT or TSF treatment conditions.

Social Responsibility: Similar to the other DrInC subscale trajectories, higher baseline social responsibility scores were related to a higher initial level (.391 units) and steeper (-.074) social responsibility negative consequences slope. MET was a significant predictor of a higher intercept (1.012 units) and steeper slope (-.241) when compared to CBT and TSF treatment conditions. In addition, the CBT assigned treatment condition was a significant predictor of a higher initial level (.691 units) when compared to the MET and TSF treatment conditions. The parameter estimates and standard errors for the conditional models are presented in Table 10.

In summary, baseline levels of negative consequences were associated significantly with both initial levels (i.e., higher baseline scores predicted higher initial status) and rates of change (i.e., higher baseline scores were associated with greater decreases in negative consequences across the 12-month period) across all categories. Age was the only predictor of smaller decreases in negative consequences (i.e., physical, interpersonal, and intrapersonal) across the 12-month post-treatment initiation period.

Table 10

Parameter Estimates, Standard Errors and Slope-Intercept (S-I) Correlations for the Baseline Covariate and Predictors in the Conditional Models

Subscale	Intercept		Slope		S-I correlation
	Estimate	SE	Estimate	SE	
Physical					-0.458
Baseline	0.384*	0.034	-0.040*	0.013	
Gender	0.917*	0.343	-0.073	0.129	
Age	-0.027	0.014	0.014*	0.005	
CBT v other	0.311	0.377	0.193	0.142	
MET v other	1.230*	0.375	-0.189	0.141	
Interpersonal					-0.583
Baseline	0.366*	0.032	-0.060*	0.013	
Gender	0.371	0.477	-0.047	0.187	
Age	-0.029	0.020	0.017*	0.008	
CBT v other	0.826	0.523	0.072	0.205	
MET v other	1.716*	0.521	-0.311	0.204	
Intrapersonal					-0.432
Baseline	0.437*	0.039	-0.057*	0.015	
Gender	0.924	0.516	0.037	0.202	
Age	-0.024	0.021	0.021*	0.008	
CBT v other	0.648	0.567	0.240	0.222	
MET v other	1.839*	0.564	-0.274	0.221	
Impulse Control					-0.640
Baseline	0.295*	0.035	-0.064*	0.013	
Gender	0.445	0.367	-0.013	0.133	
Age	-0.042*	0.016	0.009	0.006	
CBT v other	0.734	0.400	-0.078	0.145	
MET v other	1.565*	0.398	-0.396*	0.145	
Social Responsibility					-0.646
Baseline	0.391*	0.030	-0.074*	0.011	
Gender	0.309	0.286	-0.102	0.109	
Age	-0.015	0.012	0.007	0.005	
CBT v other	0.691*	0.313	-0.093	0.120	
MET v other	1.012*	0.311	-0.241*	0.119	

* Estimate is significant at $p < .01$ level

More specifically, older age individuals, on average, reported less improvement across the 12-month follow-up period than younger age individuals. Individuals assigned to the MET treatment condition reported higher levels of negative consequences across all five DrInC categories for the initial assessment period, although their scores decreased at a similar rate to those assigned to the CBT and TSF treatment conditions, except in the case of Impulse Control and Social Responsibility, where those assigned to the MET condition reported decreasing negative consequences at significantly greater rates than those individuals assigned to either the CBT or TSF treatment conditions.

Drinking Predicted by Subscale Trajectories

Unconditional models. To determine if the trajectories of the five DrInC categories of alcohol-related negative consequences, across the first 12 months of study participation, predicted drinking behavior at 15 months, the drinking variables, PDA, DDD, and HDD were added to each unconditional model and regressed on the intercept and slope factors. Overall, the unconditional models' fits to the data ranged from fair to good. The Physical and Interpersonal negative consequences models appeared to have the poorest fits to the data. Alternatively, the Social Responsibility model fit the data best, and the Intrapersonal and Impulse Control models reflected fair model fits to the data. Table 11 presents more detailed information pertaining to model fit.

The trajectory of each category of alcohol-related negative consequences was a significant predictor of PDA, DDD, and HDD at 15 months. As would be expected, the proportion of abstinent days at 15 months had a negative relationship with the trajectories of negative consequences (i.e., individuals who are experiencing fewer negative consequences were drinking less frequently at 15 months). The relationships between

Table 11

*Model Fit Statistics for the Unconditional Models Predicting Drinking at the 15-month**Follow-Up Assessment*

	PDA	DDD	HDD
Physical			
Chi-square, 7 df	39.27	40.95	39.59
Relative chi-square*	5.61	5.85	5.51
CFI	.98	.98	.98
TLI	.97	.97	.98
RMSEA	.08	.08	.07
90% CI	(.06 -.11)	(.06 -.11)	(.06 -.11)
Interpersonal			
Chi-square, 7 df	32.15	33.61	32.09
Relative chi-square	4.59	4.80	4.58
CFI	.97	.97	.97
TLI	.96	.96	.96
RMSEA	.07	.07	.07
90% CI	(.05 -.10)	(.05 -.10)	(.05 -.10)
Intrapersonal			
Chi-square, 7 df	23.75	25.72	25.52
Relative chi-square	3.39	3.67	3.65
CFI	.98	.98	.98
TLI	.98	.98	.98
RMSEA	.06	.06	.06
90% CI	(.03 -.08)	(.04 -.09)	(.04 -.09)
Impulse Control			
Chi-square, 7 df	23.35	26.42	23.45
Relative chi-square	3.34	3.77	3.35
CFI	.98	.98	.98
TLI	.98	.97	.98
RMSEA	.06	.06	.06
90% CI	(.03 -.08)	(.04 -.09)	(.03 -.08)
Social Responsibility			
Chi-square, 7 df	18.12	21.41	18.90
Relative chi-square	2.59	3.06	2.70
CFI	.99	.99	.99
TLI	.98	.98	.98
RMSEA	.05	.05	.05
90% CI	(.02 -.08)	(.03 -.08)	(.02 -.08)

* Relative chi-square equals the chi-square test statistic divided by the degrees of freedom.

both the DDD and HDD drinking measures and the intercept and slope factors were positive. The significant variances of the intercept and slope factors, again, were evidence of significant individual variation. Factor means and variances were reported previously in Table 8 for the unconditional models. Table 12 provides the parameter estimates and standard errors for the drinking variables regressed onto the negative consequences trajectories.

Table 12

Parameter Estimates, Standard Errors and S-I Correlations (r) for PDA, DDD, and HDD Predicted by the Trajectories of Alcohol-Related Negative Consequences

	PDA			DDD			HDD		
	Est.	SE	S-I <i>r</i>	Est.	SE	S-I <i>r</i>	Est.	SE	S-I <i>r</i>
Physical			-.451			-.449			-.451
Intercept	-.063	.005		.199	.014		.053	.003	
Slope	-.238	.029		.612	.078		.181	.019	
Interpersonal			-.579			-.578			-.578
Intercept	-.039	.005		.155	.013		.036	.003	
Slope	-.149	.024		.466	.067		.117	.016	
Intrapersonal			-.427			-.424			-.427
Intercept	-.037	.003		.125	.010		.033	.002	
Slope	-.142	.017		.399	.048		.106	.011	
Impulse Control			-.641			-.642			-.641
Intercept	-.077	.008		.270	.021		.063	.005	
Slope	-.325	.048		.913	.131		.236	.032	
Social Responsibility			-.648			-.648			-.646
Intercept	-.077	.010		.291	.027		.068	.007	
Slope	-.353	.061		.990	.162		.259	.040	

Conditional predictor models. To determine if gender, age, or assigned treatment condition moderated the relationship between drinking and the DrInC subscale trajectories and subsequent alcohol use, these variables were added to the predictor models, along with their counterpart baseline drinking measure, and baseline DrInC subscale scores. The models were run and the estimations terminated normally. Chi-squares of model fit suggested only fair fits of the models to the data. However, the results of other indices (e.g., CFI and TLI) and measures (RMSEA) of model fit indicated good model fit. A listing of fit statistics for each of the models is presented in Table 13.

Physical Subscale Results. The DrInC Physical subscale intercept factor remained a significant predictor of drinking at 15 months as the estimates derived from the conditional and unconditional Physical subscale models changed only minimally (i.e., less than .01) for PDA, DDD, and HDD. In addition, the directionality of the relationships across the conditional and unconditional Physical subscale models remained the same (i.e., negative for PDA, and positive for DDD and HDD). The slope factor also remained a significant predictor of drinking across the two models. Irrespective of sign, the conditional model estimates increased for all three drinking measures (i.e., PDA, DDD and HDD). Baseline measures of PDA and DDD, but not HDD, were significantly related to their respective 15-month drinking outcome measure. Additionally, the baseline Physical negative consequences score was significantly related to each of the three 15-month drinking outcome measures.

Gender, age, and assigned treatment condition were not related significantly to any of the three drinking outcome measures (i.e., PDA, DDD, and HDD) at 15 months in relation to physical alcohol-related negative consequences. Gender, however, retained its

Table 13

*Model Fit Statistics for the Conditional Models Predicting Drinking at 15-Months**Follow-Up*

Physical	PDA	DDD	HDD
Chi-square, 20 df	70.29	68.57	72.74
Relative chi-square*	3.51	3.43	3.64
CFI	.97	.97	.97
TLI	.94	.94	.94
RMSEA	.06	.06	.06
90% CI	(.05 - .08)	(.04 - .07)	(.05 - .08)
Interpersonal			
Chi-square, 20 df	67.88	68.39	68.24
Relative chi-square	3.39	3.42	3.41
CFI	.96	.96	.96
TLI	.92	.92	.92
RMSEA	.06	.06	.06
90% CI	(.04 - .07)	(.04 - .07)	(.04 - .07)
Intrapersonal			
Chi-square, 7 df	52.67	53.25	56.16
Relative chi-square	2.63	2.66	2.81
CFI	.98	.98	.98
TLI	.96	.96	.95
RMSEA	.05	.05	.05
90% CI	(.03 - .06)	(.03 - .06)	(.04 - .07)
Impulse Control			
Chi-square, 7 df	67.59	65.29	68.92
Relative chi-square	3.38	3.26	3.45
CFI	.96	.96	.96
TLI	.92	.92	.92
RMSEA	.06	.06	.06
90% CI	(.04 - .07)	(.04 - .07)	(.04 - .07)
Social Responsibility			
Chi-square, 7 df	59.02	60.16	64.02
Relative chi-square	2.95	3.01	3.20
CFI	.97	.97	.97
TLI	.94	.94	.93
RMSEA	.05	.05	.05
90% CI	(.04 - .07)	(.04 - .07)	(.04 - .07)

* Relative chi-square equals the chi-square test statistic divided by the degrees of freedom.

significant relationship with the intercept factor of physical negative consequences for each drinking outcome such that women had higher initial values in association with

PDA, DDD and HDD. Age not only retained its significant relationship with the slope factor (i.e., older individuals had slower rates of improvement), but, as a moderator of drinking outcomes, also was associated significantly with the intercept, such that older individuals had lower initial levels of Physical negative consequences for DDD and HDD, but not PDA.

Interpersonal subscale results. As with the Physical consequences subscale, the intercept and slope factors of interpersonal negative consequences were significant predictors of alcohol use at 15 months, with a negative association of both intercept and slope for PDA, and positive associations for DDD and HDD. The only significant association between baseline drinking and drinking at 15 months was for PDA. There were no significant relationships between the baseline measure of Interpersonal consequences and 15-month drinking outcomes. Gender was a significant moderator of the relationship between the Interpersonal consequences trajectory and HDD at 15 months such that women were associated with 0.06 units higher HDD than men. In addition, the MET treatment condition had significantly higher Interpersonal negative consequences trajectory intercepts associated with PDA, DDD, and HDD than the combined CBT and TSF treatment conditions. Age also was associated significantly with the rates of change (i.e., slopes) of interpersonal consequences and DDD and HDD, but not PDA.

Intrapersonal subscale results. The intercept and slope factors of the intrapersonal subscale trajectory remained significant predictors of PDA, DDD, and HDD after the moderator variables (i.e., gender, age, and treatment condition) were added to the model. Women had significantly higher initial levels of Intrapersonal consequences

when associated with DDD. Age was related significantly and negatively with DDD such that older individuals consumed less alcohol per drinking occasion (i.e., fewer DDD). Additionally, older individuals had significantly steeper slopes associated with their Intrapersonal consequences than younger individuals across all three drinking outcomes at month 15. Individuals in the MET treatment condition, relative to either the CBT or TSF treatment conditions, had significantly higher initial levels of Intrapersonal consequences associated with their drinking behavior (i.e., PDA, DDD, and HDD).

Baseline Intrapersonal scores were significantly associated with drinking at 15 months such that higher scores at baseline were associated with greater PDA, and fewer DDD and HDD. Baseline drinking measures were related significantly with their counterpart drinking measure at 15 months. These measures (i.e., baseline PDA, DDD, and HDD) were significantly associated with steeper slopes for PDA and DDD, and a less steep slope for HDD. Only baseline DDD was related significantly with higher initial levels of Intrapersonal consequences.

Impulse Control subscale results. The Impulse Control model covariates (i.e., baseline drinking measure and baseline Impulse Control subscale score) and moderators (i.e., gender, age, and treatment condition) were not significantly related to alcohol use at 15 months. On the other hand, model intercept factors remained significant predictors of each alcohol use outcome measure (i.e., PDA, DDD, and HDD), although model slope factors were not statistically significant.

The Impulse Control intercept factors indicate that older individuals had significantly lower initial Impulse Control levels than younger individuals. Individuals assigned to the CBT or MET treatment conditions had significantly higher initial levels

of Impulse Control consequences significantly associated with their alcohol use (i.e., PDA, DDD, and HDD) at 15 months than those individuals assigned to the TSF treatment condition. In addition, individuals assigned to the MET treatment condition had significantly steeper slopes associated with their alcohol use (PDA, DDD, and HDD) relative to those individuals assigned to the CBT or TSF treatment conditions. Baseline measures of drinking were associated significantly with their respective slope factor in relation to Impulse Control consequences (i.e., PDA and DDD reflected steeper slopes and HDD a less steep slope).

Social Responsibility subscale results. The intercept factors, but not the slopes, of the Social Responsibility alcohol-related negative consequences trajectories remained significant predictors of drinking at 15 months. Model covariates (i.e., baseline drinking measure and baseline Social Responsibility subscale score) were not significantly related to alcohol use at month 15. As with Impulse Control consequences, individuals assigned to the CBT or MET treatment conditions had significantly higher initial levels of Social Responsibility consequences compared to the individuals assigned to the TSF treatment condition. In addition, the MET condition had significantly steeper (negative) Social responsibility subscale slope factors, relative to either the CBT or TSF treatment conditions, associated with PDA, DDD, and HDD. Baseline PDA and HDD measures were associated significantly with the slopes of Social Responsibility subscale trajectories. The PDA measure was associated with a significantly steeper (negative) slope, while the HDD measure was associated with a significantly less steep (negative) slope. More detailed information pertaining to each conditional LGM is presented in Tables 14 - 16.

Table 14

Parameter Estimates and Standard Errors (SE) for the Conditional Models Predicting Proportion of Days Abstinent (PDA) at 15-Months Follow-Up

	Intercept	Slope	PDA
Physical			
Intercept			-0.066* (0.007)
Slope			-0.285* (0.059)
Physical BL	0.395* (0.033)	-0.049* (0.012)	0.021* (0.006)
Gender	0.914* (0.324)	-0.065 (0.121)	-0.005 (0.037)
Age	-0.023 (0.014)	0.010* (0.005)	-0.001 (0.002)
CBT vs. others	0.333 (0.356)	0.181 (0.133)	0.004 (0.041)
MET vs. others	1.250* (0.355)	-0.205 (0.132)	-0.025 (0.043)
PDA BL	0.582 (0.392)	-0.499* (0.146)	0.262 (0.054)
Interpersonal			
Intercept			-0.042* (0.007)
Slope			-0.214* (0.081)
Interpersonal BL	0.368* (0.031)	-0.062* (0.012)	0.013 (0.007)
Gender	0.390 (0.446)	-0.042 (0.173)	-0.023 (0.041)
Age	-0.026 (0.019)	0.013 (0.007)	-0.001 (0.002)
CBT vs. others	0.850 (0.489)	0.064 (0.189)	-0.014 (0.045)
MET vs. others	1.705* (0.486)	-0.312 (0.189)	-0.043 (0.055)
PDA BL	0.359 (0.527)	-0.537* (0.204)	0.264* (0.065)
Intrapersonal			
Intercept			-0.042* (0.005)
Slope			-0.152* (0.029)
Intrapersonal BL	0.439* (0.037)	-0.063* (0.014)	0.021* (0.004)
Gender	0.917 (0.490)	0.060 (0.190)	-0.007 (0.034)
Age	-0.022 (0.021)	0.016* (0.008)	-0.001 (0.002)
CBT vs. others	0.701 (0.539)	0.204 (0.209)	-0.008 (0.038)
MET vs. others	1.830* (0.535)	-0.286 (0.207)	-0.017 (0.040)
PDA BL	0.230 (0.584)	-0.733* (0.226)	0.272* (0.046)
Impulse Control			
Intercept			-0.058* (0.008)
Slope			-0.874 (0.555)
Impulse BL	0.297* (0.033)	-0.066* (0.012)	-0.029 (0.039)
Gender	0.436 (0.338)	-0.007 (0.122)	-0.007 (0.094)
Age	-0.039* (0.015)	0.006 (0.005)	0.002 (0.005)
CBT vs. others	0.765* (0.368)	-0.094 (0.133)	-0.102 (0.115)
MET vs. others	1.580* (0.367)	-0.409* (0.132)	-0.308 (0.252)
PDA BL	0.408 (0.396)	-0.453* (0.143)	-0.016 (0.275)
Social Responsibility			
Intercept			-0.066* (0.011)
Slope			-0.975 (0.658)
Social BL	0.394* (0.028)	-0.076* (0.011)	-0.032 (0.052)
Gender	0.320 (0.268)	-0.104 (0.101)	-0.110 (0.112)
Age	-0.012 (0.012)	0.003 (0.004)	0.001 (0.004)
CBT vs. others	0.717* (0.293)	-0.103 (0.111)	-0.125 (0.120)
MET vs. others	1.002* (0.292)	-0.245* (0.110)	-0.215 (0.190)
PDA BL	0.431 (0.316)	-0.423* (0.120)	-0.028 (0.298)

Table 15

Parameter Estimates and Standard Errors (SE) for the Conditional Models Predicting Drinks per Drinking Day (DDD) at 15-Months Follow-Up

	Intercept	Slope	DDD
Physical			
Intercept			0.214* (0.021)
Slope			0.814* (0.167)
Physical BL	0.369* (0.034)	-0.030 (0.013)	-0.051* (0.015)
Gender	1.016* (0.332)	-0.131 (0.124)	-0.102 (0.113)
Age	-0.026* (0.013)	0.013 (0.005)	-0.008 (0.005)
CBT vs. others	0.316 (0.356)	0.197 (0.133)	0.058 (0.118)
MET vs. others	1.237* (0.355)	-0.195 (0.133)	0.019 (0.124)
DDD BL	0.207 (0.158)	-0.130 (0.059)	0.130* (0.056)
Interpersonal			
Intercept			0.164* (0.019)
Slope			0.717* (0.231)
Interpersonal BL	0.343* (0.031)	-0.052* (0.012)	-0.031 (0.018)
Gender	0.604 (0.452)	-0.094 (0.177)	-0.027 (0.124)
Age	-0.029 (0.018)	0.017* (0.007)	-0.011 (0.006)
CBT vs. others	0.838 (0.487)	0.082 (0.190)	0.079 (0.130)
MET vs. others	1.688* (0.485)	-0.303 (0.190)	0.059 (0.158)
DDD BL	0.556* (0.212)	-0.139 (0.083)	0.105 (0.068)
Intrapersonal			
Intercept			0.141* (0.014)
Slope			0.496* (0.086)
Intrapersonal BL	0.412* (0.039)	-0.042* (0.015)	-0.051* (0.011)
Gender	1.163* (0.504)	-0.076 (0.196)	-0.093 (0.106)
Age	-0.022 (0.020)	0.020* (0.008)	-0.009* (0.005)
CBT vs. others	0.694 (0.538)	0.229 (0.210)	0.074 (0.112)
MET vs. others	1.820* (0.536)	-0.274 (0.209)	0.002 (0.118)
DDD BL	0.498* (0.237)	-0.254* (0.092)	0.159* (0.055)
Impulse Control			
Intercept			0.215* (0.024)
Slope			2.382 (1.430)
Impulse BL	0.267* (0.034)	-0.055* (0.012)	0.072 (0.085)
Gender	0.592 (0.343)	-0.048 (0.125)	-0.005 (0.262)
Age	-0.044* (0.014)	0.010 (0.005)	-0.018 (0.018)
CBT vs. others	0.746* (0.368)	-0.075 (0.134)	0.300 (0.293)
MET vs. others	1.548* (0.367)	-0.395* (0.133)	0.729 (0.636)
DDD BL	0.449* (0.160)	-0.118* (0.058)	0.264 (0.209)
Social Responsibility			
Intercept			0.255* (0.033)
Slope			2.593 (1.507)
Social BL	0.369* (0.031)	-0.066* (0.012)	0.072 (0.107)
Gender	0.404 (0.272)	-0.129 (0.104)	0.238 (0.304)
Age	-0.016 (0.011)	0.007 (0.004)	-0.017 (0.014)
CBT vs. others	0.706* (0.293)	-0.090 (0.112)	0.342 (0.287)
MET vs. others	0.993* (0.292)	-0.239* (0.111)	0.476 (0.447)
DDD BL	0.248 (0.133)	-0.076 (0.051)	0.207 (0.162)

Table 16

Parameter Estimates and Standard Errors (SE) for the Conditional Models Predicting Proportion of Heavy Drinking Days (HDD) at 15-Months Follow-Up

	Intercept	Slope	HDD
Physical			
Intercept			0.051* (0.005)
Slope			0.238* (0.042)
Physical BL	0.386* (0.033)	-0.049* (0.013)	-0.009 (0.004)
Gender	0.922* (0.324)	-0.076 (0.121)	0.040 (0.026)
Age	-0.027* (0.014)	0.011* (0.005)	-0.001 (0.001)
CBT vs. others	0.318 (0.356)	0.184 (0.133)	-0.027 (0.028)
MET vs. others	1.245* (0.354)	-0.208 (0.132)	0.012 (0.030)
HDD BL	-0.157 (0.665)	0.603* (0.248)	0.109 (0.057)
Interpersonal			
Intercept			0.036* (0.004)
Slope			0.184* (0.061)
Interpersonal BL	0.361* (0.031)	-0.061* (0.012)	-0.006 (0.005)
Gender	0.372 (0.446)	-0.052 (0.173)	0.060* (0.029)
Age	-0.033 (0.019)	0.015* (0.007)	-0.001 (0.002)
CBT vs. others	0.824 (0.488)	0.070 (0.190)	-0.013 (0.032)
MET vs. others	1.689* (0.486)	-0.315 (0.189)	0.022 (0.039)
HDD BL	0.828 (0.879)	0.564 (0.342)	0.127 (0.066)
Intrapersonal			
Intercept			0.035* (0.003)
Slope			0.123* (0.020)
Intrapersonal BL	0.429* (0.038)	-0.064* (0.015)	-0.011* (0.003)
Gender	0.916 (0.489)	0.046 (0.190)	0.035 (0.023)
Age	-0.027 (0.021)	0.017* (0.008)	0.000 (0.001)
CBT vs. others	0.678 (0.537)	0.208 (0.209)	-0.017 (0.025)
MET vs. others	1.818* (0.534)	-0.293 (0.208)	-0.001 (0.027)
HDD BL	0.821 (0.982)	0.919* (0.382)	0.126* (0.049)
Impulse Control			
Intercept			0.049* (0.005)
Slope			0.629 (0.379)
Impulse BL	0.292* (0.033)	-0.067* (0.012)	0.022 (0.027)
Gender	0.429 (0.338)	-0.017 (0.123)	0.050 (0.066)
Age	-0.045* (0.015)	0.007 (0.005)	-0.002 (0.004)
CBT vs. others	0.748* (0.368)	-0.089 (0.133)	0.048 (0.079)
MET vs. others	1.570* (0.367)	-0.412* (0.133)	0.205 (0.174)
HDD BL	0.172 (0.664)	0.489* (0.241)	-0.054 (0.225)
Social Responsibility			
Intercept			0.057* (0.007)
Slope			0.728 (0.456)
Social BL	0.393* (0.029)	-0.079* (0.011)	0.030 (0.037)
Gender	0.322 (0.269)	-0.116 (0.102)	0.130 (0.083)
Age	-0.014 (0.012)	0.004 (0.004)	-0.002 (0.003)
CBT vs. others	0.709* (0.293)	-0.101 (0.111)	0.066 (0.085)
MET vs. others	1.002* (0.292)	-0.250* (0.111)	0.147 (0.135)
HDD BL	-0.209 (0.533)	0.569* (0.202)	-0.146 (0.289)

CHAPTER V. DISCUSSION

Confirmatory Factor Analysis of the DrInC

The confirmatory factor analytic approach provided empirical evidence supporting study Hypothesis I (i.e., the DrInC's factor, or subscale, structure) although indicators of model fit were only fair. Nevertheless, all items except for one (i.e., item 32, "I have been overweight because of my drinking") loaded significantly onto their respective factors. The factor loadings were high (i.e., greater than .75) except for item 32, thereby providing evidence of the instrument's convergent validity. In addition, the correlations across factors were less than .85 (Kenny, 1998; Kline, 1998), and the squared multiple correlations were $<.70$, which are indicative of the instrument's discriminant validity, thus providing evidence for two important types of instrument validity (i.e., convergent and discriminant). Despite the less than adequate model fit resulting from this study's CFA, the DrInC instrument has been widely utilized in numerous trials since its development and has been found to have practical and clinical utility.

The moderate model fit resulting from the confirmatory factor analysis, and the lack of a significant loading of Item 32 onto the Impulse Control subscale may be a consequence of the manner in which the DrInC instrument was originally developed. In this regard, the DrInC instrument was specifically developed for use in Project MATCH by Miller and colleagues "to assemble a universe of items that would provide a comprehensive sampling of possible alcohol problems" (Miller et al, 1995, p.5). A sample of 40 items were generated to reflect problems commonly encountered in clinical practice and distributed to colleagues for review, comment, and suggestion for additional items. A total of 50 items were produced by this procedure: 45 were thought to reflect

alcohol-related problems and five items were included as control items. Questions pertaining to treatment seeking, pathological drinking practices and DSM alcohol dependence criteria were purposefully excluded in an attempt to create a “pure measure” (i.e., devoid of diagnostic criteria or treatment seeking behavior) of alcohol-related negative consequences (Miller et al, 1995, p. 5). On the other hand, a concerted effort was made to include items that might reflect concerns specific to problem-drinking women (e.g., items specific to appearance, weight, emotions).

The 45 items thought to reflect alcohol-related problems were analyzed using exploratory factor analysis in an attempt to discern the instrument’s underlying structure (i.e., dimensionality). The results obtained from this factor analytic approach failed to yield clinically meaningful categories of items. In addition, the resulting factor structure was considered unstable. Therefore, the 45 items reflecting alcohol-related problems were categorized into five content domains based on consensus classification by clinical research staff. However, 12 items did not appear to fit neatly into any of the initial four content domains created by the clinical research staff and subsequently were placed into a fifth content domain and labeled “Impulse Control.” Thus, irrespective of initial attempts to empirically derive the DrInC instrument’s factor structure, it appears that the instrument has resulted more from clinical intuition and consensus than empirical analysis.

Confirming the DrInC instrument’s factor structure is important because since its development the DrInC has been widely used in alcohol treatment outcomes research and has been adapted for administration via both personal computer and the Internet (i.e., The Drinker’s Check-Up). It also has been modified to query negative consequences

associated with other types of drug abuse (i.e., the Inventory of Drug Use Consequences, InDUC). A shortened version of the DrInC, referred to as the SIP, has become a popular tool for assessing alcohol-related negative consequences when time is limited (e.g., when conducting assessments in a hospital emergency department). The DrInC has been demonstrated to be a reliable, face valid instrument that measures the definitive issues (e.g., failure to fulfill role obligations at work, school, or home; risky drinking; recurrent legal problems) associated with AUD (Miller et al, 1995). Indeed, alcohol abuse is defined by the DSM-IV based on an individual's level, frequency, and scope of alcohol-related problems. The DrInC also has clinical utility as it can be used to increase an individual's awareness of his/her alcohol-related negative consequences via direct feedback. Such feedback contributes to heightened self-awareness which can be a powerful motivator for behavior change. Heightened self-awareness can facilitate an individual's recognition of a discrepancy between his/her current behavior (e.g., alcohol-related marital problems) and a desired state (e.g., marital harmony), as well as a recognition that alcohol is interfering with the achievement of personal values and goals (Miller & Rollnick, 2002).

A recently developed clinical approach to the treatment of AUDs, as well as many other health-related problems (e.g., hypertension, dietary changes, diabetes) referred to as Motivational Interviewing (MI) has been garnering empirical support for its efficacy (i.e., more than 200 clinical trials have been reported as well as efficacy reviews and meta analyses; Miller & Rose, 2009). A critical component of the MI approach is the provision of client feedback specific to the behavior of interest (e.g., alcohol use interfering with personal goals), which can be direct and/or indirect (e.g., assessment

exposure to instruments such as the DrInC). Central to this therapeutic approach is the selective reinforcement of client self-motivating statements, using an empathic person-centered style, in an attempt to evoke and strengthen an individual's motivation for change, which in turn is expected to enhance one's sense of responsibility regarding their behavior and directly influence behavior change. The DrInC instrument also may have therapeutic utility that is independent of AUD treatment. Clifford and colleagues, for example, have shown that the assessment of alcohol use and related problems in and of itself can contribute to significant changes in behavior (i.e., assessment reactivity effects) that are independent of AUD treatment effects (Clifford et al, 2007; Maisto et al, 2007). Research assessments may be similar to an MI session in that an exchange of information takes place between a study participant and the research interviewer, whom the participant regards as a professional interested in his/her clinical problem. Irrespective of setting, the provision of feedback delivered in a supportive, non-judgmental atmosphere may contribute to heightened self-awareness, which in turn produces a discrepancy of sufficient magnitude to cause an instigation to change.

Linear Growth Models

Unconditional models. None of the unconditional linear growth models provided a good fit to the data, although, as hypothesized, the intercept and slope means, along with the variances, for each of the five subscale models were significant. Such significance, in conjunction with the less than optimal model fits, suggests that there are other covariates and/or moderators that would contribute variance not being accounted for by the subscale trajectories themselves. In fact, the inclusion of predictor variables

(i.e., gender, age, and treatment condition) in the conditional models substantially improved the fits of all five subscale models.

Conditional models. In regards to gender, the hypothesis that women would have significantly higher levels of physical alcohol-related negative consequences, as indicated by the trajectory intercept, was supported. The fact that women reported greater physical consequences as a result of their alcohol use is not surprising given that women require less alcohol than men to experience inebriation and health issues associated with their drinking behavior. Women who drink frequently and heavily are more likely to experience the detrimental physical effects of alcohol sooner, and at lower alcohol levels than men, because their bodies are not able to metabolize alcohol as well as men due to their greater body fat content and, in general, smaller physical size. With respect to intrapersonal difficulties, women did not have significantly higher levels of intrapersonal consequences compared to men (i.e., a higher intercept) as hypothesized. One possible explanation for this lack of significance is that feeling guilt, shame, or unhappiness as a consequence of one's behavior (characteristics of the intrapersonal subscale) is more closely related to one's personality than to gender.

Participant age, as hypothesized, was a significant predictor of the impulse control intercept such that older individuals, on average, reported lower levels of impulse control problems than their younger counterparts. The study hypothesis regarding the slope of the impulse control subscale, however, was not supported. In this regard, it was hypothesized that older people would be characterized by a faster rate of change than younger individuals because it was thought that impulsivity would diminish in frequency and magnitude as one matures and thus, problem resolution would be more expedient.

Study findings however, suggest that although more mature individuals may be less impulsive than their younger counterparts, the resolution of such difficulties over time, at least within the one-year timeframe used in this study, does not vary by age. An alternative explanation is that the lower intercept necessitates a less steep slope (i.e., a floor effect).

Age also was a significant predictor of the physical, interpersonal, and intrapersonal subscale trajectory slopes such that older age was associated with less steep slopes indicating a slower rate of change, which implies less improvement in these areas of alcohol-related negative consequences relative to younger individuals. It is interesting that older individuals experienced slower recovery rates in these areas than their younger counterparts, given that the intercept level of problems in each of these areas did not differ by age, as reflected by the non-significant intercepts associated with each subscale.

One possible explanation for such findings is that the DrInC instrument measures the occurrence (i.e., frequency) of specific problems commonly associated with alcohol use, but does not provide a measure of problem severity. It may well be the case that older and younger individuals with alcohol-related problems severe enough to require AUD treatment do not differ with respect to the occurrence of alcohol-related consequences at the time of treatment entry, but in fact may differ with respect to problem severity. Greater problem severity if associated with older age would likely require a longer period of time to resolve. Furthermore, the lack of statistical significance regarding the impulse control and social responsibility subscale slopes, combined with the statistical significance of the physical, intrapersonal, and interpersonal subscale

slopes, suggests that the length of time required for the resolution of specific problems may be domain dependent.

Assigned treatment condition was hypothesized to affect the DrInC instrument subscale trajectories. More specifically, it was hypothesized that individuals assigned to the CBT treatment condition would report significantly greater improvement in both interpersonal and intrapersonal alcohol-related negative consequences relative to individuals assigned to the MET or TSF treatment conditions because CBT directly addresses skill deficiencies that contribute to alcohol abuse and related problems. Nevertheless, these treatment assignment hypotheses were not supported and perhaps this should not be too surprising. In this regard, although Project MATCH was designed to test patient by treatment interaction effects (e.g., it was hypothesized that patients with greater alcohol involvement would have better outcomes when assigned to the CBT treatment condition), only one such interaction was significant (i.e. psychiatric severity by treatment condition) and the three treatment conditions did not yield statistically significant differential alcohol use outcomes (i.e., there were no main effect differences across treatment conditions, although individuals in all three treatment conditions, on average, showed significant improvements in their alcohol use across the entire study follow-up period). Thus, it appears that all three treatments were equally efficacious with respect to the resolution of alcohol problems (i.e., frequency and quantity of alcohol use) irrespective of alcohol problem severity at the time of treatment onset, although the significant treatment condition by psychiatric interaction indicated that individuals with low psychiatric severity reported greater abstinence (i.e., greater percentage of abstinence days) when assigned to TSF than when assigned to CBT (i.e., an ordinal interaction;

Project MATCH Research Group, 1997). In the presence of more severe psychiatric disorders, the three treatment conditions did not differ and it may be that greater levels of intrapersonal and interpersonal negative consequences are associated with more severe psychiatric problems.

Unexpected findings associated with the conditional linear growth models were that the MET treatment condition trajectories had the highest intercepts across all five categories of alcohol-related negative consequences relative to the combined CBT/TSF treatment conditions and these differences were statistically significant. In addition, the CBT treatment condition social responsibility intercept was significantly greater than that of the combined MET/TSF treatment conditions. To further explore these findings, a repeated measures analysis of variance was conducted. The results obtained from this analysis showed that the TSF condition had significantly lower levels of alcohol-related negative consequences, across all five categories, during the 12-month follow-up period relative to the MET condition. One possible explanation for this effect is the one statistically significant Project MATCH patient characteristic by treatment condition interaction effect (i.e., patients with less psychiatric severity assigned to TSF reported a greater percentage of abstinence days during the follow-up period than individuals assigned to the CBT treatment condition). Thus, greater abstinence among individuals assigned to the TSF treatment condition, during the critical first year post-treatment initiation period, may have resulted in their better overall functioning at the 15-month follow-up (Maisto et al., 2002; Maisto et al., 2006).

Trajectory Relationships with Subsequent Drinking Behavior

Unconditional models. Two models (i.e., social responsibility and physical consequences) were considered exploratory because there was no mention in the literature of the potential associations between these categories of alcohol-related negative consequences and subsequent alcohol use. With respect to the remaining three models, the initial levels of both interpersonal personal and impulse control consequences were hypothesized to be positively related to subsequent alcohol use (i.e., more problems predictive of greater alcohol use at 15 months). Alternatively, intrapersonal consequences were hypothesized to be negatively associated with subsequent alcohol use (i.e., more problems predictive of better alcohol use at 15-months).

The unconditional model trajectories of all five categories of alcohol-related negative consequences, across the first 12 months of study participation, were significant predictors of drinking behavior at 15 months post-treatment initiation. In this regard, higher levels of each specific category of negative consequences, as indicated by each model intercept during the initial 3-month post-treatment initiation period (i.e., Time 1), were associated with fewer abstinent days, more frequent heavy drinking days and a greater number of drinks per drinking day. These findings indicate that, on average, individuals experiencing more alcohol related negative consequences during the initial (Time 1) portion of the critical first-year post-treatment period, irrespective of consequence domain, are more likely to continue their problematic alcohol use (i.e., alcohol use 15 months). These findings are consistent with and extend the work of Maisto and colleagues (Maisto et al. 2002, Maisto et al., 2006) showing that alcohol use during this critical period was associated with poorer future drinking. More specifically,

it appears that the presence of alcohol related negative consequences during this critical period also are predictive of poorer future alcohol use. On the other hand, findings pertaining to intrapersonal consequences are inconsistent with this dissertation study hypothesis as well as the findings reported by Blume and colleagues (2006), showing that more intrapersonal consequences were associated with increased motivation to change alcohol use behavior. Differences between the Blume et al. (2006) study and the current dissertation may account for this difference in outcome. Three potentially significant differences between the Blume et al. (2006) study and this dissertation research are the timing of the assessment of intrapersonal consequences (i.e., baseline versus post-treatment), participant age (younger adults versus adults), and outcome measure (i.e., self-reported motivation to change versus self-reported behavior change).

Significantly steeper slopes, indicative of greater rates of improvement, in each category of alcohol-related negative consequences, also were predictive of alcohol use at 15 months. The relationship between each category of alcohol related negative consequences and subsequent alcohol use was such that a steeper slope was associated with greater abstinence (i.e., PDA), fewer heavy drinking days, and a lower quantity of alcohol ingestion per drinking day. These results support study hypotheses regarding the impulse control, intrapersonal, and interpersonal subscale trajectories (i.e., intercepts and slopes). As previously noted, the social responsibility and physical consequences LGM analyses were considered exploratory and thus, hypotheses specific to these two categories of consequences and subsequent alcohol use were not posited.

Conditional models. The addition of moderators and baseline covariates improved model fits and provided further insight into the relationships between specific categories of alcohol-related negative consequences and subsequent alcohol use. The hypothesis that gender would moderate the relationships between the physical and intrapersonal DrInC subscale trajectories and alcohol ingestion on a given day (i.e., DDD) was only partially supported. Gender moderated the relationship such that females were associated with significantly higher intercepts of intrapersonal alcohol-related negative consequences, relative to men, and fewer drinks per drinking day at the 15-month follow-up. This result is consistent with Blume and colleagues (2006), who as discussed above, found that higher initial levels of intrapersonal negative consequences were predictive of greater motivation to change drinking behavior, although the Blume et al study finding's were not limited to females. It had been hypothesized in this dissertation study that females would have significantly higher initial levels of intrapersonal consequences compared to men. This hypothesis, as noted previously, was not supported by the results of the conditional model analyses, as gender was not a significant predictor of the intrapersonal consequences trajectory.

Consequences such as the ones assessed by the Intrapersonal subscale items are especially salient (i.e., personal feelings, happiness, guilt, shame). Indeed, although the trajectories of the categories of alcohol-related negative consequences were similar in that they all had negative slopes, indicating a reduction of negative consequences after the initiation of treatment across the 12-month period, the fact that the mean of the Intrapersonal subscale was consistently higher across the study period than the other subscales was noteworthy. Further, the items of the Intrapersonal subscale were more

frequently endorsed than most of the items of any of the other subscales. For example, the proportion of “0” responses, or non-endorsement, for the eight Intrapersonal items averaged approximately 0.14, and ranged from 0.04 to 0.38; on the other hand, the average proportion of non-endorsement for the 12-item Impulse Control subscale, for example, was 0.61, four times greater than the non-endorsement for Intrapersonal items, and ranged from 0.25 to 0.87.

Salient and highly self-relevant (e.g., guilt, shame, unhappiness, loss of personal growth and spiritual/moral life) alcohol-related negative consequences are more likely to be encoded, according to Hull and Levy’s theory of self-awareness, when the individual is alcohol-free, as is the case for individuals presenting for assessments specific to most alcohol treatment outcome studies, to include Project MATCH. Awareness of intrapersonal consequences, in an alcohol-free state, may enhance motivation to change behavior by creating a more easily discernible discrepancy between one’s current and a desired state, and the recognition that alcohol is interfering with these goals (Miller & Rollnick, 2002). As was suggested by Blume and colleagues (2006), therapists may want to better assist clients by focusing on any intrapersonal problems they may be experiencing to enhance and support their motivation to change drinking behavior.

Another finding of this study that is somewhat consistent with prior research, including that of Blume and colleagues (2006), was that women with higher initial levels of interpersonal negative consequences were associated with a greater proportion of heavy drinking days at 15 months. It has been found in prior research (e.g., Bennett, McCrady, Johnson, & Pandina, 1999; Larimer & Kilmer, 2000; Moeller & Dougherty, 2001) that impulsivity and/or antisocial behavior, which typically includes interpersonal

problems, were predictive of poorer outcomes in regards to drinking behavior, although these predictions were not limited to women.

Along these lines, significant treatment condition effects were that the CBT and MET treatment conditions were associated with significantly higher intercepts for impulse control negative consequences in relation to all three drinking outcomes when compared to the TSF treatment condition. Specifically, higher levels of impulse control consequences during the three-month treatment period (initial level) for those individuals in the CBT and MET conditions were predictive of fewer percent days abstinent, more drinks per drinking day and a greater percent of heavy drinking days at 15 months compared to the TSF condition. This may be reflective of the overall lower levels for all the alcohol-related negative consequences subscales associated with the TSF condition during not only the initial 3-month treatment period (intercepts) but also across the 12 months post-treatment initiation period, as discussed in the Results chapter.

In regards to age and subsequent drinking behavior, older age was associated significantly with lower intercepts for physical negative consequences in relation to DDD and HDD, such that older individuals with lower initial levels of physical negative consequences were associated with fewer DDD and HDD. It was hypothesized that age would moderate the relationship between physical consequences and DDD. These results suggest that individuals who are older, and have experienced fewer occurrences of physical alcohol-related negative consequences during the treatment period, may have reduced their drinking quantities during that time and have continued to drink less, and less heavily during that critical first year.

Further, older age no longer was associated with a slower rate of improvement (i.e., less steep negative slope) of interpersonal negative consequences, as was the case in the conditional LGM models, in relation to PDA. This may suggest that older individuals who have resolved interpersonal problems over the 12 months post-treatment initiation period have maintained their success at 15-months as denoted by greater frequency of abstinent days.

Study Limitations

This dissertation study's limitations should be considered when interpreting its data. First, Project MATCH was designed as a matching study, matching participant attributes with treatment modality. Given that only one significant matching effect was detected, the three treatment conditions were used as predictors and/or moderators, and the interaction of participant attributes with treatment modality was not considered. Another important study limitation was the use of participant self-report data. Project MATCH, however, implemented a number of procedures to ensure the reliability and validity of participant self-reported data. For example, collateral informants and laboratory tests were utilized to corroborate self-reported measures. Collaterals were interviewed at baseline, 3, 9, and 15 months, and blood and urine samples taken at the same time points. A test-retest reliability study of self-reported drinking and drug use measures found consistency across and within sites. Lab tests were highly consistent with self-reported drug and/or alcohol use at baseline and follow-up points. These procedures, as noted by Project MATCH investigators, indicated 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 Project MATCH inclusion/exclusion criteria restricted the study sample to individuals whose primary drug of abuse was alcohol. Those who had a DSM-III-R diagnosis of any type of drug dependence, or who had used intravenous drugs in the six months prior to intake were excluded. Also excluded were individuals who had acute psychosis, were considered a danger to themselves or others, could not demonstrate potential residential stability, or who could not provide the name of a contact (i.e., locator) person. Therefore, the Project MATCH study sample was not representative of the overall AUD treatment seeking population and the generalizability of this dissertation's results should be limited to similar individuals.

Future Research

One of the assumptions of conventional LGM (i.e., the data analytic approach used for this study) is that individuals come from a single population and that one growth trajectory can approximate an entire population. Another assumption is that each individual is influenced in the same way by the covariates that affect the growth factors (Jung & Wickrama, 2008). The significant variances of the intercept and slope factors, indicative of individual variation in initial levels and rates of change, in both the unconditional and conditional models developed in this study, suggest the need for a person-level examination of the data. A logical next step would be to analyze the DrInC data using latent class growth analysis (LCGA) and growth mixture modeling (GMM). These procedures capture information about inter-individual differences in intra-individual change by taking into account unobserved heterogeneity within a larger population. LCGA and GMM are *person-centered* approaches: the focus is on the relationships among individuals, and the goal is to “classify individuals into distinct

groups or categories based on individual response patterns so that individuals within a group are more similar than individuals between groups” (Jung & Wickrama, 2008). The result of GMM is separate growth models for each latent class, each with its own estimates of variance and covariate influences.

Conclusions

Assessment of the presence and frequency of alcohol-related negative consequences is a definitive factor in the diagnosis of AUDs. In addition, it appears that some categories of alcohol-related negative consequences may be experienced more frequently than others. Within the critical high-risk post-treatment initiation year, all categories of alcohol-related negative consequences showed significant reduction, which were associated with improved drinking behavior. Also within the post-treatment initiation year, high initial levels of intrapersonal and physical consequences, particularly among women, appear to be associated with improved drinking outcomes, a finding therapists may want to focus on when treating females with AUDs.

Awareness of the highly self-relevant alcohol-related negative consequences reflected in the DrInC, perhaps in combination with other measures such as the Form 90 (i.e., a calendar-based alcohol use diary), has therapeutic value (Clifford et al, 2007). For example, a plot of the means of each subscale at the quarterly assessment points across the first 12 months of study participation showed marked improvement from the treatment period (recorded at the 3-month assessment) to the three months post-treatment (6-month a follow-up assessment). However, there appeared to be a slight rise in negative consequences associated with the physical subscale, and for the other subscales, a leveling-off at the 9-month assessment. One may infer that this reflects an erosion of

treatment effects. However, at the 12-month assessment point a reduction of alcohol-related negative consequences across all subscales was reported. An explanation may be that the 9-month assessment was a major assessment point (six months post-treatment) and consisted of a comprehensive battery of instruments querying participants about all aspects of their psychological and psychosocial functioning (e.g., measures of self-efficacy, social support, marital and family relationships, depression, anger, etc.) as well as drinking behavior and related consequences. Thus, the 9-month assessment may account, at least in part, for the observed reduction in negative consequences at the 12-month assessment point (i.e., an assessment exposure related effect).

Significant reductions in alcohol use and alcohol-related negative consequences were reported across the 12-month post-treatment follow-up period. Lower initial levels (i.e., measured after treatment) and steeper slopes for all categories of alcohol-related negative consequences were associated with a greater percentage of days abstinent at the 15-month follow-up. Both lower initial (Time 1) and post-treatment levels of alcohol-related negative consequences and steeper slopes, across all domains were associated with a greater percentage of abstinent days at the 15-month follow-up. Alternatively, higher initial levels of consequences and slower rates of problem resolution (less steep negative slopes) across categories of alcohol consequences were predictive of a higher number of drinks per drinking day and a greater proportion of heavy drinking days at the 15-month follow-up. Thus it appears that the findings reported by Maisto and colleagues (1998; 2002; 2006; 2007) may not be direction specific (i.e, alcohol use during the first year post-treatment initiation period is predictive of improved psychological and psychosocial functioning, self-efficacy, and subsequent drinking behavior). That is,

alcohol use as well as experiencing alcohol-related negative consequences, during the critical first year following treatment initiation, are indicative of poorer future alcohol use (i.e., alcohol use and alcohol related consequences are related reciprocally). Therefore, it appears that the monitoring of alcohol-related negative consequences, during the critical first year post-treatment initiation, can have clinical utility. In this regard, clinicians can monitor clients during this critical period for signs of excessive alcohol use or alcohol related problems and when detected, re-engage the client in treatment.

To recapitulate, the three components of the purpose of this dissertation study were accomplished. First, the previously reported factor structure (i.e., five subscales, each measuring a different category of alcohol-related negative consequences) of the DrInC was confirmed and psychometric testing provided evidence of convergent and discriminant validity. Secondly, the trajectories of each of the five categories of alcohol-related negative consequences over the first 12 months of study participation indicated, on average, a reduction of consequences. In addition, these trajectories varied as a function of participant gender, age, and assigned treatment condition: women were associated with a higher intercept factor for the physical subscale; older individuals had lower initial levels of Impulse Control negative consequences and were associated with smaller rates of improvement in physical, interpersonal and intrapersonal alcohol-related negative consequences; and, individuals in the MET treatment condition had higher initial levels for all five of the categories of negative consequences and steeper slopes (i.e., decreases) for Impulse Control and Social Responsibility.

The trajectories of the five DrInC categories (subscales) of alcohol-related negative consequences were predictive of subsequent drinking behavior one year post-

treatment completion and these relationships were in the expected directions. Specifically, higher initial levels during the three-month treatment period were associated with poorer drinking behavior during the 15-month follow-up. Steeper slopes, or greater rates of improvement, across the 12-month post-treatment initiation period were associated with improved drinking behavior (i.e., greater PDA and fewer DDD and HDD) at 15 months. Further, some of these relationships were modified by gender, age, and treatment condition. For example, women were associated with significantly higher intercepts of intrapersonal alcohol-related negative consequences, relative to men, and fewer drinks per drinking day at the 15-month follow-up; women with higher initial levels of interpersonal negative consequences had a greater proportion of heavy drinking days at 15 months. Older individuals with lower initial levels of physical alcohol-related negative consequences were associated with fewer DDD and HDD. Older individuals, who had greater rates of improvement for interpersonal alcohol-related negative consequences, were associated with greater PDA at 15-months. Higher levels of impulse control consequences during the three-month treatment period for those individuals in the CBT and MET conditions were predictive of fewer percent days abstinent, more drinks per drinking day and a greater percent of heavy drinking days at 15 months compared to the TSF condition.

In summary, the findings derived from this dissertation have important methodological, theoretical and clinical implications. In this regard, the DrInC instrument appears to be a valid and reliable measure for alcohol-related negative consequences, at least among those presenting for AUD treatment. Consistent with the formulations of SRT, the recognition of alcohol-related difficulties is prerequisite for the

occurrence of a current alcohol use–desired alcohol use discrepancy, which is a necessary condition for behavioral self-regulation. Thus the continued monitoring of patients, that includes assessment of alcohol-related negative consequences, particularly during the critical first year post-treatment initiation, has significant promise for relapse prevention and the maintenance of behavior change, which is essential for effective AUD intervention/treatment.

APPENDIX

List of Acronyms

(Alphabetical Order)

AA	Alcoholics Anonymous
AUD	Alcohol Use Disorder
CBT	Cognitive-Behavioral Coping Skills Therapy
CFA	Confirmatory Factor Analysis
DDD	Drinks per drinking day
DrInC	Drinker Inventory of Consequences
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders-IV
FRAMES	Feedback, Responsibility, Advice, Menu, Empathy, Self-efficacy
HDD	Percent (Proportion) heavy drinking days
ICC	Intraclass correlations
MET	Motivational Enhancement Therapy
MI	Motivational Interviewing
MOC	Mechanisms of change
PDA	Percent (Proportion) days abstinent
SDU	Standard Drink Unit
SRT	Self-Regulation Theory
TSF	Twelve-Step Facilitation

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