2007

Structural Equation Modeling of Alcohol Issues in an Emergency Department Sample

Karen E. Stamm
University of Rhode Island

STRUCTURAL EQUATION MODELING OF ALCOHOL ISSUES IN AN EMERGENCY DEPARTMENT SAMPLE

BY

KAREN E. STAMM

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF

MASTER OF ARTS

IN

PSYCHOLOGY

UNIVERSITY OF RHODE ISLAND

2007

Abstract

Alcohol research often focuses on alcohol use variables. The following project is a development of a structural equation model (SEM) to test the relationships between risk taking, injuries, alcohol expectancies, alcohol consequences, and alcohol use. The model is based on principles from expectancy theory, social learning theory, the theory of reasoned action, and the transtheoretical model. The final mediational model represented a reasonable fit to the data, χ^2 (70, N=200) = 161.40, p <0.001, CFI=0.91, and RMSEA=0.09 Risk taking, injuries, and alcohol expectancies were placed as independent factors, alcohol consequences was placed as a mediator factor, and alcohol use was placed as a dependent factor. With the exception of the path from injuries to alcohol consequences, all paths were significant. The results were consistent with existing models of alcohol expectancies, alcohol consequences, and alcohol use. Additionally, there is evidence that risk taking is important in the prediction of alcohol outcomes.

Table of Contents

List of Tables

List of Figures

Chapter 1: Statement of the Problem

Structural equation modeling (SEM) is useful in describing many types of complex phenomena. This project involves the development and testing of a latent variable model predicting substance use outcomes. The theoretical framework draws on expectancy theory (i.e. Goldman, Del Boca, & Darkes, 1999; Sher et al., 1996), social learning theory (i.e. Bandura, 1977; Maisto, Carey, & Bradizza, 1999), the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), and the transtheoretical model (Prochaska et al., 1994). The hypothesized latent variable model is intended to examine risk taking and impulsive behavior and injuries as predictors of alcohol expectancies, which is a predictor of readiness to change drinking behavior, which is in turn a predictor of the substance use factors of alcohol use, other drug use, and alcohol consequences.

The present analysis is based on data collected by Longabaugh et al. (2001), which tested whether a brief intervention was beneficial in reducing negative consequences, such as alcohol-related consequences, injuries, and the number of heavy drinking days. Additionally, Ramsey et al. (2000) found that alcohol expectancies are a mediator of injury aversiveness and readiness to change. Research has examined alcohol expectancies in relation to alcohol consumption (i.e. Sher, et al., 1996; Leigh & Stacy, 1993). However, no study has looked at risk taking and injuries as predictors of substance use. This study seeks to expand existing research on alcohol expectancies by including risk taking/impulsivity and injuries into a structural model predicting substance use outcomes. The project involves three development

and testing phases: preliminary factor analyses, model testing and comparison, and model validation. Based on the results, an integration of theories will be presented in the discussion section.

Chapter 2: Justification for the Project

A wide range of factors can influence alcohol use. Specifically, risk taking, injuries, alcohol expectancies (i.e. Brown, Goldman, Inn, & Anderson, 1980; Christiansen, 1982; George et. al, 1995) and readiness to change (i.e. Prochaska, DiClemente, & Norcross, 1992; Carboni & DiClemente, 2000) may be able to predict substance use outcomes. Some of these factors can be used to indicate latent constructs, and SEM provides a technique for simultaneously testing multiple hypotheses about latent constructs (Kline, 2004). SEM is a multivariate method; as such, it allows for an investigation of complex phenomena (Tabachnick & Fidell, 2001; Harlow, 2005). Understanding the connection between risk-taking and impulsiveness, injuries and alcohol use will aid in the prevention of future negative consequences.

Alcohol use has high costs. For example, approximately 40% of the 42,000 annual traffic fatalities are related to alcohol use (NHTSA, 2002). A common reason for emergency department (ED) visits is injuries, and many of these are related to alcohol use. About 15-25% of ED visits for injuries are alcohol related (Cherpitel, 1995). The ED is a chaotic setting, but it seems logical to screen for alcohol problems in a general health setting (Welte et al., 1998), including hospitals. The ED may present an opportune time to discuss readiness to change alcohol consumption (Cherpitel, 1995). Patients may not be aware of the hazards involved in their drinking behavior. There is interest in providing brief interventions as part of emergency treatment (Dill, Wells-Parker, & Soderstrom, 2003). However, a review by Dill et al.

(2003) of ED intervention studies concluded that there was mixed evidence about whether such interventions reduce alcohol-related harm.

The main purpose of an ED visit is medical treatment; a secondary outcome may be the identification of harmful or hazardous drinking behavior. Medical staff and researchers need a brief screening instrument to discover at-risk drinkers (Cherpitel, 1995) so that problem drinkers may be provided with brief treatment options while they are in the ED. One instrument that has been found useful in this regard is the Alcohol Use Disorder Identification Test (AUDIT). Conigrave, Hall, and Saunders (1995) were the first researchers to examine the AUDIT's ability to detect a range of alcohol-related harm. The instrument contains 10 questions with a range of scores from 0 to 40. This study suggested that the AUDIT was a good predictor of alcohol-related social and medical problems. The previous cutoff score for identifying at-risk drinkers was 11, and the Conigrave et al. (1995) study suggested lowering the cut-off to 8. At this point, the AUDIT had 90% sensitivity in detecting positive cases in comparison to the DSM-III criteria for alcohol misuse or dependence. Additionally, Matano et al. (2003) found that the AUDIT had better sensitivity in identifying binge drinkers than non-binge drinkers.

An unexplored component in understanding substance use outcomes is an inclination toward risk taking and impulsivity. Risk taking can have some benefits or positive aspects. For example, risk taking has been described as a normal part of adolescence. However, impulsivity may predispose some adolescents to risky behavior (Cooper, et al., 2003). This may apply to a subset of the sample, particularly young adults. Risk-taking may be related to sensation seeking and impulsivity (Zuckerman

& Kuhlman, 2000; Bromiley & Curley, 1992), and risk-taking can be measured as a general personality trait; such traits tend to be stable over time (Bromiley & Curley, 1992). Of greater interest is risk-taking Impulsiveness is a component of risk that captures rashness or acting without thinking the behavior through properly (Dawe & Loxton, 2004). Risk taking has been included as a scale in the Jackson Personality Inventory (Jackson, 1976). Since it is difficult to generalize situation-specific risk taking, it may be more useful to examine risk taking in a general way.

Chapter 3: Theoretical Framework

The proposed model for this study draws on central constructs drawn from several major cognitive theories (i.e. expectancy theory, social learning theory, the theory of reasoned action, and the transtheoretical model). Previous alcohol research has focused on alcohol expectancies as important beliefs related to alcohol use. The theories inform various parts of the model. They are similar in their organization of key concepts and the predicted patterns of relationships between latent constructs. SEM is confirmatory in nature (Kline, 2004), which means that it is important to analyze a well-specified model. In order to build a well-specified model, strong theory is necessary. Additionally, SEM holds the possibility for model-building. A model testing approach can combine theoretical and exploratory facets.

Expectancy Theory

Expectancies are cognitive representations stored in memory about the effects of alcohol. Specifically, alcohol outcome expectancies are defined as "beliefs that people have about the behavioral, cognitive, and emotional effects of drinking alcohol" (Sher, et al., 1996, p. 561). Expectancies are important mediators in drinking behavior; they are strong mediators of actual alcohol consumption (Christiansen, Smith, Roehling, & Goldman, 1989; Goldman & Darkes, 2004). Expectancy theory recognizes the importance of cognitions in determining behavior. Expectancy theory states that positive expectancies of alcohol use will be related to increased use of alcohol. Conversely, negative expectancies will be related to decreased alcohol use

(Sher, et al., 1996). In this way, alcohol use and expectancies form a reciprocal relationship. Research has demonstrated alcohol expectancies as a mediator of alcohol use in an adolescent sample (Christiansen, et al., 1982; Christiansen, et al., 1989) and temporal ordering of expectancies and alcohol use using latent variables (Sher, et al., 1996). That is, alcohol expectancies appear to influence alcohol outcomes over a variety of situations.

A large body of literature examines the development of the Alcohol Expectancy Questionnaire (AEQ) (i.e. Brown, Goldman, Inn, & Anderson, 1980; Christiansen, 1982) and the testing of its factor structure (i.e. Leigh, 1989; Stacy, Widaman, Marlatt, 1990; Fromme, Stroot, & Kaplan, 1993; Leigh & Stacy, 1993; George et. al, 1995, Goldman, Greenbaum, & Darkes, 1997; Vik, Carrello, & Nathan, 1999). The current study uses the AEQ to assess alcohol expectancies and investigate how they relate to alcohol use and alcohol consequences.

Social Learning Theory

Social learning theory (SLT) is a social cognitive theory that posits that there is a relationship between the person, environment, and behavior (Bandura, 1977). That is, social behavior is determined by both the personal experiences and environmental factors. SLT is concerned with how cognitions influence social experiences and how cognitions operate on behavior (Grusec, 1992). Vicarious learning occurs through the observation of others (Maisto, Carey, & Bradizza, 1999), a process also known as modeling. A variety of behaviors can be learned by trial-and-error direct experience.

According to SLT, alcohol expectancies are the personal factors that will influence alcohol use. In specifically accounting for alcohol use, SLT focuses on the reciprocal relationship between the environment and behavior. For example, alcohol use may be acquired as a coping mechanism for stress. Like expectancy theory, SLT places expectancies as a mediator of alcohol use (Maisto, Carey, & Bradizza, 1999).

Theory of Reasoned Action

The theory of reasoned action (TRA) was developed by Azjen and Fishbein (1980; Fishbein & Ajzen, 1975). It is a social cognitive theory helpful in examining health behaviors. The theory uses several latent variables, including behavioral beliefs, outcome evaluations, attitudes, perceived norms, behavioral intentions, and actual behavior. There are two portions of the theory: personal factors, such as behavioral beliefs; and attitudes and normative factors, such as normative beliefs and subjective norms. Both portions influence intention, which in turn influences behavior. Since TRA models involve mediational relationships and latent constructs, it is ideal to be tested through SEM techniques (Vallerand et al., 1992).

One application of the TRA was a model of marijuana use (Morrison, Golder, Keller, and Gillmore, 2002). In testing the role of personal factors, the model included paths from positive and negative outcome beliefs to attitudes. In testing the role of normative factors, the model contained paths from normative beliefs to norms. The model also had paths from both attitudes and norms to intention and paths from intention to use. All regression paths were significant except for the path from negative outcome beliefs to attitudes.

A second example is a confirmatory model that tested the TRA in moral behavior. Vallerand, Deschaies, Cuerrier, Pelletier, and Mongeau (1992) independently tested the personal and normative components of the theory, including a possible path between norms and attitudes. Results generally supported the TRA model. However, they also supported the hypothesis that attitude was a better predictor of intention than norms.

Transtheoretical Model

The transtheoretical model (TTM) (e.g., Prochaska et al., 1994) is important in explaining the stages of change. The model contains five stages: pre-contemplation, contemplation, preparation, action, and maintenance. Pre-contemplation occurs if there is no intention to change in the future (i.e. not ready to make a change). Contemplation occurs when a person is considering a change sometime within the near future. Preparation involves actively getting ready to make a change but not actually undertaking the change. Action implies that the person is in the beginning of a change. Maintenance involves keeping up with a new change and taking steps to prevent slipping back into earlier stages of change. Progression through the stages does not necessarily happen in a linear fashion; it can happen in a "spiral" pattern (Prochaska, DiClemente, & Norcross, 1992). Often, the first attempt at change is not successful, and it takes several tries before the person moves into higher stages of change.

Regarding the relationship between readiness to change and alcohol use, the TTM predicts that people in the earlier stages of change will show more substance use,

while people in the higher stages of change will show less substance use. For example, Carboni and DiClemente (2000) found that a measure of stage was useful in predicting alcohol outcomes. It is anticipated that a similar relationship exists between readiness to change and drug use. People in earlier stages of change may also be more likely to have negative alcohol consequences.

Original Experiment and Analysis

Longabaugh et al. (2001), on which the current study builds, conducted the original data analysis. The Longabaugh et al. (2001) study was designed to test whether a brief intervention was effective in the ED. The goal was the reduction of hazardous/harmful drinking rather than reduction of alcohol consumption, and the purpose was to motivate patients to decrease the risk of experiencing negative consequences from alcohol consumption. The study tested the following hypotheses: the brief intervention group would have fewer negative consequences than standard care, the brief intervention plus booster group would decrease negative consequences more than the standard care group, and patients would have fewer negative consequences later if they were drinking at time of injury than patients not drinking at time of injury.

Participants, recruited from the ED, completed a battery of assessments in the ED. Then participants were randomly assigned into one of three groups: standard care, brief intervention, and brief intervention plus booster. Those in the brief intervention and brief intervention plus booster groups received motivational interviewing sessions focused on the participant's alcohol and/or substance use (Miller, Zweben,

DiClemente, & Rychtarik, 1992). The distribution of participants across the groups was roughly equal; the standard care group had the most, (n = 188), followed by the brief intervention group, (n = 182), and, lastly, followed by the brief intervention plus booster group (n = 169). About 69% of participants assigned to the brief intervention plus booster returned for the booster session. The study was based on the intent-to-treat model. Anyone who was randomized into one of the three groups was included in the final analysis. All participants were asked to complete another set of assessments 12 months after the emergency department visit. About 83% (n = 477) of the participants completed the 12-month follow-up. The main dependent variables used were the AUDIT, the Drinker's Inventory of Consequences (DrInC), and the number of heavy drinking days.

Three analyses of covariance (ANCOVAs) were conducted with the type of treatment group as the independent variable, the measures at 12 months as the dependent variables, and the baseline measure as the covariate. The main focus was on mean differences before and after treatment. The following results were found: negative consequences of alcohol was significant, the number of alcohol-related injuries was significant, and the number of heavy drinking days was not significant. Significant differences were found between the brief intervention plus booster and standard care groups only. Brief intervention alone was not significantly more effective than standard care. In addition, there was a greater benefit for those who returned for a booster session.

A secondary analysis by Ramsey et al. (2000) found that negative alcohol expectancies were a mediator for readiness to change. This finding is interpreted as

evidence of the negative effects of drinking. This analysis used a subset of the sample used in the overall analysis. Contrary to other studies that used positive expectancies to predict drinking outcomes (Leigh & Stacy, 1993), Ramsey et al. (2000) used expectancies to predict readiness to change, rather than drinking outcomes. The results suggest that one potential way to increase readiness to change is to focus on negative alcohol expectancies.

Hypotheses

The hypotheses addressed by the current project extend the two previous studies to address the association of risk-taking and injuries with substance use outcomes through the mediators of alcohol expectancies and readiness to change drinking and hazardous behavior. In contrast to the original study, the current project tests a series of theoretically supported prediction models using SEM. The complex model allows for multiple hypotheses to be tested. The main hypotheses are:

1) Increased risk taking is related to increased positive alcohol expectancies and decreased negative alcohol expectancies.
2) Increased injuries are related to decreased positive alcohol expectancies and increased negative alcohol expectancies.
3) Increased positive alcohol expectancies are related to decreased readiness to change, while increased negative expectancies are related to increased readiness to change.

4) Increased readiness to change is related to decreased substance use on all three substance use factors.

A common element of expectancy theory, SLT, and TRA is the importance of expectations/beliefs/attitudes about alcohol use. Both expectancy theory and SLT position expectancies as a mediator of alcohol use. They clearly indicate that expectancies come before substance use outcomes. In addition to informing the relationship between expectations and alcohol outcomes, the TRA introduces the concept of intention. The TRA places intention as a mediator of attitude and actual behavior. In a similar fashion, the TTM also informs the placement of readiness to change between expectancies and substance use outcomes, the actual behaviors that, ideally, are affected by readiness to change. In the proposed model, intention is operationalized as readiness to change. Although intention is not directly measured, it is assumed that readiness is an intention to carry out a specific behavior or to act in a particular way.

The purpose of the study is to develop and test a model that aids in the explanation of the many factors that contribute to substance use, and specifically alcohol use. The project has two development phases and one validation phase. The goal of the study is to identity aspects of the model, such as specific factor loadings and regression paths that work well in a prediction model. In other analyses of this data set as well as alcohol research in general, risk-taking/impulsivity has been largely ignored. The risk-taking/impulsivity construct adds a potentially important factor relating to both injuries and substance use. The model may more accurately reflect the complex patterns of relationships between this set of variables as they affect human

behavior. Since the model draws on several theories, an integration of these theoretical concepts is offered at the end of the project.

Chapter 4: Methods

Sample Size and Power

The sample included 539 subjects recruited at a large New England hospital. While the study was occurring, this site had approximately 69,000 annual visits to the emergency department. Most subjects were male (78%). The participants were recruited in the emergency department during nights and weekends. According to self-reported racial and ethnic information, 72% of study participants were Caucasian, 10% were African American, 14% were Hispanic, less than 1% were Asian, less than 1% were Native American, and 3% were other. Approximately half of the participants (49.1%) had a positive blood alcohol level (BAL) (i.e. $\geq$0.003) at the time of recruitment. However, participants had to pass a brief mental status exam before being enrolled in the study. Participants were at least 18 years old, and the mean age at recruitment was 27 (S.D. = 9).

In SEM, power is necessary to detect differences between models. Power is a complex issue in SEM, and there is no clear consensus regarding an optimal sample size. A sample of at least 150 is recommended in order to produce small enough standard errors (Anderson & Gerbing, 1988). Other recommendations include having at least 100 subjects for smaller designs (Fassinger, 1987) or, alternately, at least 5-10 subjects per parameter (Bentler, 1990). A sample of 500 is recommended for a split half technique (Noar, 2003). A slightly smaller sample could be used for exploratory analyses.

An exploratory factor analysis portion is necessary to test the measurement structure of the latent variables. This step minimizes post hoc model adjustments. Estimates of sample size vary, but a sample of at least 100-200 is suggested (Velicer & Fava, 1998). The factor analysis portion of the current study will be conducted on 139 subjects, which is reasonable for exploratory purposes. For two other phases of analysis, model testing and model validation, two separate samples of 200 are also reasonable and are within the suggested ranges for both planned phases of the analysis. The sample sizes have sufficient power to detect differences between models.

Power is also necessary to detect differences in the root mean square error of approximation (RMSEA: Steiger & Lind, 1980) across the models. RMSEA is used to assess model fit (Bentler, 1990) and in conducting hypothesis testing. Authors have recommended using RMSEA for power calculations (Tabachnick & Fidell, 2001). The current study will provide RMSEA values as effect sizes for tested models.

Measures

The current study employs a number of measures, some of which were already developed (i.e. AUDIT, AEQ, and DrInC) and some of which were created or modified for the purposes of the original study (i.e. Risk Taking Impulsivity Scale, Revised IBC, Decision Ladder, and Drug Questions). Table 1 shows the constructs, corresponding measures, and subscales (if any) for the instruments to be used in the model. As a preliminary step, psychometric properties were computed for all instruments from the sample data. All of the factors with the exceptions of risk-

taking/impulsivity, readiness to change, and drug use were estimated by multiple measures, which increases the reliability and validity of the constructs. In addition, using multiple measures reduces the bias among constructs.

For the purposes of the development and testing of the model, only the baseline data was used, providing a cross-sectional snapshot of the relationships proposed in the model. Although longitudinal data was available, the treatment provided in the original study was intended to change some of the key constructs in the current project, including alcohol use, alcohol consequences, and readiness to change. Thus, baseline data provided the clearest foundation for model building.

Insert Table 1 about here

Risk Taking Impulsivity Scale (Longabaugh et al., 2001). This instrument assesses how well five statements about impulsive actions describe the participant. It is scored on a 4-point Likert scale ranging from "Quite a lot" to "Not at all." Higher scores relate to an increasing inclination toward risk taking/impulsivity. The questions are based on the Jackson Personality Inventory (Jackson, 1976) and serve as the measures for the risk taking/impulsivity factor. Reliability, as measured by Cronbach's alpha, was .84.

Revised Injury Behavior Checklist (IBC) (Longabaugh et al., 2001). This instrument asks about injuries in the past year and whether those injuries were related to alcohol

use. The authors revised an adolescent version of the IBC developed by Starfield (1991) to include alcohol-related injuries. The instrument has three categories of injuries, such as assaults, motor vehicle injuries, and recreational injuries. These categories are the measures relating to the injuries factor. The total score on the IBC correlates with the AUDIT score, the DrInC Physical consequences subscale, and the DrInC impulse control subscale (Ramsey et al., 2000). These scores must be transformed because they are heavily skewed. Reliability, as measured by Cronbach's alpha, was .10 overall, .16 for the assault subscale, .34 for the motor vehicle subscale, and .03 for the recreational subscale. These very low reliabilities are not ideal and may be due to the extreme skewness found in the responses from this instrument. For example, most participants reported zero or only a few injuries, while other participants reported daily injuries (i.e. 300+ injuries in the past year). The IBC must be treated cautiously.

Alcohol Expectancy Questionnaire – III. The Alcohol Expectancy Questionnaire was developed by Brown, Goldman, Inn, and Anderson (1980). Previously, only single expectancies were presumed to influence single behaviors. In total, 90 items reflecting positive expectancies were selected for the final instrument. The instrument used a forced choice method where participants were asked whether they agreed or disagreed with a number of statements about alcohol expectancies. Brown et al. (1980) used principal components factor analysis to determine the factors underlying the 90 items. Six factors were identified: global positive, enhanced social and physical pleasure, enhanced sexual experience, power and aggression, increased social assertiveness, and

relaxation/tension reduction. The factor structure was replicated by Christiansen, Goldman, and Inn (1982). This study used a revised questionnaire containing 110 questions on a sample of adolescents, a different sample than the one used to develop the instrument.

Whereas the AEQ is useful in looking at alcohol expectancies, its factor structure has been called into question. Leigh (1989) examined Brown et al.'s (1980) six scales of the AEQ through confirmatory factor analysis and found that the model did not fit the observed data well. The author suggests that this lack of fit of the model may be related to problems with missing data or violations of assumptions. A one-factor model was also tested, and this comparison to the six-factor model indicated that the six-factor model had a slightly better fit. The power and aggression and tension reduction scales appear to be problematic because the items that load highly on these factors do not have much face validity in predicting the factors. Additionally, the global positive scale is very general and contains items correlated with other scales. Despite significant factor loadings on the six-factor model, the model may be misspecified.

In another study of the AEQ's factor structure, Fromme, Stroot, and Kaplan (1993) used exploratory and confirmatory factor analyses. The exploratory analysis of this study indicated that there were four positive and three negative factors. The model tested in confirmatory analyses did not have a good fit; however, the study supported criterion validity of the factors by finding that the model fit well for the negative expectancies. A third study (Vik, Carrello, & Nathan, 1999) found four

factors in the AEQ: social coping, social enhancement, personal coping, and personal enhancement.

These three studies question the discriminant validity of the instrument, and this lack of validity is problematic for interpretations of data collected by the AEQ (Leigh, 1989). Specifically, the six underlying factors should not be assumed to be independent of each other. Correlations between the latent variables indicate that there is a good amount of overlap. The lack of confirmation of the model may help to explain one of Brown et al.'s (1980) results, namely, a differing pattern in expectancies across drinking experience. Participants with less drinking experience had a greater association with the global positive factor, and participants with more drinking experience had a greater association with the sexual enhancement and aggressive scales.

The questionnaire used in the present study consists of 40 self-reported items about the effects of alcohol. This study used the AEQ-III (George et al., 1995), a revised version of Brown et al.'s (1980) and Rohsenow's (1983) AEQs. Rather than using a forced choice between agree and disagree as in the original instrument, the AEQ-III asks participants to rate the extent to which they agree or disagree with statements about alcohol expectancies. The instrument contains the six positive subscales from Brown et al. (1980) as well as two negative subscales (cognitive and physical impairment, and careless unconcern). A confirmatory analysis of the factor structure (George et al., 1995) found a good fit for the eight factors with the hypothesized model. This analysis also revealed that the factor structure was similar

across race and gender groups. Internal consistency coefficients ranged from .83 to .93 on each of the eight scales, which are acceptable values for reliability.

Overall, there is some support for scales in the Alcohol Expectancy Questionnaire. The differences may be partly due to calling the same factor different names, varying model specification, or sampling variation. However, it is necessary to proceed with caution with this instrument because of mixed results regarding its scales. For this instrument, the preliminary factor analysis is critical; psychometric properties are thoroughly examined before proceeding onto other steps.

Since there is a lack of consensus on the number of factors of the AEQ, only the broadest scales of positive and negative expectancies are used in the current study. The distinction between positive and negative expectancies is a fundamental one (Goldman & Drakes, 2004). Both positive and negative expectancies predict alcohol use (Leigh & Stacy, 1993), although positive expectancies were a stronger predictor than negative expectancies.

Reliability, as measured by Cronbach's alpha, was .94 overall. For the two broad categories of expectancies, reliability was .93 for total positive subscale and .83 for total negative subscale. The 6 positive subscales had the following reliability estimates: .74 for the global positive subscale, .76 for the power and aggression subscale, .84 for the sexual enhancement subscale, .85 for the social expressiveness subscale, .75 for the social and physical pleasure subscale, and .73 for the tension reduction subscale. The 2 negative subscales had the following reliability estimates: .75 for the cognitive impairment subscale and .77 for the careless unconcern subscale.

Decision Ladders (Longabaugh et al., 2001). Three versions of a decision ladder were used to determine where participants were in thinking about changing behaviors: drinking, hazardous behavior, and both drinking and hazardous behavior. Readiness to change is measured on a 10-point scale. The anchoring points included taking action to make a change, starting to think about how to change, thinking about change but not quite ready, thinking about considering changing someday, and no thought of change. The responses loosely correspond to the TTM stages of change. The three drinking and hazardous behavior ladders are combined into the single indicator of the Readiness to Change construct for the current study. Reliability, as measured by Cronbach's alpha, was .87.

Alcohol Use Disorders Identification Test. The AUDIT is a standardized instrument that was developed in primary care settings across cultures (Saunders, Aasland, Amundsen, & Grant, 1993). Its 10 items are intended to distinguish between alcohol dependence and problem drinking. The AUDIT contains the following types of questions: 3 drinking behavior questions, 2 adverse psychological reaction questions, 2 alcohol-related problems questions, and 3 alcohol use questions. The timeframe for the instrument is events that have occurred in the past 12 months. Saunders, Aasland, Barbor, de la Fuente, and Grant (1993) further examined the factor structure of the AUDIT. About 92% of hazardous drinkers had an AUDIT score of 8 or greater, while 94% of non-hazardous drinkers had scores of less than 8. In terms of validity, these estimates demonstrate a good ability to distinguish between hazardous and non-

hazardous drinking. The instrument's internal consistency is .80, indicating fairly stable reliability.

In the original study, the AUDIT was used as a screening tool. A cut-off of 8 (out of a total possible score of 40) represents hazardous drinking, while a cut-off of 12 represents harmful drinking. The total AUDIT score is used as the measure of Alcohol Use in the current study. Reliability, as measured by Cronbach's alpha, was .77 overall, .75 for the dependence subscale, .72 for the quantity/frequency subscale, and .51 for the negative consequences subscale.

Drug Questions (Longabaugh et al., 2001). These questions use Likert scales to measure the use of cannabis, cocaine/crack, hallucinogens, inhalants, amphetamines, barbiturates/sedatives, heroin/opiates, and steroids in the past 12 months. The responses include: none, less than once a month, monthly, weekly, or daily. The total score on these questions is used as the measure of frequency of Drug Use in the current study. Reliability, as measured by Cronbach's alpha, was .61

Drinker's Inventory of Consequences. This instrument asks about negative experiences related to alcohol use. It was developed during Project MATCH (Matching Alcohol Treatments to Client Heterogeneity) (Miller, Tonigan, & Longabaugh, 1995), which studied a sample of 1,728 alcohol-treatment-seeking participants at multiple sites. In the first phase, the instrument was developed on all participants. In the second phase, reliability tests on the instrument were conducted on the different but much smaller sample (Del Boca & Brown, 1996). During this latter

phase, subjects were tested at two points, two days apart. The reliability tests were conducted on a smaller sample than in the overall instrument development. All subjects met the DSM criteria for either alcohol dependence or alcohol abuse.

The original DrInC contains 50 items total in five subscales: physical (i.e. I have had a hangover), social responsibility (i.e. I have missed work or school), intrapersonal (i.e. I have been unhappy because of my drinking), impulse control (i.e. I have taken foolish risks when I have been drinking), and interpersonal (i.e. My family has been hurt by my drinking). The instrument measures the number of negative consequences that occurred within the past three months. During the instrument's development, items aimed at detecting alcohol dependence were excluded; the goal was to select items related to alcohol abuse.

The scales have demonstrated mostly high reliability. Impulse control had the lowest reliability at .79; all other scales had reliability coefficients ranging from .91 to .96. Reliability was higher for the lifetime DrInC than the recent DrInC. The scales were largely unique in the amount of variance that they accounted for, as indicated by squared multiple correlations below .70 (Miller, Tonigan, & Longabaugh, 1995).

The current study used a 45-item version of the Lifetime DrInC, an instrument slightly shorter than the 50-item original instrument. The 50-item instrument included a 5-item control scale, and this scale was removed from the 45-item version. In the original analysis, these scores were logarithmically transformed in order to make the scores more normally distributed. The current project uses the Lifetime DrInC, which asks whether an event has ever happened because of drinking alcohol, to represent the construct of Alcohol Consequences. Reliability, as measured by Cronbach's alpha,

was .80 overall, .70 for the physical subscale, .81 for the social responsibility subscale, .86 for the intrapersonal subscale, .73 for the impulse control subscale, and .83 for the interpersonal subscale.

Procedures and Analyses

The analysis was separated into three phases, and the total sample was split into three randomly selected samples. As an initial step, it was essential to perform preliminary analyses to ensure that the data did not violate assumptions of factor analysis and SEM, and to make any necessary transformations. For example, substance use variables are generally not normally distributed; logarithmic transformations may reduce non-normality. Descriptive statistics, internal consistency, and correlations between variables were calculated, and the variables were examined for violations of statistical assumptions. Since both injuries and alcohol consequences were highly non-normally distributed, transformations were used. The indicators for injuries and alcohol consequences were logarithmically transformed.

In the first phase, preliminary exploratory factor analyses were conducted to determine whether the measures indicating each latent factor formed unidimensional constructs. This phase was intended to verify the factor structure of each construct (see Figure 1). This step was particularly important for the Alcohol Expectancy Questionnaire, in which there was no clear indication of the number of underlying scales. For all constructs, each factor was tested separately. This portion of the analysis was conducted on data from a sample of approximately 139 participants.

The second phase involved testing a series of three nested models. The proposed mediational model (Figure 1) was tested using the EQS program (Bentler & Wu, 2002). The model contains two independent factors, two mediators, and three outcome factors. The independent factors are risk taking/impulsivity, as measured by the single Risk Taking Impulsivity Scale, and injuries, as measured by the number of injuries in assaults, motor vehicle injuries, and recreational injuries. The first mediator factor is alcohol expectancies, which has two measures of positive and negative expectancies. The second mediator factor is readiness to change drinking behavior, which is measured by scores on readiness to change drinking only, hazardous behavior only, and both drinking and hazardous behavior. The outcome measures are substance use factors, which consist of alcohol use, other drug use, and alcohol consequences. The alcohol use factor and drug use factors are measured by single scales. The alcohol consequences factor consists of the five subscales for the Drinker's Inventory of Consequences: physical, social responsibility, intrapersonal, impulse control and interpersonal.

In order to determine the mediational effects, it is necessary to test whether the independent factor is correlated with the mediator, which in turn must correlate with the dependent factor (Collins, Graham, & Flaherty, 1998). A simple correlation between the mediator and the dependent factor is not enough to indicate mediation. A mediator is a variable that must come between the independent factor and dependent factor (Baron & Kenny, 1986). A series of models assists in ruling out other hypotheses. Two nested models are tested and compared to the mediational model. A full model (Figure 2) has paths from the independent factors, risk taking/impulsivity

and injuries, to the three outcome factors, alcohol use, drug use, and alcohol consequences in addition to all paths described in the mediational model. A direct effects model (Figure 3) does not have the paths from the independent factors to mediators or the paths from the mediators to the outcome factors.

Chi-square difference tests were used to compare the models. It was expected that the mediational model would have the best fit with the data. Figure 4 depicts the hypothesized set of paths for each of the three models in one integrated path diagram. Bold lines delineate the mediational model paths (Figure 1). Light-faced lines represent the paths for the direct effects model (Figure 3). The full set of bold and light-faced lines make up the full model (Figure 2). A significant difference between the full model (Figure 2) and the direct effects model (Figure 3) would indicate that more parameters are needed to explain the data, and it is anticipated that the additional parameters will be the mediational paths. It was expected that the direct effects model will have a significant chi-square value, indicating a difference between that model and the actual data. It was also expected that the mediational model and the full model will have small and non-significant chi-square values. In this case, the more parsimonious model, the proposed mediational model, would be selected as the best model to explain the data. During this phase, adjustments in model paths were made based on Lagrange Multiple tests, which indicated additional paths to improve model fit. The second phase was conducted on approximately 200 subjects.

Finally, the third phase was a validation of the model. This step provided an indication of whether the results could be replicated. The third part was conducted on

the remaining approximately 200 subjects. Figure 5 shows a flow chart of the three phases of the project.

For both the second and third phases, it was anticipated that the chi-square value would be small, relative to the degrees of freedom. Whereas the chi-square value gives an indication of overall model fit, the comparative fit index (CFI) (Bentler, 1990) provides a more specific assessment of model fit. Ideally, the CFI value should be large (i.e. > .95) (Bentler & Hu, 2002). In addition to measures of model fit, RMSEA (Steiger & Lind, 1980), a measure of error, was used. Preferably, RMSEA should be small (i.e. ideally < .05, or at least < .10).

It was anticipated that the results of the analysis would allow for an integration of the main theories supporting the model. Expectancy theory, SLT, the TRA, and the TTM each inform separate paths specified in the model. Expectancy theory and SLT make similar predictions about the expectations, while the TRA and the TTM are similar regarding readiness to change. The TRA is the link between expectations or beliefs, readiness to change, and actual behavior. Currently, no model combines these theories in the way specified in this project; the results should allow for a cohesive interpretation of substance use outcomes.

Insert Figures 1-5 about here

Chapter 5: Results

The preliminary analyses did not reveal any special problems. Table 2 shows the means and standard deviations of the sums for each of the instruments and subscales, where applicable. In order to reduce non-normality, the three subscales on the IBC (assaults, MVCs, and recreational injuries) were transformed logarithmically. Similarly, the five subscales of the Drinc (physical, social responsibility, intrapersonal, impulse control, and interpersonal) were also transformed logarithmically. Table 2 also shows reliability estimates as measured by Cronbach's alpha. With the exception of the IBC, which had very low reliability, reliability estimates were acceptable. Correlations among total sums of the factors were within reasonable values (i.e. <.70), suggesting a lack of multicollinearity. ANOVAs were conducted on risk taking, injuries, alcohol expectancies, readiness to change, alcohol use, drug use, and alcohol consequences by sample. These analyses indicated no differences across the three subsamples on the main factors of interest, indicating that the each subsample appeared to be similarly representative of the large full sample.

Insert Table 2 about here

Phase I: Exploratory Factor Analyses

For the factor analysis phase, each construct was tested with the items indicating that factor. Promax oblique rotation was used. The number of eigenvalues greater than one was used as an indication of the number of underlying factors for each construct (Kaiser, 1974). For some constructs, scree plots (i.e. plots of the number of factors and eigenvalues) were used to assist in the determination of the number of underlying factors. An "elbow" in the scree plot can be a rough indication of the number of underlying factors. Table 3 shows the results of the factor analysis phase.

Three manifest constructs were tested in order to determine that these factors only contained one factor. Factor analysis indicated one factor for the risk taking/impulsivity construct. The sum of the 5 items was used. The single factor had an eigenvalue of 2.92. For the readiness to change construct, factor analysis indicated one factor. The sum of the 3 items was used. The single factor had an eigenvalue of 2.40. For the drug use construct, factor analysis indicated one factor. The sum of the 8 items was used. The single factor had an eigenvalue of 2.64.

For the latent factors, factor analyses sometimes indicated a complex factor structure. For injuries, factor analysis indicated 7 factors. However, upon examination of the pattern of factor loadings, a complex structure was found (i.e. items loaded highly on more than one factor). Additionally, the scree plot indicated an "elbow" after the third factor. The existing subscales of assaults, motor vehicle injuries, and recreational injuries were used as indicators of a construct of injuries. For alcohol expectancies, factor analysis indicated 11 factors with complex loadings. Additionally, the scree plot indicated an "elbow" after the second factor. Two theoretically driven

factors, positive alcohol expectancies and negative alcohol expectancies, were used in order to maintain a loose association to the concepts of pros and cons found in TTM. For alcohol use, factor analysis indicated 3 factors with eigenvalues of 3.57, 1.30, and 1.25. As expected, the three existing factors of dependence, quantity/frequency, and negative consequences were used. For alcohol consequences, factor analysis indicated 13 factors with a complex structure. The scree plot indicated that eigenvalues tapered off after the 5th factor, and The five subscales of physical, social responsibility, intrapersonal, impulse control, and interpersonal were used.

No modifications of the model were made based on the results of Phase 1.

Insert Table 3 about here

Phase II: Model Testing

This phase involved testing of three nested model: a mediational model (Figure 1), a full model (Figure 2), and a direct effects model (Figure 3).

Two versions of the mediational model were tested; a model with 3 separate substance use factors and a model with a single substance use factor. The mediational model with 3 substance use factors was significant, indicating that it did not appear to be a good explanation of the data; χ^2 (99, N=200) = 311.61, $p < 0.001$, CFI=0.80, and RMSEA=0.12. Goodness of fit statistics suggested poor fit; the CFI should be closer to 1, and the RMSEA should be <.10.

Due to poor fit of the data to the model, model modifications were attempted. The substance use factors were combined into a single substance use outcomes factor. The mediational model with one substance use factor did not significantly improve fit with the data, χ^2 (101, N=200) = 308.07, $p < 0.001$, CFI=0.80, and RMSEA=0.12. Although still fitting poorly, the one-substance-use-factor mediational model had a slightly better fit than the three-substance-use-factor model. All paths and estimated factor loadings were significant at $p<.05$, except the regression path from the Injuries construct to the Alcohol Expectancies construct.

As a comparison to the mediational model, other one-substance-use-factor models were tested. The full model offered slightly better fit than a mediational model, χ^2 (99, N=200) = 251.67, $p < 0.001$, CFI=0.85, and RMSEA=0.10. In contrast, the direct effects model showed the least acceptable fit to the data, χ^2 (103, N=200) = 321.17, $p <0.001$, CFI=0.79, and RMSEA=0.12. Goodness of fit indices show relatively poor fit, particularly for the direct effects model. Of the three models tested, the full model showed the best fit. However, the full model still does not meet optimal levels of fit (e.g., CFI > .90 or .95).

Insert Figures 6-8 about here

Because none of the models resulted in good fit, model revisions that seemed theoretically relevant were considered before proceeding with the analysis. The

Lagrange Multiplier test suggested additional parameters to improve model fit. In the mediational model, the LM test suggested paths between IBC and Drinc subscales as well as positive alcohol expectancies and Drinc subscales. Because of these possible relationships, the alcohol expectancies constructs was placed as an independent factor. The readiness to change construct and the drug use measure were removed, as they did not appear to add to the model's fit.

The revised mediational model contained alcohol expectancies, risk taking, and injuries as independent factors or variables, alcohol consequences as a mediator factor, and alcohol use as a dependent factor. The three independent variables were significantly correlated with each other (*r* for alcohol expectancies and risk taking = .35, *r* for risk taking and injuries = .50, and *r* for alcohol expectancies and injuries = .38). The measurement structure showed that all subscales loaded significantly on their respective factors. All regression paths were significant at $p < .05$, with the exception of the path from injuries to alcohol consequences. The revised mediational model had reasonable fit, χ^2 (df=71, N=200) = 161.86, $p < .0001$, CFI=.90, RMSEA=.09. Figure 6 shows this model.

Insert Figures 9-10 about here

The full model (Figure 7) was tested as a comparison model and contained all the paths of the mediational model with additional paths from alcohol expectancies, risk taking, and injuries to alcohol use. This model had similar reasonable fit as

compared to the mediational model, χ^2 (68, N=200) = 161.21, p <0.001, CFI=0.91, and RMSEA=0.09. The additional paths between the independent factors and dependent factors were all non-significant.

A mediational model with alcohol use as the mediator factor and alcohol consequences as the dependent factor was also tested. This set of relationships seemed more plausible than models testing alcohol consequences as a mediator factor and alcohol use as the dependent factor. Overall model fit was only slightly worse than the model specifying alcohol consequences as a mediator factor and alcohol use as a dependent factor, χ^2 (71, N=200) = 184.88, p <0.001, CFI=0.89, and RMSEA=0.10. All factor loadings were significant, and all regression paths except for the path from injuries to alcohol use were significant. Figure 11 shows this model.

It was possible that a high degree of overlap existed between the alcohol consequences factor and the alcohol use factor. To test this possibility, a correlation between the errors for alcohol consequences and alcohol use was added to the mediational model. This model had more reasonable fit than the mediational model without correlated errors, χ^2 (70, N=200) = 161.40, p <0.001, CFI=0.91, and RMSEA=0.09. All factor loadings were significant, and all regression paths were significant except the path from injuries to alcohol use were significant. Figure 12 shows this model.

A full model that contained all the paths of the mediational model was tested. Additional paths were added from alcohol expectancies, risk taking, and injuries to alcohol consequences use as well as correlated errors between alcohol consequences and alcohol use. However, the model did not converge. When the correlation between

the errors was removed, the full model (Figure 13) ran properly. This model had similar reasonable fit as compared to the mediational model, χ^2 (69, N=200) = 164.38, p <0.001, CFI=0.91, and RMSEA=0.09. All factor loadings were significant. The only regression paths that were significant were the paths from alcohol expectancies to both alcohol consequences and alcohol use.

A direct effects model (Figure 14) was also tested. It included only paths from alcohol expectancies, risk taking, and injuries to alcohol use. It also included the correlation between the errors for alcohol use and alcohol consequences. This model had somewhat poor fit, χ^2 (71, N=200) = 191.54, p <0.001, CFI=0.88, and RMSEA=0.10. All factor loadings were significant. Regression paths were significant from alcohol expectancies and risk taking to alcohol consequences. In comparison to the mediational model presented in Figure 12, the direct effects model has a poorer fit to the data, as indicated by slightly larger χ^2 and RMSEA values.

Of the various models tested, the mediational model presented in Figure 12 represents both the best fitting and the most theoretically sound model.

Insert Figures 11-14 about here

Phase III: Model Validation

The final phase of the analysis was a validation of the mediational model (Figure 6) on a subsample of 200. Because of extensive changes made during the

model development phase, it was critical to test the final model on a different sample. Generally, the results were similar to the model fit in Phase II. The model had a reasonable fit, χ^2 (68, N=200) = 140.33 p <0.001, CFI=0.92, and RMSEA=0.08.

Chapter 7: Discussion

This project sought to expand upon existing research on alcohol use by including a risk-taking construct as a predictor of alcohol outcomes. The original proposed model was very complex and did not fit the data as expected, suggesting model misspecification. As a result, the second phase became an exploratory model building analysis. The readiness to change construct and the measure of drug use were removed, and the remaining relationships were respecified. The main change in the revised model was placing the alcohol expectancies construct as an independent factor, rather than using alcohol expectancies as a mediator factor. The final model tested in Phase II included alcohol expectancies, risk taking, and injuries as independent factors, alcohol use as a mediator factor, and alcohol consequences as a dependent factor.

Several main hypotheses and theories were supported by the model. Alcohol expectancies and risk taking were positively related to the alcohol use construct, and the alcohol use construct was positively related to alcohol consequences. The model supports the cognitive-based theories of expectancy theory (i.e. Goldman, Del Boca, & Darkes, 1999; Sher et al., 1996), SLT (Bandura, 1977; Maisto, Carey, & Bradizza, 1999), and the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Although these theories suggest that alcohol expectancies or other beliefs are mediators of behavior, they all support the idea that alcohol expectancies precede actual behavior. Expectancy theory and SLT predict alcohol expectancies precede alcohol use. Similarly, the TRA predicts that behavioral beliefs and social norms have an impact

on behavior. None of the theories make specific predictions about whether alcohol consequences should precede alcohol use or whether alcohol use should precede alcohol consequences. Both constructs are behavioral measures. The model was tested with both patterns of relationships. Intuitively, it was expected that alcohol use should be related to alcohol consequences. In looking at fit indices, the models (Figures 9-10) specifying alcohol consequences as mediator and alcohol use as a dependent variable and the models (Figures 11-14) specifying alcohol use as a mediator and alcohol consequences as a dependent variable had very similar fit. However, theoretical relationships must also be taken into consideration. Although it may make empirical sense to specify alcohol consequences as a mediator and alcohol use as a dependent variable, these sets of relationships do not make as much theoretical or practical sense. Adding a correlation between the errors of alcohol use and alcohol consequences demonstrated a high degree of overlap between these constructs. The measures for both constructs identify patterns of drinking with an emphasis on finding heavy drinkers. The Drinker Inventory of Consequences is a measure of alcohol-related negative consequences. Participants who have or acknowledge high levels of consequences are likely to have patterns of harmful or hazardous drinking. The AUDIT, the measure of alcohol use, is a screening tool for harmful and hazardous drinking.

While most of the hypotheses and theories were supported, not all hypotheses and theories were supported. The hypothesis that injuries were related to alcohol consequences was not supported. Due to respecifying the model, most of the original hypotheses were not supported. Incorporating a transtheoretical model (Prochaska et

al., 1994) construct did not work well with these data. Specifically, the TTM construct of readiness to change does not appear to play an active role in this model. The model provided a good fit to the data only when the readiness to change factor was removed. LM tests did not specify any other relationships to other parts of the model. The cognitive theories focus on explaining beliefs in relation to behavior, while TTM focuses on explaining behavior change. Cognitive-based theories and TTM do not make similar predictions about the underlying data structure; future research could examine how these types of theories can be integrated.

An important contribution of this project is the inclusion of risk taking in models of alcohol use. Specifically, foolish risk or impulsivity is positively related to alcohol use. This result suggests that risk taking as a personality trait may be a predictor of hazardous or harmful patterns of alcohol use. The correlations between the three independent variables also suggest that risk taking is related to alcohol expectancies and injuries. Risk taking may be part of a complex set of relationships regarding behavior around alcohol use.

It is noteworthy to mention some limitations of the data. First, several of the subscales (i.e. the motor vehicle crash subscale on injuries, dependence on alcohol use, and negative expectancies on alcohol expectancies) had high kurtosis values, indicating non-normality or violations of assumptions. Additionally, there was less than optimal reliability for the Injuries measure. It is possible that the non-significant path from injuries to alcohol consequences was a result of low reliability. Some of the constructs may have a complex factor structure. For example, LM tests suggested additional paths from the intrapersonal scale on the alcohol consequences factor to risk

taking and injuries. Adding these paths did not make theoretical sense and would have made the model more complicated to interpret without significantly increasing the model fit. Conceptualizing risk taking as an indicator of a personality trait may partially explain why the LM test suggested a path to the intrapersonal scale. Future research should address these concerns by using other measures of the constructs.

A second limitation of this project is that it is a secondary data analysis. Measures were selected or developed for the purpose of the original study. Often, SEM is not a primary objective in conducting a study. The primary purpose of the original study was to determine whether brief counseling interventions were effective in reducing negative consequences of alcohol use.

A third limitation includes the use of self-report data. In particular, data concerning alcohol use may fall prey to the self-presentation bias. Study participants may want to appear more positive than they actually are or may want to conform to the researcher's expectations.

A fourth limitation concerns the level of cognitive functioning among participants. Since the theories informing the model are cognitively based, it is important that participants had a certain level of cognition functioning at the time of recruitment. Participants were required to pass a brief mental status task before being consenting, and it is reasonable to assume that a certain amount of cognitive functioning was needed in order to pass the test. Also, approximately half of the participants had positive BALs at the time of recruitment. However, participants had to be sober enough to understand the consent process.

Future directions include the testing of longitudinal models. The model, although reasonable in the revised form, did not fit well as a cross-sectional analysis of alcohol issues. Longitudinal analyses present more compelling evidence for temporal ordering. One possibility is to look at the timeframe for specific instruments and determine whether temporal ordering can be examined indirectly. While this may provide some evidence of temporal ordering, it will not fully explain longitudinal effects. Another option is longitudinal cross-sectional analysis. For example, the model could be tested using data from baseline for the independent factors, data from 3 months for the mediator factors, and data from 12 months for the dependent factors. A third option is latent growth curve modeling. The dependent factors could be examined in this fashion in order to determine if there is a change over time. A final option would be to combine a conventional SEM model with latent growth modeling approach on the dependent factors.

Another future direction to clarify the relationship of TTM concepts and alcohol outcomes by testing additional models. Because it did not appear to relate clearly to other constructs, the readiness to change factor was dropped from the final version of the model. In addition, positive and negative alcohol expectancies could be separated into two constructs. Positive and negative alcohol expectancies loosely resemble the pros and cons concepts of the TTM.

This project attempts to include risk-taking and injuries in a model predicting alcohol outcomes. Interpretation must be made cautiously, since no method can infer causality. However, the project confirms a relationship from risk-taking and alcohol expectancies to alcohol use and alcohol consequences. Behavioral beliefs (i.e. alcohol

expectancies) and personality traits (i.e. risk taking) appear to be important variables in explaining alcohol outcomes. Cognitive theories offer a plausible explanation of these relationships.

Table 1

Constructs, Corresponding Measures, and Subscales

Construct	**Measures**	**Subscales**
Risk Taking/ Impulsivity	Risk Taking Impulsivity Scale	---
Injuries	Revised Injury Behavior Checklist (IBC)	Assaults MVCs Recreational
Alcohol Expectancies	Alcohol Expectancy Questionnaire - III (AEQ)	Positive Negative
Readiness to Change	Decision Ladder	-----
Alcohol Use	Alcohol Use Disorders Identification Test (AUDIT)	Dependence Quantity/Frequency Negative Consequences
Drug Use	Drug Questions	---
Alcohol Consequences	Drinker Inventory of Consequences (DrInC)	Physical Social Responsibility Intrapersonal Impulse Control Interpersonal

Table 2. Means, Standard Deviations, and Reliability Estimates (Cronbach's Alpha) for Instruments and Subscales

Instrument	Subscale	Mean Score (SD)	Reliability (Cronbach's Alpha)	N
Risk Taking Impulsivity Scale	---	11.17 (3.91)	.84	500
Revised Injury Behavior Checklist (IBC)	Total	8.43 (26.03)	.10	532
	Assaults	3.40 (7.98)	.16	537
	MVCs	0.58 (1.86)	.34	538
	Recreational	4.64 (24.12)	.03	533
Alcohol Expectancy Questionnaire – III	Total	3.34 (.90)	.94	467
	Positive	3.47 (3.12)	.93	480
	Global Positive	3.22 (2.91)	.74	494
	Power & Aggression	2.17 (1.82)	.76	498
	Sexual Enhancement	2.58 (2.29)	.84	501
	Social Expressiveness	2.12 (1.63)	.84	501
	Social & Physical Pleasure	1.89 (1.36)	.75	498
	Tension Reduction	2.18 (2.10)	.73	498
	Negative	3.10 (1.34)	.83	489
	Cognitive Impairment	1.88 (1.37)	.75	493
	Careless Unconcern	2.20 (2.33)	.71	496
Decision Ladder	---	12.41 (10.12)	.87	537
AUDIT	Total	12.83 (7.14)	.77	530
	Dependence	1.39 (2.30)	.76	533
	Quantity/Frequency	7.33 (2.77)	.72	535
	Negative Consequences	4.16 (3.87)	.51	532
Drug Use Questions	----	1.01 (1.23)	.61	467
Drinker Inventory of Consequences	Total	15.65 (10.61)	.80	528
	Physical	3.38 (1.92)	.70	537
	Social Responsibility	2.10 (2.10)	.81	534
	Intrapersonal	2.53 (2.53)	.86	536
	Impulse Control	4.68 (3.01)	.73	534
	Interpersonal	2.95 (2.58)	.83	533

Table 3. Phase I: Factor Analysis Results

Instrument	Original Model	Final Model	Eigen-value	% Variance	Factors Found	Factors Used
Risk Taking Impulsivity Scale	IV	IV	2.92	58.37	1	1
Revised Injury Behavior Checklist (IBC)	IV	IV	3.13	17.37	7	3 The scree plot indicated an "elbow" after the 3rd factor.
			2.18	12.13		
			1.53	8.51		
			1.22	6.80		
			1.14	6.32		
			1.09	6.03		
			1.04	5.75		
Alcohol Expectancy Questionnaire – III	Mediator	IV	11.56	29.13	11	2 The scree plot indicated an "elbow" after the 2nd factor. 2 theoretically driven factors were extracted.
			3.26	8.16		
			2.18	5.44		
			2.00	5.00		
			1.76	4.39		
			1.55	3.88		
			1.52	3.80		
			1.16	2.89		
			1.10	2.74		
			1.07	2.67		
			1.02	2.54		
Readiness to Change	Mediator	Not included	2.40	79.84	1	1
AUDIT	DV	Mediator	3.57	35.73	3	3
			1.30	13.03		
			1.25	12.45		
Drug Use Questions*	DV	Not included	2.64		1	1
Drinker Inventory of Consequences	DV	DV	12.19	27.10	13	5 13 complex factors, The scree plot tapered off after the 5th factor, and high reliability was found with 5 scales.
			3.24	7.20		
			2.43	5.41		
			1.84	4.09		
			1.72	3.83		
			1.39	3.09		
			1.28	2.85		
			1.27	2.81		
			1.23	2.74		
			1.17	2.61		
			1.10	2.44		
			1.06	2.36		
			1.01	2.23		

Figure 1 Proposed Mediational Model

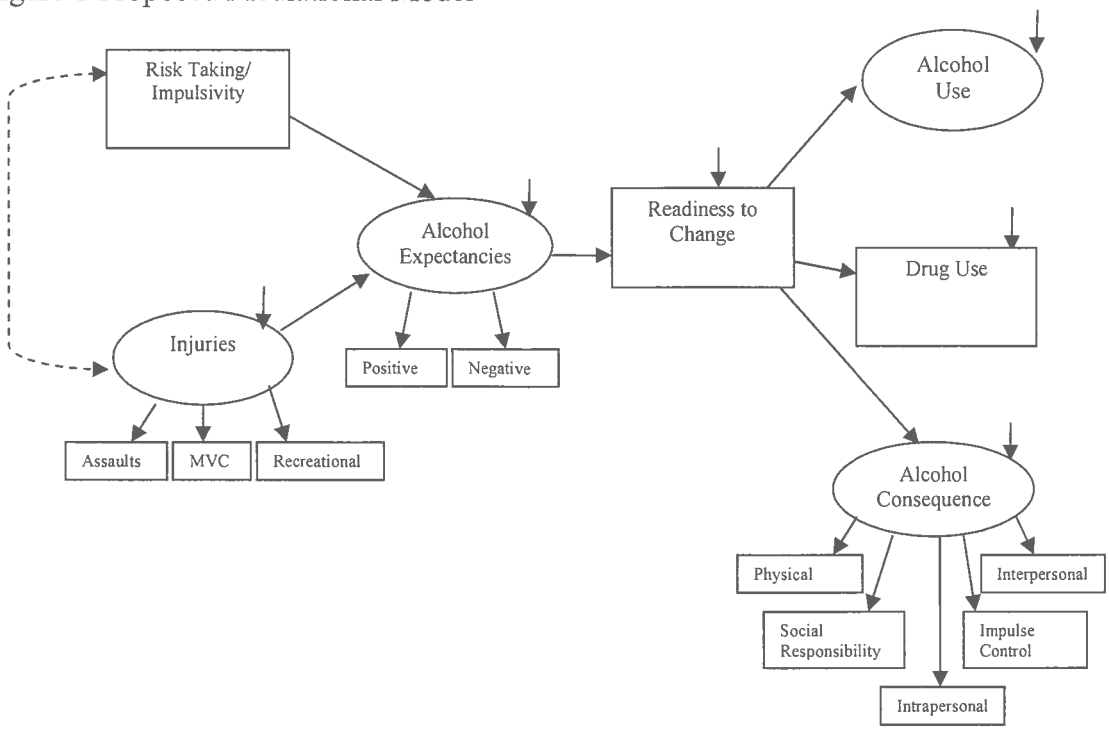


Figure 2 Full Model

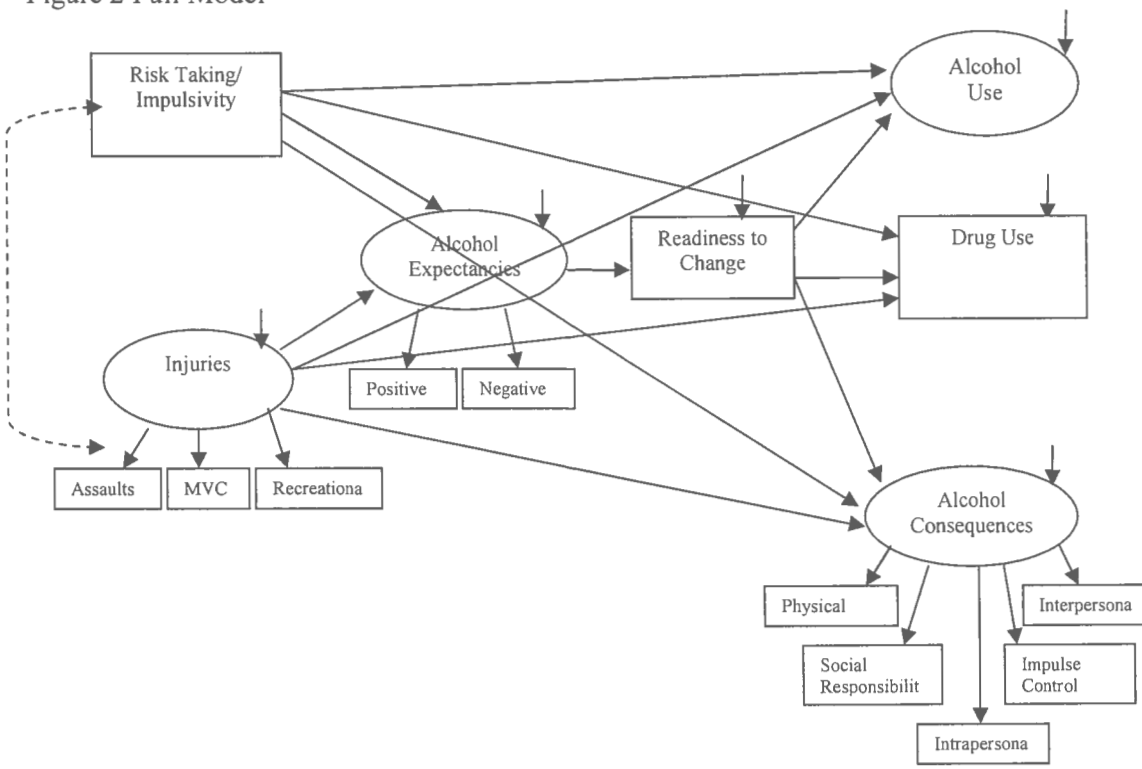


Figure 3 Direct Effects Model

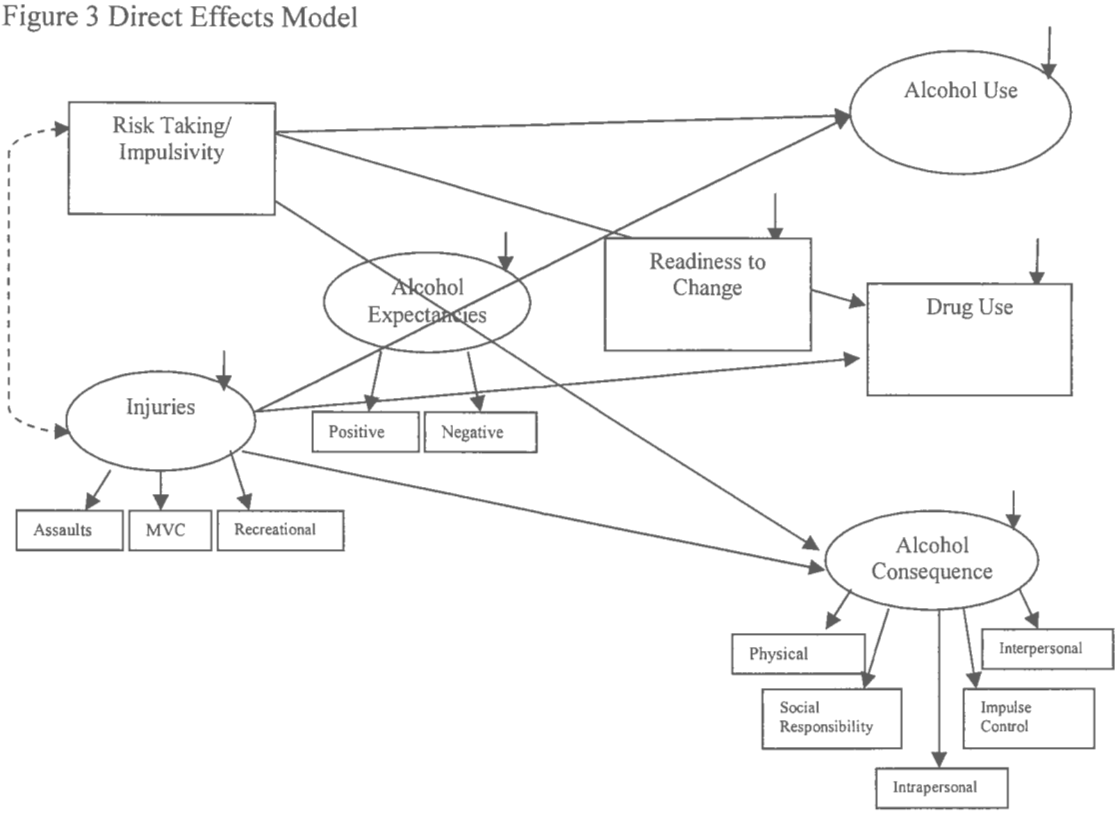


Figure 4 Anticipated Pattern of Regression Weights between Factors

Proposed Mediational Model (Figure 1) – **Bold** solid lines
Bold paths anticipated to be positive and high (regression weight >.70)

Full Model (Figure 2) – All **bold** and thin solid lines between factors
Bold paths anticipated to be positive and high (regression weight >.70)
Light-faced paths anticipated to be negative and low (regression weight <.30)

Direct Effects Model (Figure 3) – Thin solid lines
Light-faced paths anticipated to be negative and low (regression weight <.30)

Direction
+ = anticipated positive relationship
- = anticipated negative relationship

Strength
High = regression weight >.70
Low = regression weight < .30

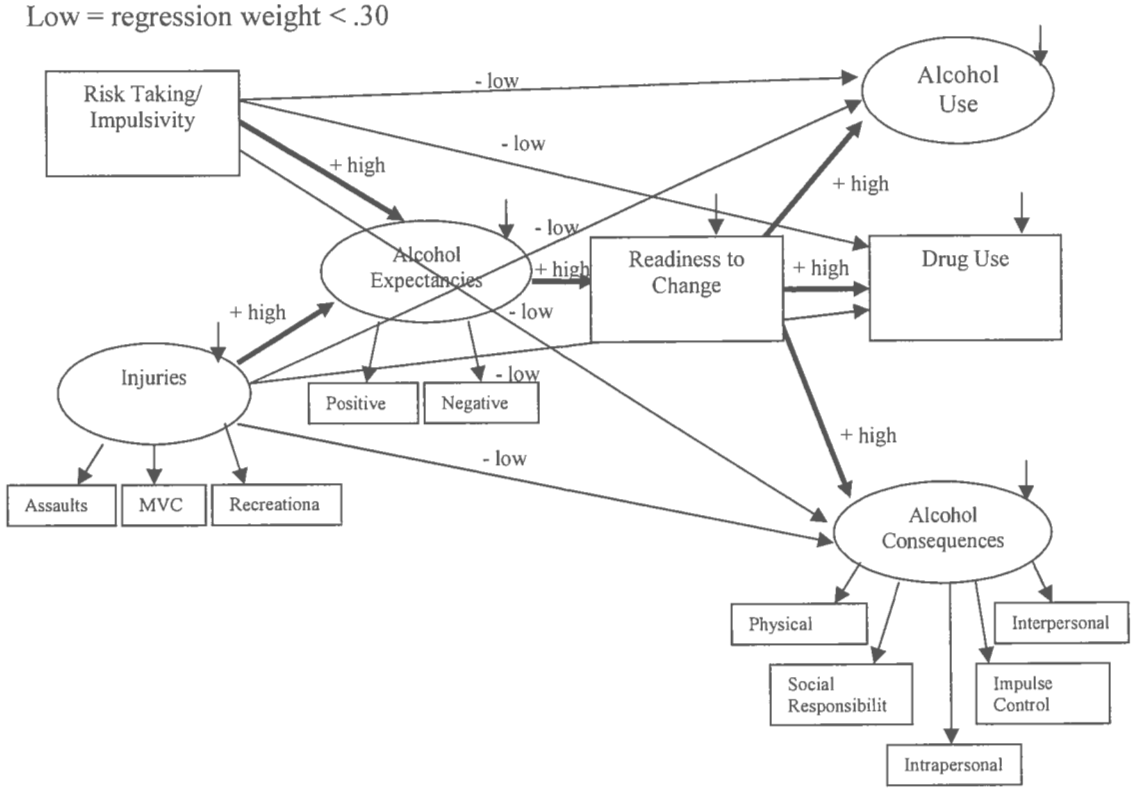


Figure 5 Flow Chart of Project Phases

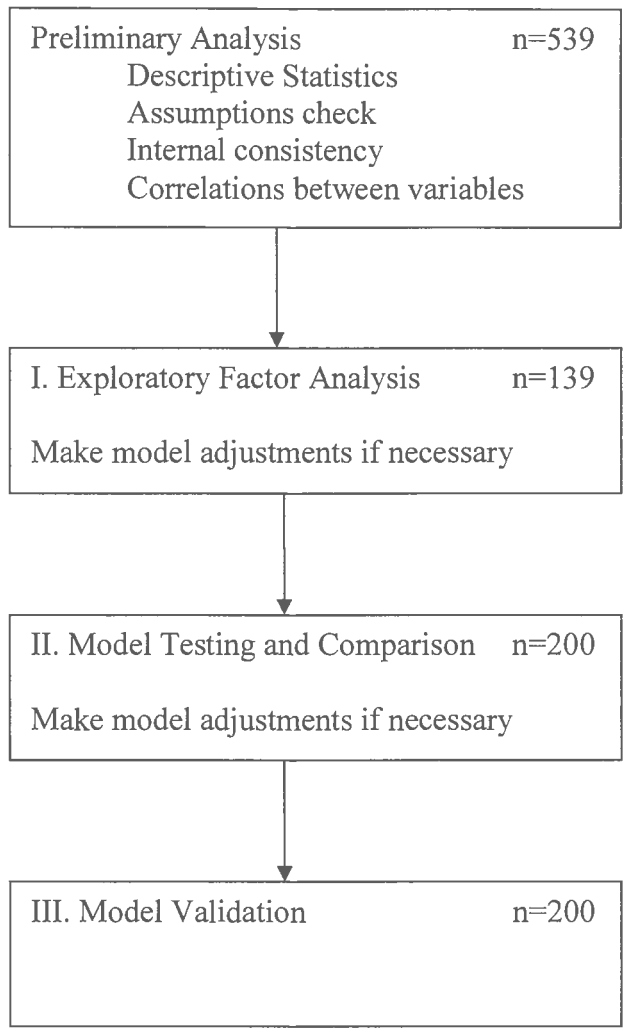


Figure 6 Original Mediational Model with One Substance Use Factor χ^2 (df=101, N=200) = 308.07, p < .0001, CFI = .80, RMSEA = .12.

Note: All paths and loadings were significant at p >.05 except for the path between injuries and alcohol expectancies.

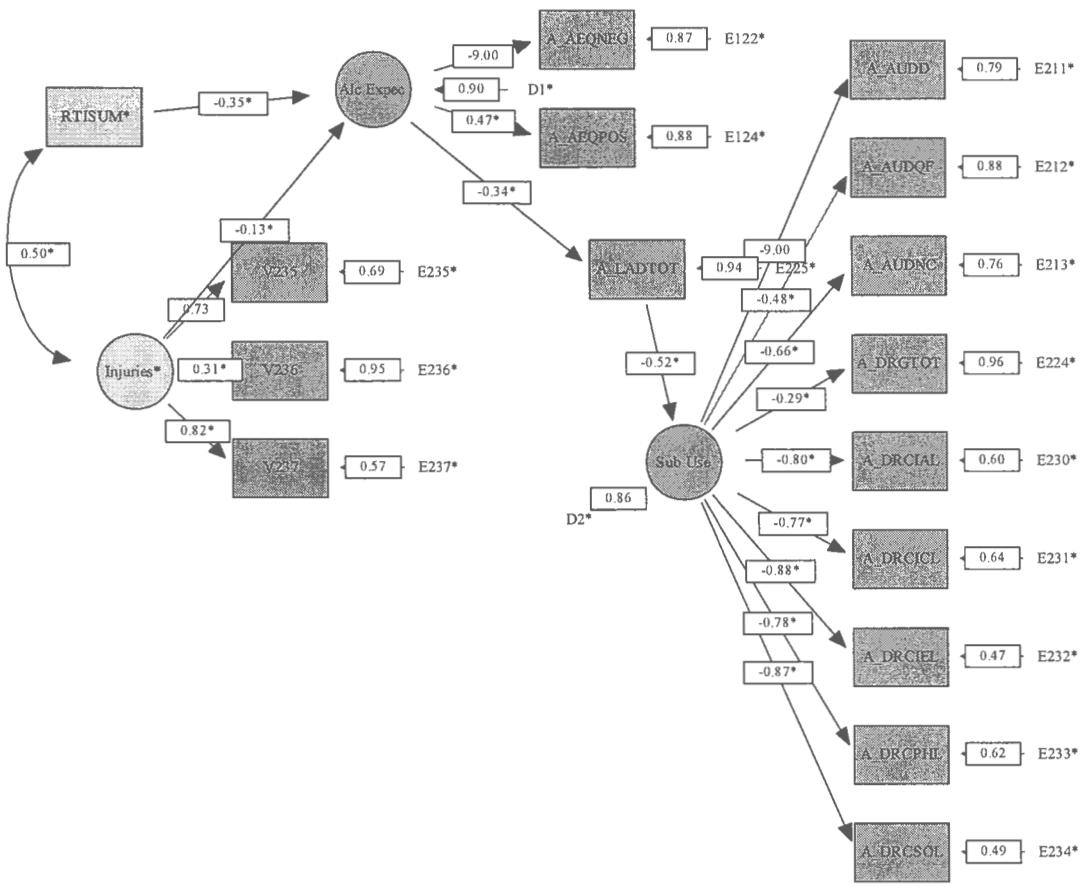


Figure 7 Original Full Model, χ^2 (df=99, N=200) = 251.67, p < .0001, CFI = .85, RMSEA = .10

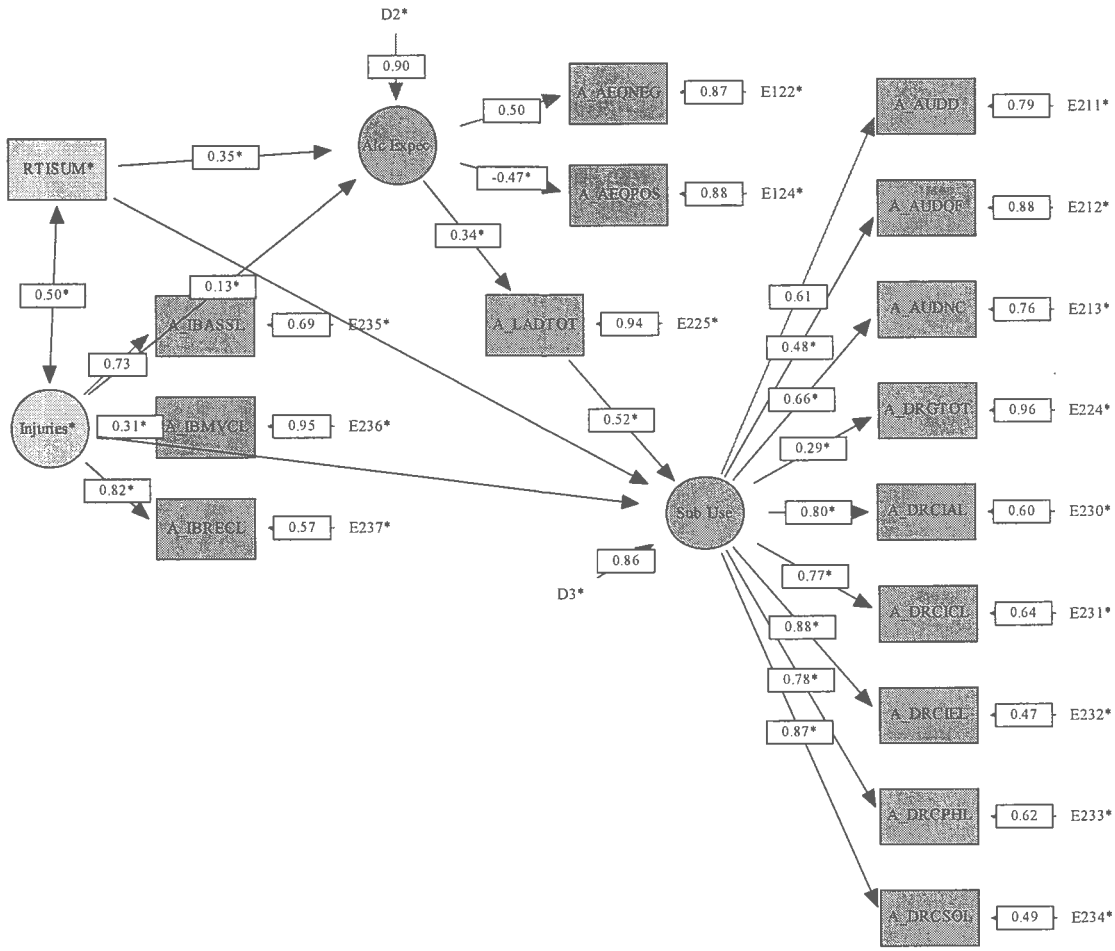


Figure 8 Original Direct Effects Model, χ^2 (df=103, N=200) = 321.17, p < .0001, CFI = .79, RMSEA = .12.

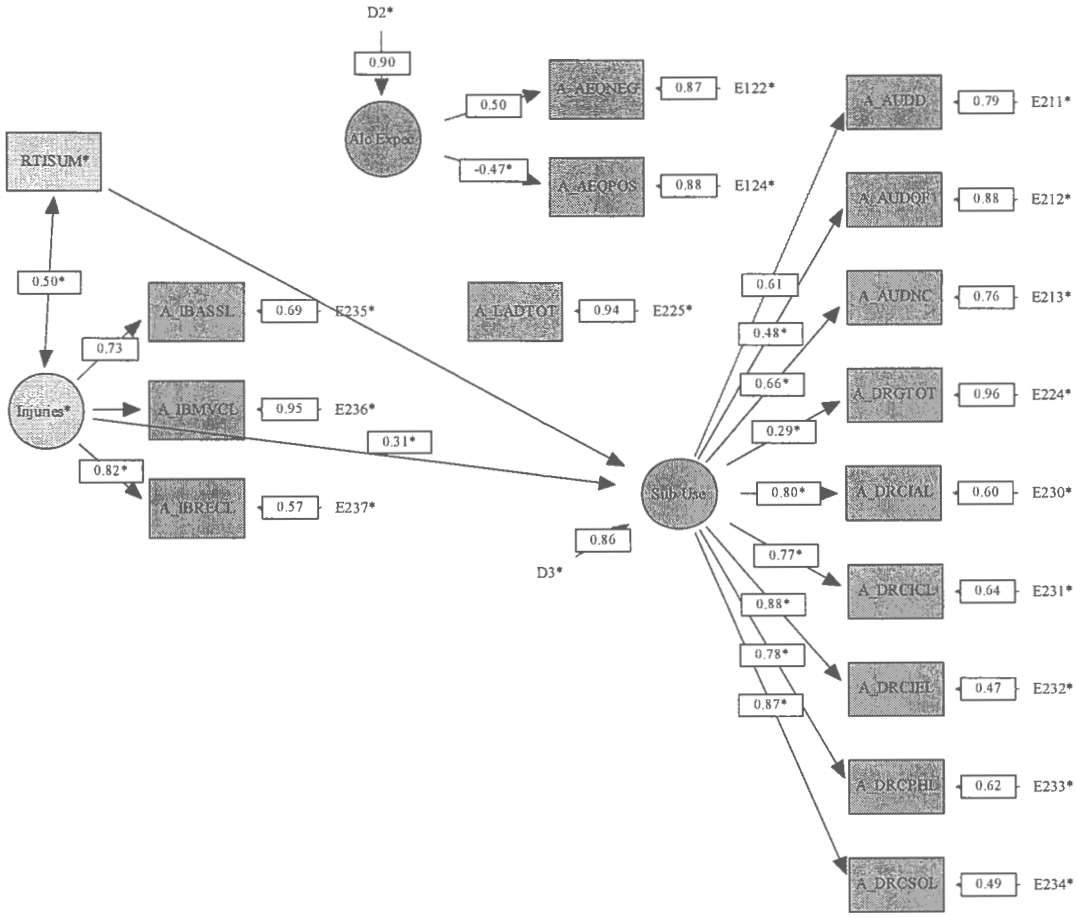


Figure 9 Revised Mediational Model with Alcohol Use as a Dependent Factor, χ^2 (df=71, N=200) = 161.86, p < .0001, CFI = .90, RMSEA = .09.

* p <.05
** p < .01
All factor loadings were significant.

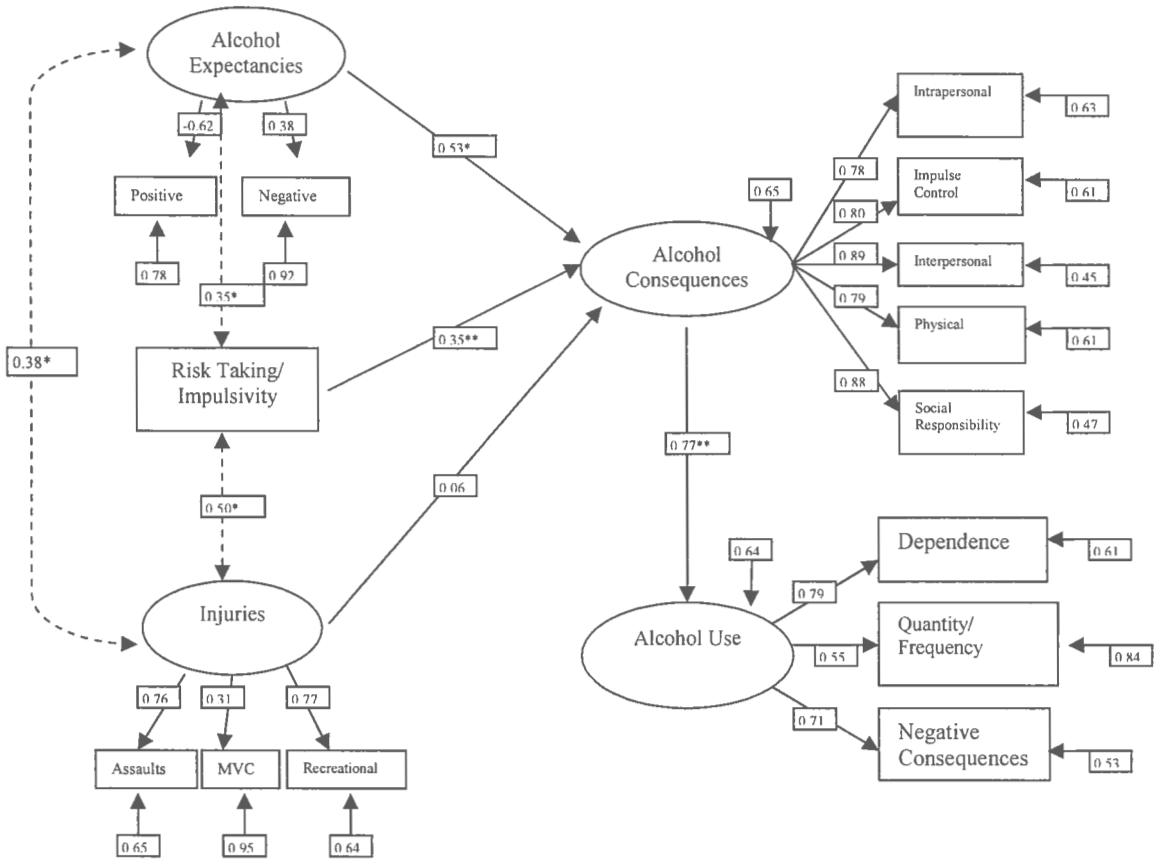


Figure 10 Revised Full Model, χ^2 (df=68, N=200) = 161.21, p < .0001, CFI = .91, RMSEA = .09.

* p <.05
** p < .01
All factor loadings were significant.

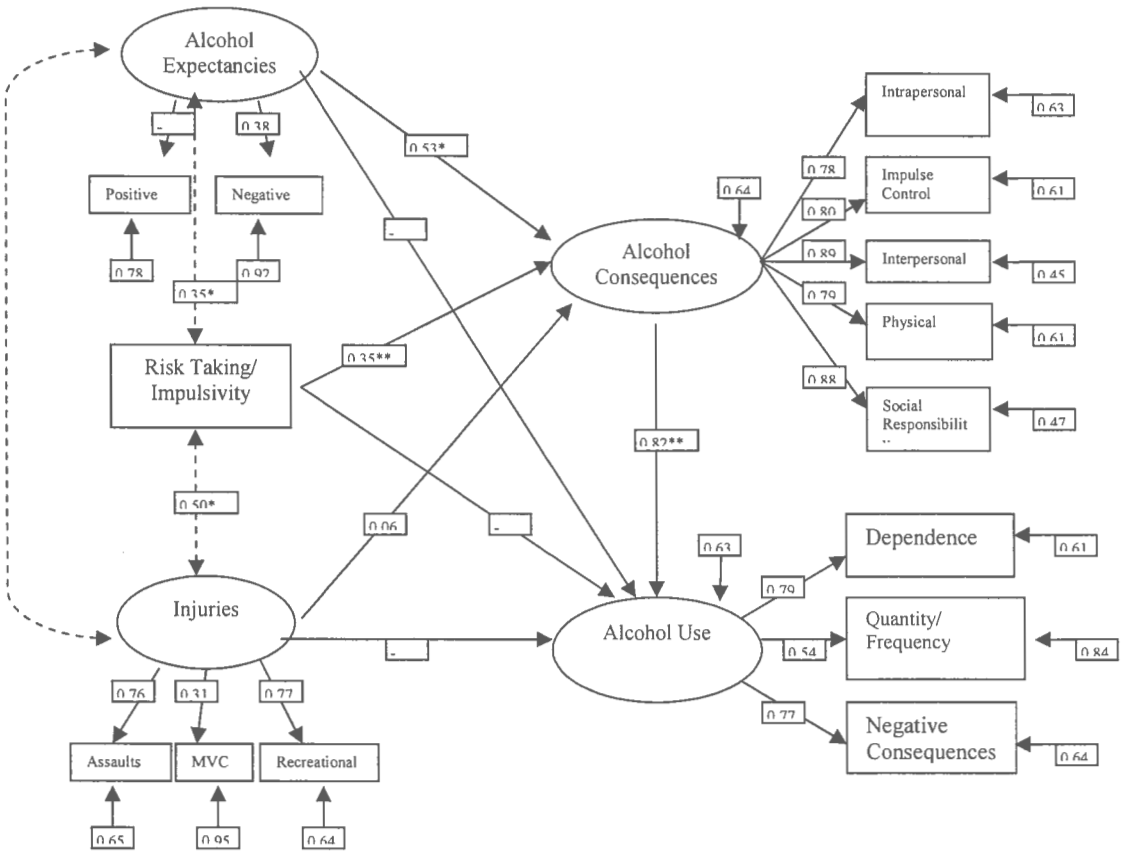


Figure 11 Revised Mediational Model with Alcohol Consequences as a Dependent Variable χ^2 (69, N=200) = 164.38, $p < 0.001$, CFI=0.91, and RMSEA=0.09.

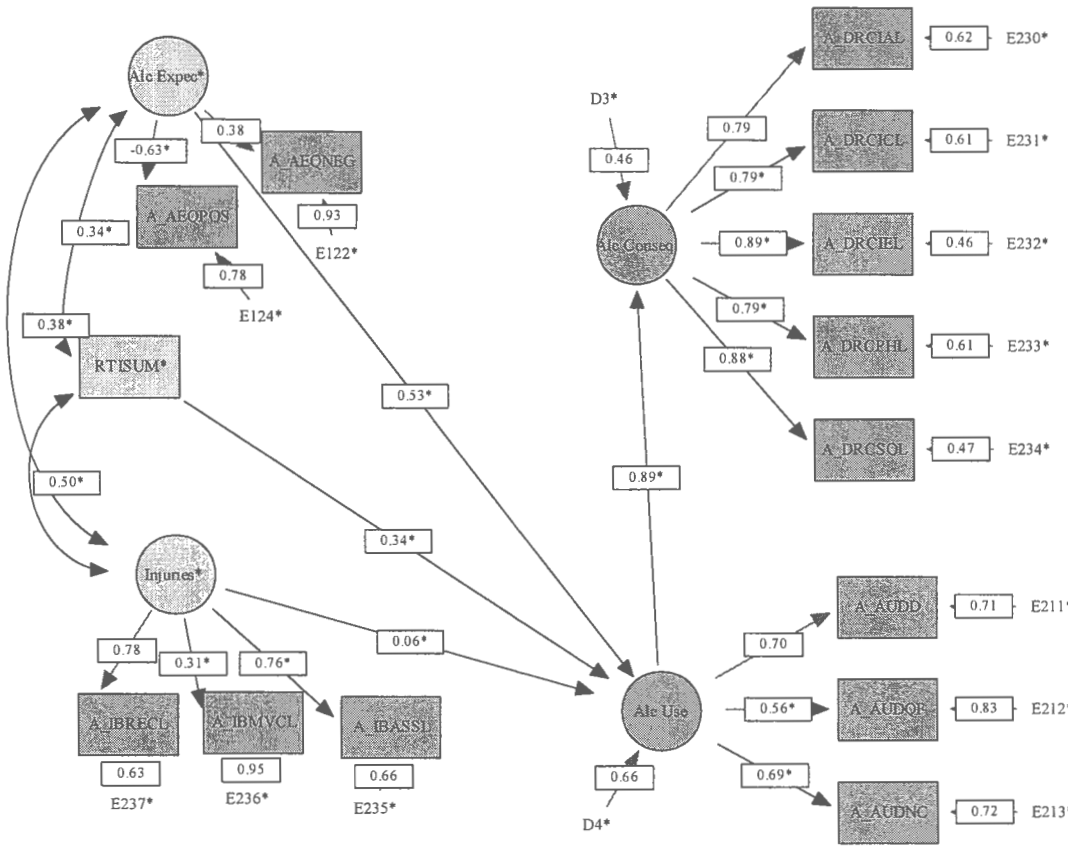


Figure 12 Final Mediational Model with Correlated Errors, χ^2 (70, N=200) = 161.40, p <0.001, CFI=0.91, and RMSEA=0.09

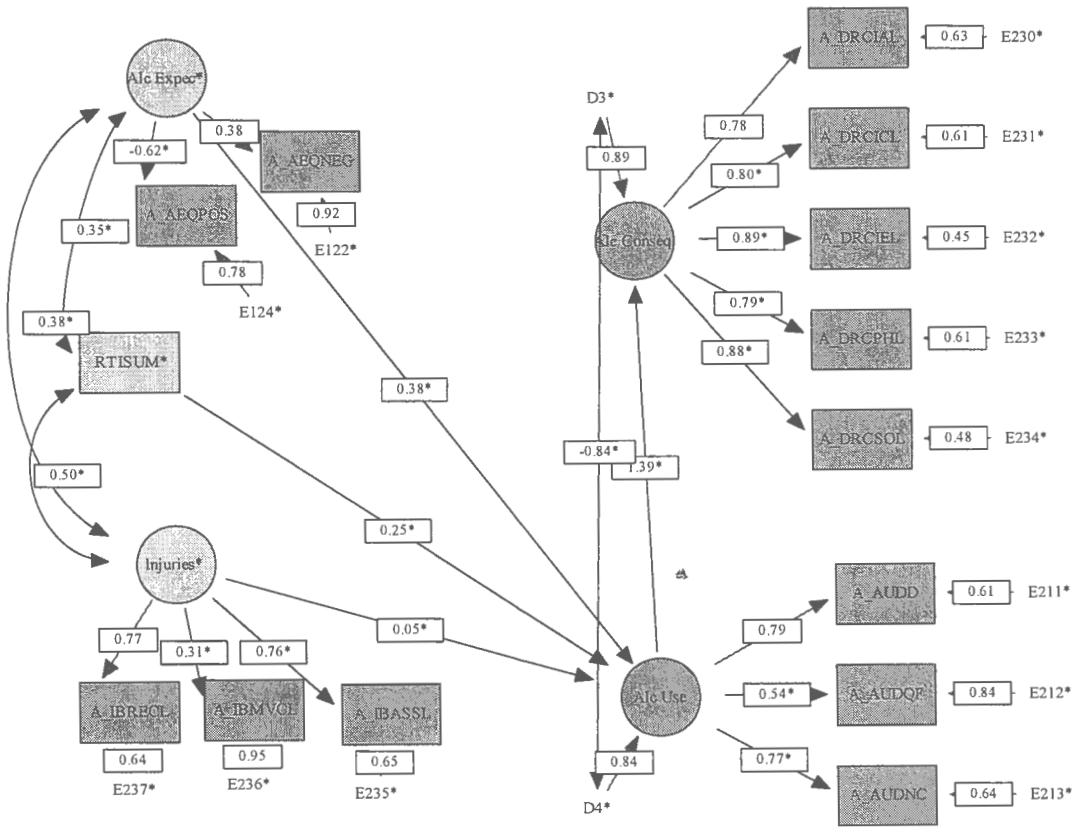


Figure 13 Final Full Model without correlated errors, χ^2 (69, N=200) = 164.38, p < 0.001, CFI=0.91, and RMSEA=0.09.

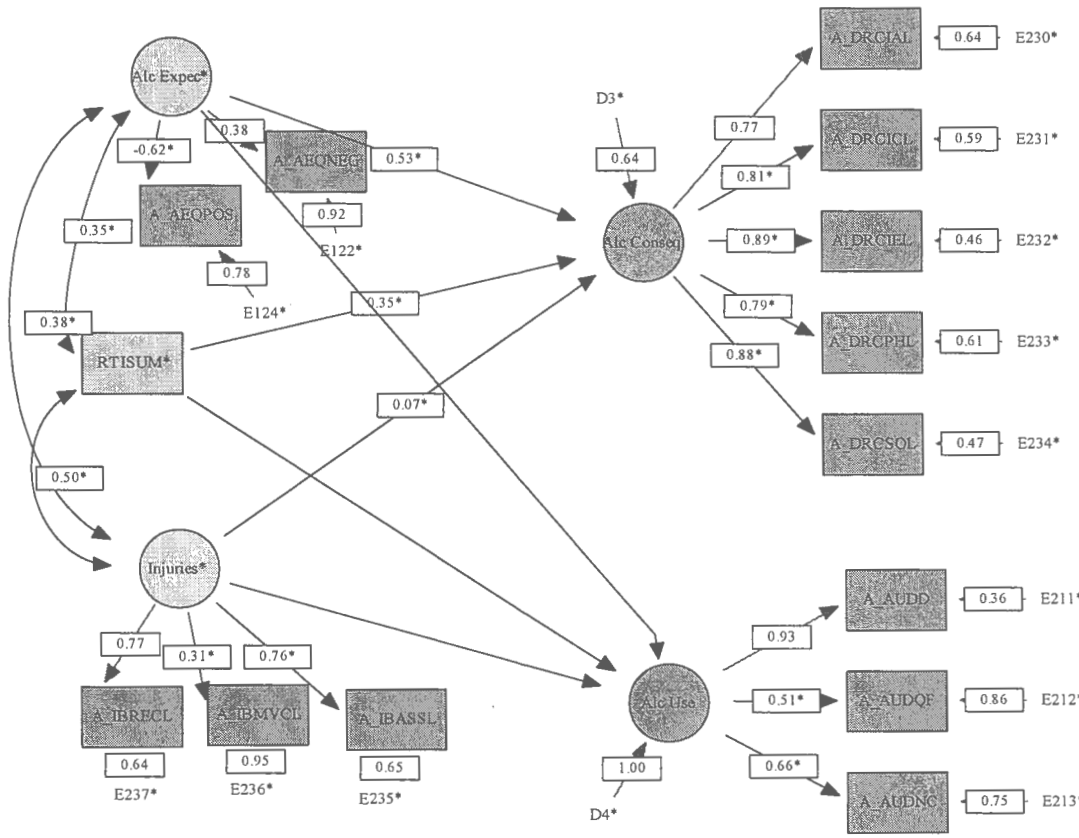
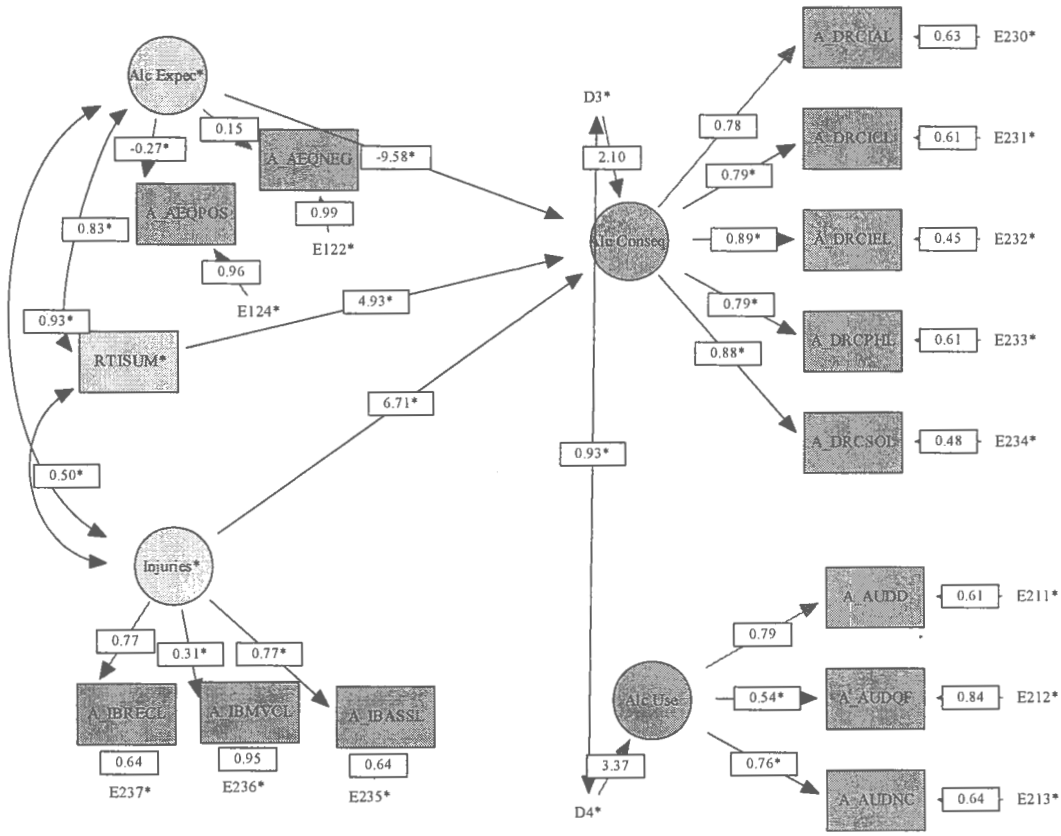


Figure 14 Final Direct Effects Model, χ^2 (71, N=200) = 191.54, p <0.001, CFI=0.88, and RMSEA=0.10



Appendix A

Risk Taking Impulsivity Scale

How well do the following statements describe you? Would you say that this describes you quite a lot, some, a little, or not at all?

	Quite a lot	Some	A little	Not at all
1. I often act one the spur-of-the-moment without stopping to think.				
2. I get a real kick out of doing things that are a little dangerous.				
3. You might say I act impulsively.				
4. I like to test myself every now and then by doing something a little chancey.				
5. Many of my actions seem to be hasty.				

Appendix B

Injury Behavior Checklist

Below is a list of ways people get hurt or injured. For each injury listed, please answer each of the three questions. Do not describe an injury more than once. For example, if you feel and cut yourself, describe the injury in either #2 (injured by cutting yourself) or #6 (injured by falling) but not both. To decide which question to answer, use the one that was the biggest cause of the injury.

PLEASE DO NOT COUNT THE CURRENT INJURY

	During the past 12 months, how many times were you injured this way? (if none write 0)	For how many of these injuries were you treated by a doctor?	For how many of these injuries had you been drinking alcohol within 2 hours of the injury?
1. Injured by being in a physical fight with someone?			
2. Injured by cutting yourself?			
3. Injured by a gun, BB gun, or pellet gun?			
4. Injured by being hit by something like a rock or glass?			
5. Injured by nearly drowning?			
6. Injured by falling?			
7. Injured by being burned by fire, chemicals, electricity, or hot liquid?			
8. Injured by an animal or serious insect bite?			

	During the past 12 months, how many times were you injured this way? (if none write 0)	For how many of these injuries were you treated by a doctor?	For how many of these injuries had you been drinking alcohol within 2 hours of the injury?
9. Injured while driving a car, truck, or bus?			
10. Injured while a passenger in a car, truck, or bus?			
11. Injured while riding on a bicycle, skateboard, or rollerblading?			
12. Injured whole riding a motorcycle, moped, snowmobile, or all-terrain vehicle (ATV?			
13. Injured by being hit by a moving vehicle while walking?			
14. Injured by being sexually assaulted?			
15. Injured by playing sports or exercising?			
16. Injured by other games or activities?			
17. Injured by being physically attacked?			
18. Injured in some other way? Please describe how.			

Appendix C

Alcohol Expectancy Questionnaire (AEQ)

Indicate the extent to which you agree or disagree with the following statements: Agree strongly, agree moderately, agree slightly, disagree slightly, disagree moderately, disagree strongly.

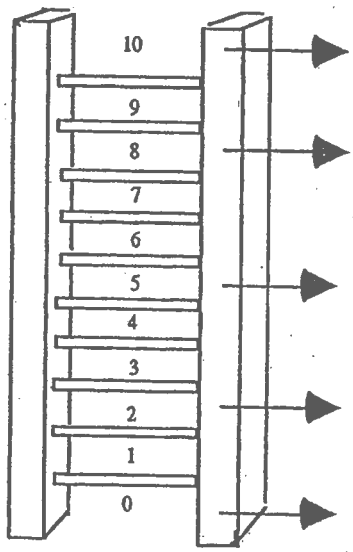
1. Drinking makes me feel warm and flushed.
2. Alcohol lowers muscle tension in my body.
3. A few drinks make me feel less shy.
4. Alcohol helps me to fall asleep more easily.
5. I feel powerful when I drink, as if I can really make other people do as I want.
6. I'm more clumsy after a few drinks.
7. I am more romantic when I drink.
8. Drinking makes the future seem brighter to me.
9. If I have had a couple of drinks, it is easier for me to tell someone off.
10. I can't act as quickly when I've been drinking.
11. Alcohol can act as an anesthetic for me, that is, it can stop pain.
12. I often feel sexier after I've had a few drinks.
13. Drinking makes me feel good.
14. Alcohol makes me careless about my actions.
15. Some alcohol has a pleasant, cleansing, tingly taste to me.
16. Drinking makes me more aggressive.
17. Alcohol seems like magic to me.
18. Alcohol makes it hard for me to concentrate.
19. I'm a better lover after a few drinks.
20. When I'm drinking, it is easier to open up and express my feelings.
21. Drinking adds a certain warmth and friendliness to social occasions for me.
22. If I'm feeling tied down or frustrated, a few drinks make me feel better.
23. I can't think as quickly after I drink.
24. Having a few drinks is a nice way for me to celebrate special occasions.
25. Alcohol makes me worry less.
26. Drinking makes me less efficient.
27. Drinking is pleasurable because it's enjoyable for me to join in with people who are enjoying themselves.
28. After a few drinks, I am more sexually responsive, that is, more in the mood for sex.
29. I feel more physically coordinated after I drink.
30. I'm more likely to say embarrassing things after drinking.
31. I enjoy having sex more if I've had some alcohol.
32. I'm more likely to get into an argument if I've had some alcohol.
33. Alcohol makes me less worried about doing things well.
34. Alcohol helps me sleep better.
35. Drinking gives me more confidence in myself.
36. Alcohol makes me more irresponsible.
37. After a few drinks it is easier for me to pick a fight.
38. A few drinks make it easier for me to talk to people.
39. If I have a couple of drinks, it is easier to express my feelings.
40. Alcohol makes me more interesting.

Appendix D

Decision Ladders

Decision Ladder 1

Each rung on this ladder represents where various people are in thinking abut changing their drinking. Circle the number that indicates where you are now.



Taking action to change (e.g., cutting down).

Starting to think about how to change my drinking patterns.

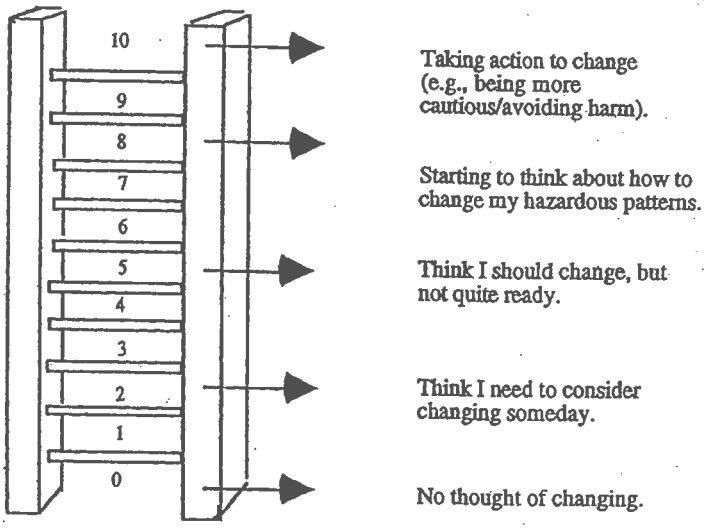
Think I should change, but not quite ready.

Think I need to consider changing someday.

No thought of changing.

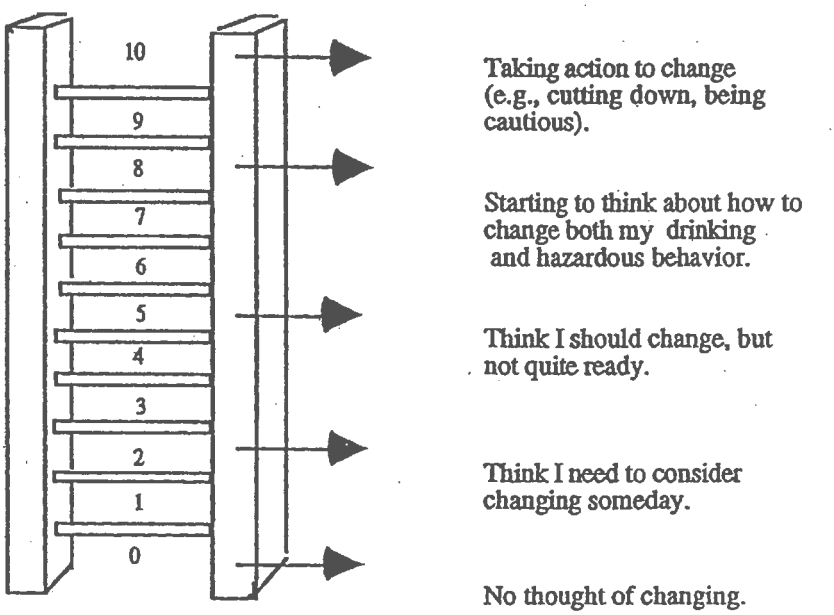
Decision Ladder 2

Each rung on this ladder represents where various people are in thinking abut changing their hazardous behavior. Circle the number that indicates where you are now.



Decision Ladder 3

Each rung on this ladder represents where various people are in thinking abut changing both their drinking and hazardous behavior. Circle the number that indicates where you are now.



Appendix E

Alcohol Use Disorders Identification Test (AUDIT)

Now I'm going to ask you some questions about your use of alcoholic beverages during the past 12 months. For the following questions, one STANDARD DRINK equals one can, glass, or bottle of beer, one shot of liquor or a mixed drink, or one glass of wine.

1. How often do you have a drink containing alcohol?
    0 Never
    1 Monthly or less
    2 2 to 4 times a month
    3 2 to 3 times a week
    4 4 or more times a week

2. How many drinks containing alcohol do you have on a typical day when you are drinking?
    0 None
    1 1 or 2
    2 3 or 4
    3 5 or 6
    4 7 or 9
    5 10 or more

3. How often do you have six or more drinks on one occasion?
    0 Never
    1 Less than monthly
    2 Monthly
    3 Weekly
    4 Daily or almost daily

4. (MEN) How often do you have five or more drinks on one occasion?
    0 Never
    1 Less than monthly
    2 Monthly
    3 Weekly
    4 Daily or almost daily

4. (WOMEN) How often do you have six or more drinks on one occasion?
    0 Never
    1 Less than monthly
    2 Monthly
    3 Weekly
    4 Daily or almost daily

5. How often during the past 12 months have you found that you were unable to stop drinking once you had started?
    0 Never
    1 Less than monthly
    2 Monthly
    3 Weekly
    4 Daily or almost daily

6. How often during the past 12 months have you failed to do what was normally expected from you because of drinking?
   0 Never
   1 Less than monthly
   2 Monthly
   3 Weekly
   4 Daily or almost daily

7. How often during the past 12 months have you needed a first drink in the morning to get yourself going after a heavy drinking session?
   0 Never
   1 Less than monthly
   2 Monthly
   3 Weekly
   4 Daily or almost daily

8. How often during the past 12 months have you had a feeling of guilt or remorse after drinking?
   0 Never
   1 Less than monthly
   2 Monthly
   3 Weekly
   4 Daily or almost daily

9. How often during the past 12 months have you been unable to remember what happened the night before because you had been drinking?
   0 Never
   1 Less than monthly
   2 Monthly
   3 Weekly
   4 Daily or almost daily

10. How often during the past 12 months have you or someone else been injured as the result of your drinking?
   0 Never
   4 Less than monthly
   4 Monthly
   4 Weekly
   4 Daily or almost daily

11. How often during the past 12 months has a relative, friend, or doctor or other health worker been concerned about your drinking or suggested you cut down?
   0 Never
   4 Less than monthly
   4 Monthly
   4 Weekly
   4 Daily or almost daily

Appendix F

Drinker Inventory of Consequences
Lifetime version

Instructions: Here are a number of events that drinkers sometimes experience. Read each one carefully, and circle the number that indicates whether this has EVER happened to you. If an item does not apply to you, circle zero (0).

During the past 12 months, about how often has this happened to you? Circle one answer:	No	Yes
1. I have had a hangover or felt bad after drinking.	0	1
2. I have felt bad about myself because of my drinking.	0	1
3. I have missed days of work or school because of my drinking.	0	1
4. My family or friends have worried or complained about my drinking.	0	1
5. The quality of my work has suffered because of my drinking.	0	1
6. My ability to be a good parent has been harmed by my drinking.	0	1
7. After drinking, I have had trouble with sleeping, staying asleep, or nightmares.	0	1
8. I have driven a motor vehicle after having three or more drinks.	0	1
9. My drinking has caused me to use other drugs more.	0	1
10. I have been sick and vomited after drinking.	0	1
11. I have been unhappy because of my drinking.	0	1
12. Because of my drinking, I have not eaten properly.	0	1
13. I have failed to do what is expected of me because of my drinking.	0	1

During the past 12 months, about how often has this happened to you? Circle one answer:	No	Yes
14. I have felt guilty or ashamed because of my drinking.	0	1
15. While drinking I have said or done embarrassing things.	0	1
16. When drinking my personality has changed for the worse.	0	1
17. I have taken foolish risks when I have been drinking.	0	1
18. I have gotten into trouble because of my drinking.	0	1
19. While drinking or using drugs, I have said harsh or cruel things to someone.	0	1
20. When drinking, I have done impulsive things that I regretted later.	0	1
21. I have gotten into a physical fight while drinking.	0	1
22. My physical health has been harmed by my drinking.	0	1
23. I have had money problems because of my drinking.	0	1
24. My marriage or love relationship has been harmed by my drinking.	0	1
25. I have smoked tobacco more when I am drinking.	0	1
26. My physical appearance has been harmed by my drinking.	0	1
27. My family has been hurt by my drinking.	0	1
28. A friendship or close relationship has been damaged by my drinking.	0	1
29. I have been overweight because of my drinking.	0	1
30. My sex life has suffered because of my drinking.	0	1

During the past 12 months, about how often has this happened to you? Circle one answer:	No	Yes
31. I have lost interest in activities and hobbies because of my drinking.	0	1
32. My spiritual or moral life has been harmed by my drinking.	0	1
33. Because of my drinking, I have not had the kind of life that I want.	0	1
34. My drinking has gotten in the way of my growth as a person.	0	1
35. My drinking has damaged my social life, popularity, or reputation.	0	1
36. I have spent too much or lost a lot of money because of my drinking.	0	1
37. I have been arrested for driving under the influence of alcohol.	0	1
38. I have had trouble with the law (other than driving while intoxicated) because of my drinking.	0	1
39. I have lost a marriage or a close love relationship because of my drinking.	0	1
40. I have been suspended/fired from or left a job or school because of my drinking.	0	1
41. I have lost of friend because of my drinking.	0	1
42. I have had an accident while drinking or intoxicated.	0	1
43. While drinking or intoxicated, I have been physically hurt, injured, or burned.	0	1
44. While drinking or intoxicated, I have injured someone else.	0	1
45. I have broken things while drinking or intoxicated.	0	1

Appendix G

Drug Use Questionnaire

Now I am going to ask you some questions about your use of drugs during the past 12 months. During the past 12 months:

1. About how often did you use cannabis (for example, hash, marijuana)?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

2. About how often did you use cocaine/crack?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

3. About how often did you use hallucinogens (for example, LSD, mescaline)?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

4. About how often did you use inhalants (such as glue, gasoline, paint, white out) to get high or to relax?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

5. About how often did you use amphetamines (for example, stimulants, speed) that were <u>not</u> prescribed for you by a doctor?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

6. About how often did you use barbiturates/other sedatives (for example, Xanax, Quaaludes, Valium, Librium Tranquilizers) that were not prescribed for you by a doctor?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

7. About how often did you use heroine/other opiates (for example, Codeine, Demeraol, Darvon, Morphine, Percodan) that were not prescribed for you by a doctor?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

8. About how often did you use steroids that were not prescribed for you by a doctor?
   4 None (not at all in the last 12 months)
   3 Less than once a month
   2 Monthly (once or more a month, but not weekly)
   1 Weekly (once or more a week, but not daily)
   0 Daily (once or more a day)

Bibliography

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Anderson, J. C., & Gerbing, D. W. (1988). Structural modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103(3),* 411-423

Bandura, A. (1977). *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Baron, R. M., & Kenny, K. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51(6),* 1173-1182.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107(2),* 238-246.

Bentler, P. M., & Wu, E. J. C. (2002). *EQS 6 for Windows User's Guide*. Encino, CA: Multivariate Software.

Bromiley, P., & Curley, S. P. (1992). Individual differences in risk taking. In J. F. Yates (Ed.), *Risk-Taking Behavior* (pp. 87-132). Chichester, England: John Wiley & Sons.

Brown, S. A., Goldman, M. S., Inn, A., & Anderson, L. R. (1980). Expectations of reinforcement from alcohol: Their domain and relation to drinking patterns. *Journal of Consulting and Clinical Psychology, 48(4),* 419-426.

Carboni, J. P., & DiClemente, C. C. (2000). Using transtheoretical model profiles to differentiate levels of alcohol abstinence success. *Journal of Consulting and Clinical Psychology, 68(5),* 810-817.

Cherpitel, C. J. (1995). Screening for alcohol problems in the emergency room: A rapid alcohol problems screen. *Drug and Alcohol Dependence, 40*, 133-137.

Christiansen, B. A., Goldman, M. S., & Inn, A. (1982). Development of alcohol-related expectancies in adolescents: Separating pharmacological from social-learning influences. *Journal of Consulting and Clinical Psychology, 50(3),* 336-344.

Christiansen, B. A., Smith, G. T., Roehling, P. V., & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology, 57(1)*, 93-99.

Collins, L. M., Graham, J. W., & Flaherty, B. P. (1998). An alternative framework for defining mediation. *Multivariate Behavior Research, 33(2),* 295-312.

Conigrave, K. M., Hall, W. D., & Saunders, J. B. (1995). The AUDIT questionnaire: Choosing a cut-off score. *Addiction, 90,* 1349-1356.

Cooper, M. L, Wood, P. K., Orcutt, H. K., Albino, A. (2003). Personality and the predisposition to engage in risky or problem behaviors during adolescence. *Journal of Personality and Social Psychology, 84(2)*, 390-410.

Dawe, S., & Loxton, N. J. (2004). The role of impulsivity in the development of substance use and eating disorders. *Neuroscience and Biobehavioral Reviews, 28*, 343-351.

Del Boca, F. K., & Brown, J. M. (1996). Issues in the development of reliable measures in addictions research: Introduction to Project MATCH assessment strategies. *Psychology of Addictive Behaviors, 10(2),* 67-74.

Dill, P. L., Wells-Parker, E., & Soderstrom, C. A. (2003). The emergency care setting for screening and intervention for alcohol use problems among injured and high-risk drivers: A review. *Traffic Injury Prevention, 5*, 278-291.

Fassinger, R. E. (1987). Use of structural equation modeling in counseling psychology research. *Journal of Counseling Psychology, 34(4),* 425-436.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior.* Reading, MA: Addison-Wesley.

Fromme, K., Stroot, E., & Kaplan, D. (1993). Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychological Assessment, 5(1)*, 19-26.

George, W. H., Frone, M. R., Cooper, M. L., Russell, M., Skinner, J. B., & Windle, M. (1995). A revised alcohol expectancy questionnaire: Factor structure confirmation and invariance in a general population sample. *Journal of Studies on Alcohol, 56,* 177-185.

Goldman, M. S., Del Boca, F. K., & Darkes, J. (1999). Alcohol expectancy theory: The application of cognitive neuroscience. In K. E. Leonard & H. T. Blane (Eds.), *Psychological Theories of Drinking and Alcoholism* (pp.106-163). New York: Gilford Press.

Goldman, M. S., & Darkes, J. (2004). Alcohol expectancy multiaxial assessment: A memory network-based approach. *Psychological Assessment, 16(1)*, 4-15.

Goldman, M. S., Greenbaum, P. E., & Darkes, J. (1997). A confirmatory test of hierarchical expectancy structure and predictive power: Discriminant

validation of the alcohol expectancy questionnaire. *Psychological Assessment, 9(2)*, 145-157.

Grusec, J. E. (1992). Social learning theory and developmental psychology: The legacies of Robert Sears and Albert Bandura. *Developmental Psychology, 28(5)*, 776-786.

Harlow, L. L. (2005). *Essence of multivariate thinking*. Mahwah, NJ: Lawrence Erlbaum Associates.

Jackson, D. N. (1976). *Jackson Personality Inventory manual*. Port Huron, MI: Research Psychologists Press.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39,* 31-36.

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling*. New York: Guildford Press.

Leigh, B. C. (1989). Confirmatory factor analysis of alcohol expectancy scales. *Journal of Studies on Alcohol, 50(3),* 268-277.

Leigh, B. C. & Stacy, A. W. (1993). Alcohol outcome expectancies: Scale construction and predictive utility in higher order confirmatory models. *Psychological Assessment, 5(2)*, 216-229.

Longabaugh, R., Woolard, R. F., Nirenberg, T. D., Minugh, A. P., Becker, B., Clifford, P. R., Carty, K., Sparadeo, F., & Gogineni, A. (2001). Evaluating the effects of a brief motivational intervention for injured drinkers in the emergency department. *Journal of Studies on Alcohol, 62,* 806-816.

Maisto, S. A., Carey, K. B., & Bradizza, C. M. (1999). Social learning theory. In K. E. Leonard & H. T. Blane (Eds.), *Psychological Theories of Drinking and Alcoholism* (pp.106-163). New York: Gilford Press.

Maisto, S. A., Carey, M. P., Gordon, C. M., & Gleason, J. R. (2000). Use of the AUDIT and the DAST-10 to identify alcohol and drug use disorders among adults with a server and persistent mental illness. *Psychological Assessment, 12(2),* 186-192.

Matano, R. A., Koopman, C., Wanat, S. F., Whitsell, S. D., Borggrefe, A., Westrup, D. (2003). Assessment of binge drinking of alcohol in highly educated employees. *Addictive Behaviors, 28,* 1299-1310.

Miller, W., Tonigan, J., & Longabaugh, R. (1995). *The Drinker Inventory of Consequences (DrInC): An instrument for assessing adverse consequences of alcohol abuse. Test manual* (Vol. 4 Project MATCH Monograph Series). Rockville, MD: National Institute on Alcohol Abuse and Alcoholism.

Miller, W. R., Zweben, A., DiClemente, C. C., & Rychtarik. (1992). *Motivational Enhancement Therapy Manual: A Clinical Research Guide for Therapists Treating Individuals with Alcohol Abuse and Dependence.* (Vol. 2 Project MATCH Monograph Series. Washington: Government Printing Office.

Morrison, D. M., Golder, S., Keller, T. E., & Gillmore, M. R. (2002). The theory of reasoned action as a model of marijuana use: Tests of implicit assumptions and applicability to high-risk young women. *Psychology of Addictive Behaviors, 16(3),* 212-224.

National Highway Traffic Safety Administration (NHTSA). (2002). *Traffic Safety Facts 2001 – A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System, Report No. DOT HS 809 484*, NHTSA, U.S. Department of Transportation, Washington, D.C.

Noar, S. M. (2003). The role of structural equation modeling in scale development. *Structural Equation Modeling, 10(4),* 622-647.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47(9)*, 1102-1114.

Prochaska, J. O., Velicer, W. F., Rossi, J. S., Goldstein, M. G., Marcus, B. H., Rakowski, W., Fiore, C., Harlow, L. L., Redding, C. A., Rosenbloom, D., & Rossi, S. R. (1994). Stages of change and decisional balance for 12 problem behaviors. *Health Psychology, 13(1)*, 39-46.

Ramsey, S. E, Gogineni, A., Nirenberg, T. D., Sparadeo, F., Longabaugh, R., Woolard, R., Becker, B. M., Clifford, P. R., & Minugh, P. A. (2000). Alcohol expectancies as a mediator of the relationship between injury and readiness to change drinking behavior. *Psychology of Addictive Behaviors, 14(2)*, 185-191.

Rohsenow, D. J. (1983). Drinking habits and expectancies about alcohol's effects for self versus others. *Journal of Consulting and Clinical Psychology, 51,* 752-756.

Saunders, J. B., Aasland, O. G., Amundsen, A., & Grant, M. (1993). Alcohol consumption and related problems among primary health care patients: WHO

collaborative project on early detection of persons with harmful alcohol consumption – I. *Addiction, 88,* 349-362.

Saunders, J. B., Aasland, O. G., Barbor, T. F., De la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption – II. *Addiction, 88,* 791-804.

Sher, K. J., Wood, M. D., Wood, P. K., & Raskin, G. (1996). Alcohol outcome expectancies and alcohol use: A latent variable cross-lagged panel study. *Journal of Abnormal Psychology, 105(4)*, 561-574.

Stacy, A. W., Widaman, K., & Marlatt, G. A. (1990). Expectancy models of alcohol use. *Journal of Personality and Social Psychology, 58(5),* 918-928.

Starfield, B. (1991). *Injury Behavior Checklist (adapted version)*. Unpublished subscale. Adolescent health status instrument, Baltimore, MD: Johns Hopkins University.

Steiger, J. H., & Lind, J. M. (1980, June). *Statistically based tests for the number of common factors*. Paper presented at the annual meeting of the Psychometric Society, Iowa City, IA.

Tabachnick, D. G., & Fidell, L. S. (2001). *Using Multivariate Statistics* (4th ed). New York: Harper Collins.

Vallerand, R. J., Deschaies, P., Cuerrier, J.-P., Pelletier, L. G., & Mongeau, C. (1992). Ajzen and Fishbein's theory of reasoned action as applied to moral behavior: A confirmatory analysis. *Journal of Personality and Social Psychology, 62(1)*, 98-109.

Velicer, W. F., & Fava, J. L. (1998). Effects of variable and subject sampling on factor pattern recovery. *Psychological Methods, 3(2),* 231-251.

Vik, P. W., Carrello, P. D., & Nathan, P. E. (1999). Hypothesized simple factor structure for alcohol expectancy questionnaire: Confirmatory factor analysis. *Experimental and Clinical Psychopharmacology, 7(3),* 294-303.

Volk, R. J., Steinbauer, J. R., Cantor, S. B., & Holzer, C. E. III. (1997). The Alcohol Use Disorders Identification Test (AUDIT) as a screen for at-risk drinking in primary care patients of different racial/ethnic backgrounds. *Addiction, 92(2),* 197-206.

Welte, J. W., Perry, P., Longabaugh, R., & Clifford, P. R. (1998). An outcome evaluation of a hospital-based early intervention program. *Addiction, 93(4),* 573-581.

Zuckerman, M., & Kulhman, D. M. (2000). Personality and risk-taking: Common biosocial factors. *Journal of Personality, 68(6),* 999-1029.