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Megan Risi
University of Rhode Island, megan.m.risi@gmail.com

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RISK TAKING AS AN OUTCOME OF AN ALCOHOL HARM REDUCTION TRIAL

By

MEGAN M. RISI

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

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MEGAN RISI

APPROVED:

Thesis Committee:

Major Professor: Robert G. Laforge

Nicole H. Weiss

Natallia Katenka

Nasser H. Zawia

DEAN OF THE GRADUATE SCHOOL

UNIVERSITY OF RHODE ISLAND

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Abstract

Alcohol related risk taking behaviors are often assessed within measures of alcohol related problems and consequences. Although some research has found evidence that brief intervention on certain risk taking behaviors is effective, the larger scope of risk taking behaviors is often ignored. The present study aims to fill the gap of risk taking measures by (a) identifying a subscale from a scale assessing alcohol-related risk and consequences that captures risk taking behavior outside of alcohol consumption, (b) confirming that this risk taking scale holds across samples and (c) that the risk taking measure will show change over time, and (d) evaluating whether the risk taking scale is moderated by a brief intervention treatment. Results indicated that there a risk taking scale could be identified over a larger scale of risks and consequences. Confirmatory factor analysis confirmed the factor structure of the scale. And finally, growth curve modeling provided evidence for measuring risk taking over time. In the current study, no effect of treatment was found on risk taking, though due to study design, this was not unexpected.

Acknowledgement

I would like to thank my major professor Dr. Robert G. Laforge for all of his help in the development of this Master's thesis. I would also like to thank my committee members, Dr. Nicole H. Weiss and Dr. Natallia Katenka, for their continued support through this process.

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Chapter 1

Introduction

Brief intervention techniques for alcohol use have been studied extensively for nearly four decades and are considered to be effective in identifying and helping to reduce problematic drinking behaviors in nondependent adults (O'Donnell et al., 2013). Most brief intervention studies focus on outcomes related to alcohol consumption such as number of drinks per week, number of drinks per occasion, and heavy episodic (binge) drinking (Aseltine, Katz, & Geragosian, 2010; Blow et al., 2009; Curry, Ludman, Grothaus, Donovan, & Kim, 2003; Saitz, Svikis, D'Onofrio, Kraemer, & Pearl, 2006; Trinks, Festin, Bendtsen, & Nilsen, 2010). Other studies have looked at negative consequences related to alcohol as an outcome (D'Onofrio et al., 2008; Schermer, Moyers, Miller, & Bloomfield, 2006; Smith, Hodgeson, Bridgeman, & Shepard, 2003; Suffoletto et al., 2012) with minimal mention of risk taking behaviors other than those defined by consumption. When other risk taking behaviors are addressed in these studies, the focus is often on specific behaviors such as sexual risk taking (Suffoletto et al., 2012) and driving under the influence (Schermer et al., 2006; Sommers et al., 2013). However, many studies focus more on the consequences of drinking (e.g., injury, sexually transmitted infections, automobile accidents, arrests) than the risk taking behaviors themselves (Gentilello et al., 1999; Monti et al., 1999; Schermer et al., 2006).

A number of studies have investigated the use of brief intervention in emergency departments in an effort to zero in on risk taking behaviors (Blow et al., 2006; Blow et al., 2011; Cunningham et al, 2015; Houry, Hankin, Daugherty, Smith, & Kaslow, 2011; Longabaugh et al., 2001; Mello, Longabagh, Baird, Nirenberg, & Woolard, 2008;

Sommers et al, 2013). Sommers and colleagues (2013) found that delivering brief interventions for more than one risky behavior in an emergency department significantly reduced risky driving for 9 months and hazardous drinking for 6 months (Sommers et al., 2013). Although these studies often have significant findings for the efficacy of brief interventions, these results are moderated by the attribution of the injury to alcohol by the patient (Walton et al., 2008).

Risk taking behaviors are goal-directed and may result in more than one outcome, one of which is often undesirable and/or dangerous (Furby & Beyth-Maron, 1992). Although alcohol consumption is considered a risky behavior, several other risky behaviors are often assessed with alcohol consumption. Some risky behaviors associated with alcohol-related consequences include driving while intoxicated (Morris, Treloar, Niculete, & McCarthy, 2014; Sommers et al., 2013), drinking until blacking out (White, 2003), eating poorly (Barry & Piazza, 2012; Ferriter & Ray, 2011; Scott et al., 2018), using violence or aggression (Franzen, Sadikaj, & Moskowitz, 2018; Massa, Subramani, Eckhardt, & Parrott, 2018), engaging in risky sexual behaviors (Carey, et al, 2018), or taking other risks that may lead to injury (Afshar, Netzer, Salisbury-Afshar, Murthi, & Smith, 2016).

Understanding why and how people engage in risky behaviors surrounding alcohol use and misuse has been a focus of much research over the years. Risk taking behaviors are often attributed to impulsivity, which is a potential underlying mechanism influencing altered decision making (Krause et al., 2017) and the development of substance use disorders (Jupp & Dalley, 2014; Littlefield & Sher, 2010). Alcohol myopia theory (Steele & Josephs, 1990), which posits that short-sighted information processing

that is part of alcohol intoxication, has been widely attributed to risk taking behaviors (Franzen, et al., 2018; Massa et al., 2018; Norris, Davis, George, Martell, & Heiman, 2002). According to alcohol myopia theory, the pharmacological effects of alcohol taxes a person's cognitive resources, narrowing one's limited attention onto the most salient cues in the environment, with more peripheral information being largely ignored (Steele & Josephs, 1990). In this model, risk taking behavior is more likely to occur when risk taking cues are present (e.g., aggression in the context of domestic conflict).

Another possibility as to why people engage in risky behaviors when consuming alcohol is more motivational than cognitive. Tyszka, Macko, and Stańczak (2015) examined ambiguity aversion in an effort to understand why people become more risk prone when they consume alcohol. Ambiguity aversion refers to the preference for situations with known risks over situations with unknown risks. The researchers found that along with becoming less risk averse, people under the influence of alcohol would become less ambiguity averse. Tyszka and colleagues also attribute these results to socially and culturally valued patterns of conduct. Moderate risk is often valued in Western culture and people will shift toward risky decisions to gain approval from peers (Tyszka et al., 2015). Despite the fact that alcohol-related risk taking behaviors are of great interest to researchers, these behaviors are often assessed with measures including alcohol-related consequences, which confounds a cause (i.e., alcohol-related risk taking behaviors) with an effect (i.e., alcohol-related consequences; Miller, Tonigan, & Longabaugh, 1995; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993; White & Labouvie, 1989). Differentiating risk taking behaviors from consequences and alcohol consumption may allow for more nuanced analyses of alcohol harm interventions.

Risk taking behaviors are often targeted because of the public health problems that they pose (e.g., drinking and driving; sexual risk taking; aggression). When brief intervention studies target risk taking behaviors, they are often recruited from emergency departments where potential participants are experiencing problems and consequences related to risky drinking (Blow et al., 2006; Blow et al., 2011; Cunningham et al., 2010; Mello et al., 2008; Nilsen et al., 2008; Sommers et al., 2013; Suffoletto et al., 2012). Since the goal of brief interventions is often to target risky drinking behaviors in an effort to prevent alcohol use disorders (Zoorob, Snell, Kihlberg, & Senturias, 2014), it stands to reason that identifying and intervening on general risk taking behaviors prior to consequences could benefit public health.

No study to date uses a broad risk taking measure for alcohol use. The present study aims to fill the gap of risk taking measures by (a) identifying a subscale from a scale assessing alcohol-related risk and consequences that captures risk taking behavior outside of alcohol consumption, (b) confirming that this risk taking scale holds across samples and (c) that the risk taking measure will show change over time, and (d) evaluating whether the risk taking scale is moderated by a brief intervention treatment.

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Chapter 2

Methodology

2.1 PARR Study

Secondary data analyses were performed using data from the Population Alcohol Risk Reduction Trial (PARR; Laforge, 2003). PARR is a randomized trial of the efficacy of a computer-based brief individually tailored motivational feedback intervention designed to minimize harm related to alcohol-related risk taking behavior. Participants (N = 1329) were non-dependent at-risk adult drinkers recruited from a Manage Care Organization. They were randomly assigned to an experimental treatment (n = 430), an assessment matched control condition (n = 438), or a minimally assessed condition (n = 461) using urn randomization to ensure baseline group equivalence on prognostic indicators, including gender and high-risk drinking behaviors and alcohol related problems (Laforge et al., 2003; Stout et al., 1994).

Participants were proactively recruited from the membership of a Managed Care Organization and data were collected by telephone survey on up to six occasions over a two-year period: baseline, 3-, 6-, 12-, 18- and 24-months post-baseline. The treatment group received brief tailored multidimensional motivational feedback reports following the baseline, 3- and 6-month assessments. As part of a larger battery, information was collected on demographics (baseline only), and repeated measures of drinking behaviors and related cognitive measures, such as situational temptations to drink, reactance to alcohol harm reduction messaging, stage of readiness to change high risk drinking, decisional balance, several measures of processes of change (e.g., consciousness raising,

dramatic relief, counter-conditioning, stimulus control), measures of health care utilization (e.g., “During the last 12 months, how many times have you been to a hospital emergency room about your own health””), and 25 items that assess alcohol related risk taking and negative or harmful consequences, including the 15-item short inventory of problems (SIP-2R; Miller, Tonigan, & Longabaugh, 1995).

2.2 Present Study Design

The proposed study was conducted in three phases. Phase I involved the development of a psychometrically sound measure of alcohol-related risk taking behavior, other than alcohol consumption, from available measures in the PARR data set. Baseline data from participants randomized into the minimally assessed group (n = 461) was used for this analysis. Phase II involved the confirmation of an alcohol-related risk taking measure using confirmatory factor analysis (CFA) to develop a risk taking variable to be used in Phase III. A random split half sample (n = 430) of the combined treatment and control group was used for CFA analysis. Phase III evaluated the efficacy of the brief individualized feedback intervention on change in alcohol-related risk taking behavior. Phase III analyses uses mixed model regression to examine whether longitudinal change in risk taking is moderated by exposure to the intervention. Then, each time point for the remaining random split half sample (n = 438) was used for Phase III analyses. See Figure 1 for flow chart of sample.

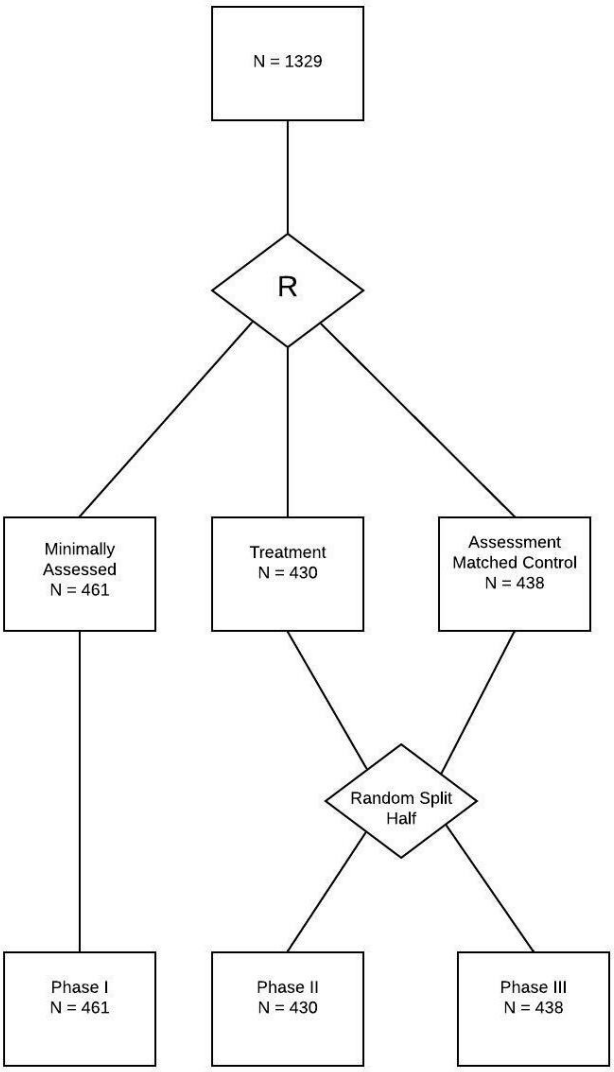

Figure 1. Flow chart of sample by Phase

2.3 Participants

The sample was middle aged (M = 42.73, SD = 12.67), predominantly white (89.3%), and evenly split among gender (49.2% male, 50.8% female). Further breakdown of race/ethnicity is as follows: 3.27% Black or African American, 1.28% Asian or Pacific Islander, 0.58% American Indian or Alaskan Native, and 5.60% other or not listed. All

participants were covered by health insurance and most were employed (85.3%). See Table 1 for demographics

Table 1: Demographics of Sample

	PARR Study (N=1329)	PARR min (n=461)	Phase II (n=430)	Phase III (n=438)
Age	42.79 (12.68)	42.91(12.71)	43.33(13.14)	42.14(12.18)
Female	50.8%	52.1%	51.6%	48.6%
Marital Status:				
Married	62.6%	63.7%	60.0%	64.1%
Not Married	22.1%	20.8%	23.8%	21.9%
Not married but living together	8.1%	8.1%	7.5%	8.8%
Widowed	1.6%	1.8%	2.1%	0.9%
Divorced	5.5%	5.7%	6.5%	4.4%
Race/Ethnicity				
American Indian or Alaskan Native	0.6%	0.7%	0.9%	0.2%
Asian or Pacific Islander	1.2%	1.1%	1.4%	1.2%
Black or African American	3.7%	4.6%	3.3%	3.2%
White	89.3%	89.2%	89.9%	88.7%
Other	5.2%	4.4%	4.5%	6.7%
Non-Hispanic	95.9%	95.8%	96.5%	95.4%
Hispanic	4.1%	4.2%	3.5%	4.6%
Highest grade of school completed				
Less than high school	0.7%	1.1%	0.2%	0.7%
12 years (high school diploma or GED)	14.5%	15.8%	13.6%	14.3%
College (more than 13-16 years)	47.3%	45.5%	47.2%	49.4%
Graduate School	37.4%	37.6%	39.0%	35.6%
Employment status				
Employed full time	74.4%	72.2%	75.1%	76.1%
Employed part time	10.9%	12.2%	10.5%	9.9%
Unemployed	2.3%	2.0%	1.9%	3.2%
Homemaker	3.9%	5.0%	3.7%	3.0%
Retired	4.6%	4.6%	5.4%	3.9%
Other	3.9%	3.7%	3.5%	3.9%

Note. PARR min = minimally assessed group used in Phase I only.

2.4 Measures used in all phases

Construct Validity Measures Additional measures included in the larger study were evaluated as part of validity efforts. These included smoking, the four dropped items from the original 25-item alcohol-related risk and consequences scale (e.g., "I have had an accident while drinking or intoxicated;" "While drinking I have gotten into sexual situations that I later regretted") as well as questions about drinking behaviors (i.e., "Over the past three months, how many drinks containing alcohol did you have on a typical day when you are drinking?;" "During the past 30 days, what is the highest number of drinks that you had on any one occasion?" "How often during the last year have you found that you were not able to stop drinking once you had started?"), frequency of binge drinking in the past month (five or more drinks in a row for men, four or more drinks in a row for women) and history of drinking (i.e., age of first drink, age first got drunk).

2.5 Analyses used in all phases

Construct validity Construct validity of the risk taking measure was evaluated in each of the participant samples studied in the three phases of this thesis by examining the statistical association of the risk taking summary score in each sample with other measures of risk taking behavior. Convergent validity was determined by comparing the risk-taking measure to risky behaviors such as smoking, binge drinking frequency, and exceeding NIAAA recommended drinks per week. Discriminant validity was completed by comparing the risk-taking measure with low risk behaviors such as low risk drinking and low volume drinking. Convergent validity was evaluated using Pearson's correlation

for continuous items. Point biserial, a special case of Pearson's correlation, was used for dichotomous variables (i.e., "I have had an accident while drinking or intoxicated;" "While drinking, I have gotten into sexual situations I later regretted").

Chapter 3

Phase I: Development of a Risk taking Measure

3.1 Description

Phase I of the study sought to develop a psychometrically sound measure of alcohol-related risk taking behavior from a measure of alcohol-related problems. Many scales evaluating consequences of alcohol use include measures of alcohol-related risk taking behaviors as indicators of alcohol related adverse consequences. The goal of Phase I was to explore the factor structure of the measure of alcohol-related problems used in the PARR study to identify whether alcohol related risk taking variables load on a single factor, distinct from other the other variables that assess other dimensions of alcohol related adverse consequences.

3.2 Methodology

3.2.1 Phase I Participants

Phase I of the study consisted of a subset of the larger PARR study who were randomized into a minimally assessed group and completed baseline only. The minimally assessed group comprised of 461 participants with an average age of 42.91 (*SD* = 12.71). The sample was 52.1% female, 89.2% White, and 73.5% employed at least part time.

3.2.2 Phase I Measures

Alcohol-Related Risk and Consequence Measure The PARR study repeatedly assessed 25 items adapted from several alcohol consequences scales that assess different dimensions of alcohol related risk taking and adverse consequences and are commonly

mentioned in alcohol literature on adult drinking (Allen & Columbus, 1997; Miller, 1996). The first 15 items of the PARR alcohol risks and consequences measure comes from a revised version of the short inventory of problems (SIP-R2). A subset of the longer 50-item Drinking Inventory of Consequences (DrInC), the SIP-R2 is a self-report measure of recent alcohol-related consequences that measures five domains of problems non-dependent alcohol drinkers might have experienced in the recent past: physical, inter-personal, intra-personal, impulse control, and social responsibility (Miller et al., 1995). The SIP-2R takes three items from each of the established five-factors of the DrInC, forming a shorter inventory of alcohol related problems while, theoretically, maintaining the relationship between the observed and unobserved variables. Participants are asked to indicate how often each of the listed items has occurred in the past three months ("never," "once or a few times," "once or twice a week," "daily or almost daily"; scored 0-3). Ten additional items of risk taking and consequences using the same response format was used to complete the 25-item measure.

The following four items from the consequences scale were found to have non-normally distributed (dichotomous) responses and were dropped from the model:

I have had money problems because of my drinking;

I have had an accident while drinking or intoxicated;

I have been stopped or arrested for driving under the influence;

While drinking, I have gotten into sexual situations that I later regretted.

3.2.3 Phase I Data Analytic Strategy

Phase I of the study used exploratory factor analysis (EFA) to define the factor structure of the 25 alcohol-related risk and consequences measure. Four of the items were dropped from the analyses due to dichotomous responses resulting in the analysis of 21 alcohol-related risk and consequences measure. Factor analysis was justified using Bartlett's test of sphericity and the Kaiser-Meyer-Oklin (KMO) measure of sampling adequacy (Bartlett, 1950; Kaiser, 1970). The Bartlett's Test of Sphericity should be significant ($p < .05$) and the KMO index, which ranges from 0 to 1, should be at least 0.50 considered suitable for factor analysis (Field, 2009).

One of the most important decisions to consider when conducting an EFA is the number of factors to retain (Farbrigar, Wegener, MacCallum, & Strahan, 1999; Hayton, Allen, & Scarpello, 2004). Due to the importance of the decision concerning the correct number of factors to retain, many researchers have compared different rules and methods (e.g., Steger, 2006). Parallel analysis has been indicated by many studies as a consistently accurate model of factor extraction (Henson & Roberts, 2006; Thompson & Daniel, 1996; Thompson, 2004). Parallel analysis is a Monte Carlo method comparing observed eigenvalues extracted from the correlation matrix to be analyzed with those obtained from uncorrelated normal variables (Horn, 1965). For the present study, the number of factors to retain was based on parallel analysis, a visual examination of the scree plot, and considerations regarding the meaning and interpretability of the factor model.

Principal axis factoring (PAF), an extraction method that has no distributional assumptions (Fabrigar, et al., 1999), was conducted to define underlying latent factors for the alcohol-related risk and consequences measure. PAF is less likely to inflate factor loadings or underestimate factor correlations than other methods (Fabrigar et al., 1999) as

it recognizes measurement error (Baglin, 2014). Although an orthogonal risk taking factor was anticipated, oblimin, an oblique rotation factor pattern solution was chosen for PAF due to risk taking behaviors being correlated with alcohol-related problems (Cyders, Flory, Rainer, & Smith, 2009; Magid, MacLean, & Colder, 2007). If the items that load on the risk factor are actually orthogonal to the other scale items, they will all be found to load on the same factor, regardless of whether oblique or some other type of factor rotation is used. The goal of the PAF was to identify a risk taking subscale distinct from the consequences items. Items were considered part of the risk taking scale if they loaded onto the same latent factor at |.30| or higher. Items that loaded |.30| or higher on two or more factors were defined as complex.

The underlying structure of the hypothesized model was tested to evaluate the degree of model fit and assess whether the fit could be improved as a function of testing alternative models. Four models were tested: a five-factor model based on the existing structure of the SIP-2R as well as three-, four-, and six-factor models to determine if the established five-factor model held with the present data and additional items.

Once the final risk taking measure was identified, tests for preliminary construct validity were completed. Convergent validity was determined using Pearson's correlation for continuous items. Point biserial, a special case of Pearson's correlation, was used for dichotomous variables (i.e., "I have had an accident while drinking or intoxicated;" "While drinking, I have gotten into sexual situations I later regretted"). For items with ordinal responses (i.e., "Have you smoked cigarettes in the past year?") Spearman's rho was calculated to determine preliminary validity.

3.3 Phase I Results

A positive correlation was observed among 25 items of alcohol consequences in a correlation matrix. Bartlett's test of sphericity, which tests that the correlation matrix has an identity matrix, was found statistically significant (χ^2 (24) = 5318.8, $p < 0.001$). A statistically significant Bartlett's test provides a minimum standard to proceed for factor analysis. The KMO measure of sampling adequacy was found to be 0.84, which is acceptable to justify factor analysis (Kaiser, 1974).

Four models were run with the 21 items from the PARR alcohol-related risk and consequences scale distributed across three-, four-, five-, and six- factors. Of the tested models, the four-factor had the best fit, explaining 41% of the variance. All items in the final model loaded at or above |.34| (see Table 2). The final four factor structure included interpersonal conflicts, intrapersonal conflicts, life consequences, and risk taking subscales.

As shown in Table 2, the risk taking subscale identified by the four factor model consisted of the following seven items: "Because of my drinking, I haven't eaten properly;" "I have taken foolish risks when drinking;" "When drinking I have done impulsive things I regretted later;" "I have been a passenger in a vehicle in which the driver was under the influence of alcohol;" "I have driven a vehicle while under the influence;" "I have found myself in situations which increased my chances of getting hurt;" and "I have awoken in the morning after a lot of drinking and found that I could not remember a part of the evening before." Cronbach's alpha for the risk taking scale was .70 in this sample. A unit-weighted risk taking score was computed by summing the seven items in the risk taking subscale. The risk taking score had a mean of 1.45 (*SD* = 1.79) with skewness and kurtosis of 1.57 and 2.84, respectively.

Table 2. Factor loadings for items within subscales of the risk and consequences scale

	Risk Taking	Interpersonal Conflicts	Intrapersonal Conflicts	Life Consequences
Because of my drinking, I haven't eaten properly.	**0.34**			
I have taken foolish risks while drinking.	**0.76**			
When drinking, I've done impulsive things that I regretted later	**0.37**			
I have been a passenger in a vehicle in which the driver was under the influence of alcohol.	**0.53**			
I have driven a vehicle while under the influence.	**0.36**			
I have found myself in situations which increased my chances of getting hurt.	**0.41**			
I have awoken in the morning after a lot of drinking and found that I could not remember a part of the evening before.	**0.48**			
I have been unhappy because of my drinking.		**0.74**		
I have failed to do what is expected of me because of my drinking.		**0.41**		
I have felt guilty or ashamed because of my drinking		**0.68**		
My family has been hurt by my drinking.			**0.87**	
A friendship or close relationship has been damaged by my drinking.			**0.71**	
My drinking has damaged my social life, popularity, or reputation.			**0.53**	
I have experienced 'conflicts' at home due to my drinking			0.42	
My physical health has been harmed by my drinking				**0.47**
My physical appearance has been harmed by my drinking.				**0.52**
I have spent too much or lost a lot of money because of my drinking				**0.49**

Construct validity of the Phase 1 risk taking scale All correlation coefficients were in the expected direction and showed shared variance (see Table 3 for means and standard deviations of validity items). As expected, the risk taking scale was positively

correlated with risky behaviors such as smoking (r_s = .231, p < .001), typical numbers of alcohol drinks per day (r = .342, p < .001), frequency of binge drinking in past month (r = .455, p <.001), highest number of drinks per drinking occasion (r = .482, p < .001), and inability to stop drinking once started (r = .343, p <.001). The risk taking scale was also positively correlated with dropped items from the alcohol-related risks and consequences: I have had an accident while drinking or intoxicated (r_{pb} = .238, p <.001) and While drinking I have gotten into sexual situations I regretted later (r_{pb} = .401, p <.001). Additionally, the risk taking scale was negatively correlated with age of first drink (r = -.102, p = .042) and age first got drunk (r = -.145, p = .004), indicating that alcohol-related risk taking is correlated with drinking and getting drunk at an earlier age.

Table 3: Descriptive statistics for Phase I construct validity

	PARR min (n=461)	
	M(SD)	*n*(%)
Nonsmoker		358 (78%)
Regular Smoker		65 (14.2%)
Light Smoker		36 (7.8%)
Binge drinking in past month	1.83 (3.21)	
Age of first alcoholic drink	15.83 (3.15)	
Age of first time drunk	16.98 (3.65)	
I have had an accident while drinking or intoxicated (no)		454 (98.5%)
While drinking I have gotten into sexual situations that I later regretted (no)		440 (95.4%)
Over the past three months, how many drinks containing alcohol did you have on a typical day when you are drinking?	2.66 (1.60)	
During the past 30 days, what is the highest number of drinks that you had on any one occasion?	5.09 (2.97)	

How often during the last year have you found that you were not able to stop drinking once you had started?	1.15 (0.50)

3.4 Phase I Discussion

Factor extraction using PAF and a priori evaluation of the factor structure identified a four-factor model. The proposed factor structure assumed by the SIP-2R (Miller et al., 1995) did not hold in this sample. However, analyses did identify a risk taking factor among the 25-item risk and consequences measure in the PARR study. These results replicated in an orthogonal model.

Preliminary construct validity indicated support for a scale measuring risk taking in a non-alcohol dependent adult population.

Chapter 4

Phase II: Confirmation of the Risk taking Measure

4.1 Description

Phase II of the study used Confirmatory Factor Analysis (CFA) to test whether the factor structure of the risk taking measure identified in Phase I will be replicated in a different sub-sample of the PARR study participants. CFA will be used to evaluate the factor structure, item loadings and model fit of seven-item risk taking factor.

4.2 Phase II Methodology

4.2.1 Phase II Participants

For Phases II and III, the combined treatment and assessment matched control groups who had been randomly assigned to group at baseline (n = 868), were now randomly split into two half-samples; with one-half ample used in each phase. The split half sample used for the Phase II CFA consisted of 430 participants, with an average age of 43.33 (SD = 13.14). The sample was 51.6% female, primarily white (89.9%), and employed at least part time (85.5%).

4.2.2 Phase II Measures

Risk Taking Measure Phase II used the seven-item risk taking scale identified by the EFA performed in Phase I of the study. These items asked “During the last 3 months, about how often has this happened to you?” (“never,” “once or a few times,” “once or twice a week,” “daily or almost daily”).

4.3 Phase II Results

The results of the final CFA model are shown in Figure 2 and Table 4. The results indicate that factor loadings and goodness of model fit for the seven-item risk scale identified in the EFA in Phase I is replicated by the CFA results from a different sample of PARR study participants in Phase II. The loadings of all seven items of the risk scale are high and, after accounting for the within factor item correlation between two items that measure aspects of driving under the influence, the goodness of fit statistics for the risk taking scale had good to excellent fit to the data, $\chi 2(19) = 35.49$, $p = .001$, CFI = 0.963, TLI = 0.941, RMSEA [90%CI] = 0.064 [0.038, 0.089], SRMR = 0.038. Standardized parameter estimates are presented in Figure 2.

Coefficient alpha for the risk taking measure in the Phase II sample showed acceptable reliability, $\alpha = 0.77$. The unit weighted risk taking scale in this sample had a mean score of 1.79 (SD = 2.12) with skewness and kurtosis of 1.43 and 2.34, respectively. The mean and SD for the risk factor score for the Phase II sample compares favorably with the Phase I sample risk taking score (Phase 1 mean=1.45, SD=1.79, n=438), although given the large sample sizes the between sample difference was marginally statistically significant (t=-2.30, df=828.65, p=.022). CFA model modification indices suggested the presence of significant covariation in the error terms of two risk scale items; #16 (“I have been a passenger in a vehicle in which the driver was under the influence of alcohol”) and #18 (“I have driven a car, motorcycle, truck, boat or other motor vehicle”). These two items assess risk taking related to alcohol use and motor vehicles, and it appears that the correlated errors are due to method error related to similar item content. Hence, the error terms for items 16 and 18 were allowed

to covary in the final CFA model. See Table 4 for item loadings. See Figure 2 for the final CFA model with standardized results.

Table 4: Risk Taking Scale loadings

Item	Question	Loading
2	Because of my drinking, I haven't eaten properly.	0.465
5	I have taken foolish risks while drinking.	0.688
6	When drinking, I've done impulsive things that I regretted later	0.685
16	I have been a passenger in a vehicle in which the driver was under the influence of alcohol.	0.464
18	I have driven a vehicle while under the influence.	0.511
20	I have found myself in situations which increased my chances of getting hurt.	0.468
21	I have awoken in the morning after a lot of drinking and found that I could not remember a part of the evening before.	0.649

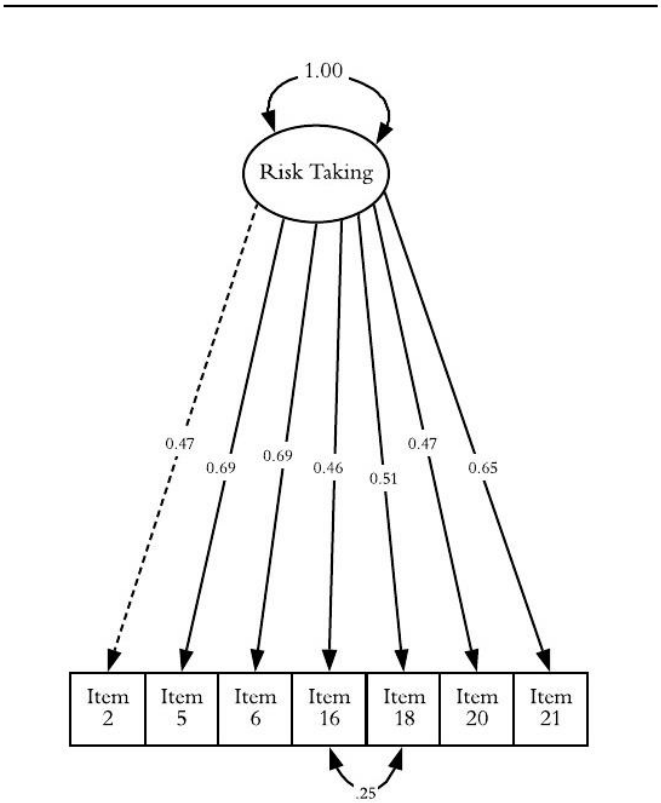

Figure 2: Confirmatory Factor Analysis with standardized results

Construct Validity of the Risk taking scale in the Phase II sample population

All correlation coefficients were in the expected direction and showed shared variance (see Table 5 for means and standard deviations of validity items). As expected, the risk taking scale was positively correlated with risky behaviors such as typical numbers of alcohol drinks per day (r = .356, p < .001), binge drinking in past month (r = .384, p <.001), highest number of drinks per occasion (r = .452, p < .001), and inability to stop drinking once started (r = .239, p <.001). The risk taking scale was also positively correlated with dropped items from the alcohol-related risks and consequences: I have

had an accident while drinking or intoxicated (r_{pb} = .304, p <.001) and While drinking I have gotten into sexual situations I regretted later (r_{pb} = .398, p <.001). Additionally, the risk taking scale was negatively correlated with age of first drink (r = -.102, p = .042), indicating that alcohol-related risk taking is correlated with drinking and getting drunk at an earlier age. The risk taking scale was not correlated with smoking (r_s = .094, p = .052) and age first got drunk (r = -.066, p = .214) in this sample.

Table 5: Descriptive Statistics of Construct Validity Measures

	Phase II (n=430)
Nonsmoker	81.6%
Regular Smoker	12.8%
Light Smoker	5.6%
Binge drinking in past month	1.78 (3.36)
Age of first alcoholic drink	16.09 (3.01)
Age of first time drunk	17.56 (4.92)
I have had an accident while drinking or intoxicated	96.50%
While drinking I have gotten into sexual situations that I later regretted	92.10%
Over the past three months, how many drinks containing alcohol did you have on a typical day when you are drinking?	2.59 (1.62)
During the past 30 days, what is the highest number of drinks that you had on any one occasion?	5.01 (3.06)
How often during the last year have you found that you were not able to stop drinking once you had started?	1.18 (0.59)

4.4 Phase II Discussion

In Phase I, a risk taking measure was identified using EFA in a sample of n = 461 PARR study participants. In Phase II, the factor structure, item loadings, and goodness of fit of the CFA model of the latent risk taking variable factor was confirmed in a separate sample of 430 PARR study participants, after accounting for modest by significant method error correlation (r = .25) between two items that assess similar substantive content. The resulting CFA model provided a good fit to the data, the estimated means and variation of the unit weighted risk taking were comparable between the Phase I and Phase II samples, and consistent evidence of construct validity supports the conclusion that the risk taking measure identified in Phase I suggest that there is empirical confirmation of the validity of the risk taking scale in the Phase II participant sample.

Chapter 5

Phase III Growth Curve Analysis

5.1 Phase III Description

A seven-item measure of alcohol related risk taking was identified in Phase I and confirmed in a separate sample of PARR study participants in Phase II. In Phase III the goal was to determine if a) risk taking changed over time and b) if any change in risk taking over time is moderated by treatment, which targeted alcohol risk taking as part of the brief multidimensional individualized motivational feedback intervention.

5.2 Phase III Methodology

5.2.1 Phase III Participants

Phase III used the second half of the split half sample of the combined treatment and assessment matched control group (N = 868), consisting of 438 participants with an average age of 42.14 (*SD* = 12.18). The sample was 51.4% male, 88.7% white, 76.3% non-smoking, and 86.0% employed at least part time.

5.2.2 Phase III Measures

Risk Taking A risk taking measure was developed in Phases I and confirmed in Phase II of the present study. The risk taking measure consisted of seven items of alcohol-related risk taking behaviors. Participants were primed with “During the last 3 months, about how often has this happened to you?” (“never,” “once or a few times,” “once or twice a week,” “daily or almost daily”).

Time Time represents the repeated measures of the risk taking measure collected by telephone survey at the six occasions over the two-year study period; baseline, 3-, 6-, 12-, 18- and 24-months post-baseline. For mixed model and latent growth curve analyses that require a continuous interval measure of Time, the time measure is scaled to represent years since baseline; Baseline = 0, 3-month assessment = 0.25, 6-month assessment = 0.5, 12-month assessment = 1, 18-month assessment = 1.5, and 24-month assessment = 2. The scaled time measure is needed to prevent model convergence problems while preserving the time intervals between assessment waves. Initially, exploratory analyses of the shape of the time trend in risk taking was coded as a nominal categorical variable representing each assessment wave with the baseline wave as the referent coded as 0, and subsequent waves coded consecutively, 1, 2, 3, 4, 5. This approach assumes equal time intervals, ignoring information on the length of the actual time interval between successive waves. Twisk (2003) has shown that using time coded as an ordered nominal variable can be very useful to help visually identify the approximate shape of the underlying growth trend(s).

Treatment Treatment refers to the experimental group into which the participants were randomly assigned. Treatment is an indicator variable representing experimental condition coded to indicate the brief feedback intervention condition (Treatment = 1) and the assessment matched "Control" condition (Treatment = 0). The assessment matched control group received the same survey assessments as the Treatment group at each assessment wave, but did not receive the brief tailored motivational feedback reports following the baseline, 3- and 6-month assessments.

5.2.3 Phase III Analytic Strategy

Growth model analyses were performed to evaluate the optimal functional form of time as well as change in the risk taking score over time, conditioned on Treatment group. The distribution of the risk taking variable scores over the six timepoints tended to be non-normal and positively skewed, which is a violation of the normal linear mixed model assumptions. To address this distributional problem, Poisson and negative binomial generalized linear mixed models (GLMM) models were compared. Change over time in the risk taking measure used generalized linear mixed-effects modeling (GLMM) to develop an appropriate longitudinal regression model. GLMM methodology models temporal patterns of change while taking into account the dependency of repeated measures and provides accurate estimates of the model's fixed effect estimates and their correct standard errors (Fitzmaurice, Laird, & Ware, 2011). GLMM regression models using both Poisson and negative binomial distributional links can be effective ways of modeling skewed longitudinal count and continuous outcome data that is skewed or zero-inflated data, as is often seen in alcohol and other health behavior data (Rideout, Hinde, & Demétrio, 2001).

The GLMM methodology provides fixed effect estimates of the intercept and slope for predictors with variance corrected standard errors, as well as estimates of the random intercept and one or more random slope(s) estimates, as needed to determine the mixed model that best fits the data. The fixed effect intercept is the average starting point and estimates of the fixed slope(s) of model predictor variable(s) represent the estimate of the amount of change from the fixed intercept in the outcome measure for a unit change in the predictor variable(s). Random effects estimate the amount of variation due to correlated responses (dependence) in repeated measures taken on the same individual.

The random intercept estimates individual variation from the group level fixed effect estimate of the intercept. The random slope(s) estimate(s) represent the amount of individual variation from the group level estimate(s) of the fixed slope(s).

The Unconditional Model Analysis

The purpose of the unconditional model analyses was to find the best functional form of time for the growth model for risk taking. The unconditional growth model analysis assesses whether there is systematic variation in the change in risk taking, and is used to identify which of the different possible parameterizations of the functional form of time best fits the underlying trend in the data. To identify the optimal functional form of time for risk taking, a series of models with successively complex parameters for time was compared and the most appropriate candidate model (or models) is determined based on a comparison of fit statistics analogous to the approach described in Phase II. For nested growth curve models, goodness of fit was compared using Liklihood ratio test. For non-nested growth curve models, the Akaike Information Criterion (AIC; Akaike, 1973) and Bayesian Information Criterion (BIC; Schwarz, 1978) were used, with smaller values indicating a better fitting model. The initial shape of the underlying pattern of growth was explored with the nominal time model, and then by comparing a series of successively higher order linear polynomial growth models. The end result of the unconditional model analyses is to identify an optimal expression of time for use in the conditional model analyses.

Conditional Model Analyses

The results of the unconditional analyses are then used as the initial parameterization of time for the growth model. The conditional growth curve model considers repeated measures of an outcome behavior (i.e., risk taking) as a function of time and other individual and group level measures (Duncan & Duncan, 1995; Singer and Willet, 2003). In this study, the next step was to determine if the change in risk taking behaviors is moderated by treatment group.

The hypothesis being tested in the conditional analyses proposes that the risk taking over time was differentially reduced more in the treatment group compared to the control group. This model tests whether there are significantly different patterns of growth between the two experimental conditions since all participants were randomly assigned to experimental condition, the conditional model included terms for the predictors; Treatment group, Time and Treatment group by Time. The moderation hypothesis is tested by evaluating the statistical significance of the Treatment by Time interaction term in the GLMM model.

5.3 Phase III Results

Cross Sample Validation

See Table 6 for descriptive statistics for the risk taking measure by time for the sample used in Phase II and the sample used in Phase III. Coefficient alpha for the risk taking scale in this phase was acceptable, $\alpha = 0.74$. A series of independent samples t-tests were conducted to determine if significant differences in risk scores existed by time in the Phase II and Phase III samples. No significant differences were found between samples at baseline [$t(800) = 1.0$, $p = 0.2$], 3-month [$t(700) = -0.6$, $p = 0.5$], 6-month

[$t(700) = -0.2$, $p = 0.8$], 12-month [$t(700) = -0.4$, $p = 0.7$], 18-month [$t(700) = 2$, $p = 0.09$], or 24-month [$t(700) = 0.8$, $p = 0.4$].

Table 6. Risk Taking descriptive statistics at each time point by sample.

	Phase II Sample		Phase III Sample	
Time	M (SD)	n	M (SD)	n
Baseline	1.76 (2.12)	426	1.76 (1.97)	433
3- month	1.61 (2.03)	380	1.61 (2.06)	368
6- month	1.51 (1.95)	369	1.52 (2.00)	357
12- month	1.58 (2.05)	361	1.43 (1.81)	359
18- month	1.68 (2.12)	360	1.37 (1.75)	361
24- month	1.65 (2.11)	357	1.48 (1.77)	357

Unconditional Growth Model

Descriptive statistics indicated that the risk taking scale was non-normal and thus did not meet the assumptions for a linear model. Unconditional models were built using first a Poisson distribution and then a negative binomial distribution. Comparison of the continuous time model results for the Poisson and negative binomial GLMMs indicated that models built with the log-link and negative binomial distribution were superior to those built with the log-link and Poisson distribution, consistently resulting in smaller residual variance for models in the negative binomial models.

Table 7 shows results comparing the unconditional negative binomial growth models. Model 1 was the GLM negative binomial model with nominal time without random effects. Model 2 was a GLMM which added a random intercept to Model 1 to

take into account dependence due to repeated measures. Model 2 is a significant improvement over Model 1, as indicated by the significant LLRT and lower values of AIC and BIC. Model 3 fit better than Model 2, indicating that there is significant individual variation in the linear slope over the two- year study period. Comparison of the AIC and BIC estimates for non-nested nominal time Model 3 and Model 4, suggests that nominal time model fits the data better than the linear time random intercept model. Models that were more complex than Model 9 failed to converge. The best fitting continuous time model was Model 8, the quadrative fixed and quadratic random slopes model.

Table 7. Unconditional Negative Binomial Growth Model Results										
Model	**Fixed Effects**	**Random Effects**	**LL**	**df**	**AIC**	**BIC**	**LL Ratio Test χ2 (Δdf)**			
							Models*	**χ2 diff**	Δdf	***p-value***
1	Intercept, Nominal Time	NA	-3792.71	7	7599.41	7639.39	-	-	-	-
2	Intercept, Nominal Time	Intercept	-3605.78	8	7227.55	7273.25	1 vs 2	-186.93	-1	0.000
3	Intercept, Nominal Time	Intercept, Time	-3578.82	10	7177.63	7234.75	2 vs 3	-26.96	-2	0.000
4	Intercept, Time	Intercept	-3610.8	4	7229.61	7252.46	3 vs 4	NA	NA	NA
5	Intercept, Time	Intercept, Time	-3579.49	6	7170.97	7205.24	4 vs 5	-31.31	-2	0.000
6	Intercept, Time, Time^2	Intercept	-3606.32	5	7222.64	7251.2	5 vs 6	26.83	-1	0.000
7	Intercept, Time, Time^2	Intercept, Time	-3578.86	7	7171.71	7211.69	5 vs 7	-0.63	-1	0.427
8	Intercept, Time, Time^2	Intercept, Time, Time^2	-3565.64	10	7151.27	7208.39	5 vs 8	-13.85	-4	0.008
9	Intercept, Time, Time2, Time^3	Intercept	-3605.97	6	7223.95	7258.22	8 vs 9	40.33	-1	0.000
10	Intercept, Time, Time^2, Time^3	Intercept, Time	-3578.9	7	7173.71	7219.4	8 vs 10	13.21	-2	0.001

Note. LL= -2 Log Likelihood, df = degrees of freedom, AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion

The results of the best fitting nominal time model are shown in Table 8 for illustrative purposes. These results reveal a significant decreasing linear trend in risk taking over the two- year follow-up period.

Table 8. Unconditional model measuring risk taking over nominal time.

Variable	Estimate	*SE*	*t*	*p*
Intercept	0.170	0.068	4.11	0.013
3-Month	-0.052	0.058	-0.91	0.364
6-Month	-0.098	0.063	-1.55	0.121
12-Month	-0.220	0.076	-2.89	0.004
18-Month	-0.392	0.094	-4.15	< 0.001
24-Month	-0.566	0.117	-4.83	< 0.001

Note. SE = Standard Error

The predicted effect of time on risk taking from the best fitting continuous time model (Model 8) are shown in Figure 3. When the effect of time is modeled as an interval level variable reveals that there was a steep linear decline between baseline and the 18-month follow-up, after which risk taking leveled off and decreased slightly. The fixed effect estimates for both the linear and quadratic terms for continuous time were statistically significant. The linear time effects was B = -0.604, SE = 0.157, p = .0001, and the quadratic term fixed effects estimate for was B = 0.190, SE = 0.076, p = .0127.

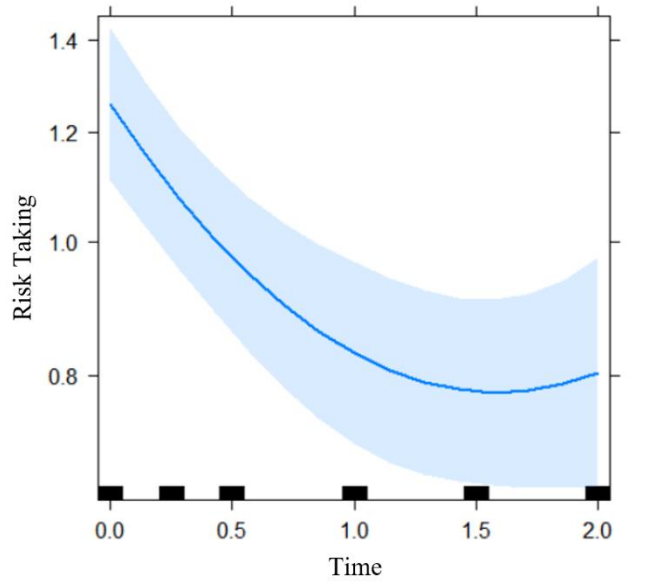

Figure 3. Predicted effect of time on risk taking

Conditional Model

The conditional results of the best fitting negative binomial GLMM nominal time model, are shown in Table 9. The Type III test of the Time by Group interaction assessing whether change in risk taking was moderated by the Treatment shows was not significant as indicated by the LL ratio test χ^2 (6) = -2.42, p = 0.877, for the comparison of best fitting unconditional nominal Time model Group and Group by Time interaction terms added. As was evident in the unconditional models, these results also indicated a decreasing secular trend in risk taking over most of the study period.

Table 9. Linear mixed effects model with treatment group moderating the effects of time on risk taking.

Variable	Estimate	*SE*	*t*	*p*
Intercept	0.293	0.096	3.00	0.003
3-Month	-0.195	0.108	-1.80	0.072
6-Month	-0.192	0.108	-1.77	0.076
12-Month	-0.347	0.112	-3.10	0.002

18-Month	-0.320	0.110	-2.89	0.004
24-month	-0.308	0.110	-2.79	0.005
Group	-0.022	0.135	-0.16	0.872
3-Month by Group	0.049	0.149	0.33	0.741
6-Month by Group	-0.090	0.153	-0.59	0.555
12-Month by Group	0.104	0.154	0.67	0.500
18-Month by Group	0.011	0.155	0.07	0.945
24-Month by Group	0.098	0.154	0.64	0.523

Note. SE = Standard Error

Construct Validity of the risk taking scale score in the Phase III sample

All correlation coefficients were in the expected direction and showed shared variance (see Table 10 for means and standard deviations of validity items). As expected, the risk taking scale was positively correlated with risky behaviors such as smoking (r = .141, p = .003), typical numbers of alcohol drinks per day (r = .294, p < .001), binge drinking in past month (r = .252, p <.001), highest number of drinks per occasion (r = .394, p < .001), and inability to stop drinking once started (r = .225, p <.001). The risk taking scale was also positively correlated with dropped items from the alcohol-related risks and consequences: I have had an accident while drinking or intoxicated (r_{pb} = .328, p <.001) and While drinking I have gotten into sexual situations I regretted later (r_{pb} = .429, p <.001). The risk taking scale was not correlated with age of first drink (r = -.087, p < 1.000), age first drunk (r = -.092, p = .081), or typical numbers of alcohol drinks per day (r = .028, p = .556) in this sample.

Table 10: Descriptive statistics for Phase III construct validity

	Phase III (n=438)
Nonsmoker	76.3%
Regular Smoker	14.6%
Light Smoker	9.1%
Binge drinking in past month	1.69 (3.32)

Age of first alcoholic drink	15.70 (3.15)	
Age of first time drunk	16.90 (3.15)	
I have had an accident while drinking or intoxicated		97.20%
While drinking I have gotten into sexual situations that I later regretted		93.10%
Over the past three months, how many drinks containing alcohol did you have on a typical day when you are drinking?	2.82 (1.72)	
During the past 30 days, what is the highest number of drinks that you had on any one occasion?	5.31 (3.09)	
How often during the last year have you found that you were not able to stop drinking once you had started?	0.83 (0.38)	

5.4 Discussion

Phase III of this study replicated and cross-validated a third separate sample of moderate drinking adults. The unconditional growth model analysis provided evidence that the risk taking scale can detect significant trends in the change over time. The unconditional model demonstrated that a negative binomial GLMM was the most appropriate. Analysis of the model showed evidence of a temporal decrease in risk taking within this population. To test if the study intervention had an effect on risk taking over time, moderation was added to the model. No significant differences between treatment and assessment matched control groups were found. The goal of the PARR study was to intervene on alcohol related problems. The lack of treatment differences may be due to

other factors that affect both treatment conditions, such as the repeated assessment of study related variables including pros and cons of high risk drinking, situational temptations to drink at high or frequent levels, and several processes of change believed to be related to high risk drinking behaviors and negative consequences.

Chapter 6

Discussion

6.1 General Discussion

The goal of the present study was to identify a risk taking measure from a 25-item scale of alcohol-related risk and consequences used in the PARR study. In Phase I, exploratory analysis indicated the existence of a risk taking factor within a measure of alcohol-related risk and consequences scale. In Phase II, the factor structure of the risk taking measure was confirmed using CFA. In Phase III, analysis of the risk taking variable indicated change over time in risk taking, although this change was not moderated by treatment in this study.

Identifying a risk taking scale is an important preliminary step in targeting alcohol-related risk taking behaviors. Traditionally, measures that assess alcohol-related risk taking behaviors are assessed with alcohol-related consequences as a single alcohol-related problems scale (Miller et al., 1995; Saunders et al, 1993; White & Labouvie, 1998). Previous studies have identified the need for targeting risk taking behaviors within alcohol brief intervention studies (Blow et al., 2006; Blow et al., 2011; Cunningham et al., 2010; Longabaugh et al., 2011; Mello et al., 2008; Sommers et al., 2013).

Although researchers have targeted specific risk taking behaviors in alcohol brief interventions, consequences such as motor vehicle collisions (Schermer et al., 2006; Sommers et al., 2013) and other emergency department visits (Suffoletto et al., 2003) often serve as the recruitment for such intervention studies. Sommers and colleagues (2013) found that targeting two risky behaviors (i.e., risky driving and hazardous

drinking) in an emergency department significantly reduced both risky behaviors for an extended period of time (9- and 6-months respectively; Sommers et al., 2013). By using a general risk taking measure, researchers might be able to identify non-dependent adult drinkers who may benefit from interventions aimed at the reduction of risk taking behaviors.

The present study used PAF to identify factors within a 25-item risk and consequences scale. This exploratory factor analysis identified four factors. A single factor made up of risk taking variables was identified and the remaining factors consisted of various consequences. With the identification of a risk taking subscale, analyses proceeded to Phase II where we confirmed the factor structure of the subscale. CFA confirmed the existence of a risk taking scale. From there, we moved to demonstrating that risk taking through this scale could be modeled over time. The final analysis sought to determine if the change in risk taking over time was moderated by treatment condition (i.e., intervention and assessment matched control).

Unconditional negative binomial GLMM model analysis with random intercept and random slope using linear time provided evidence that the risk taking measure can be modeled over time. Significant temporal decreases in risk taking over time from the baseline assessment was seen at all timepoints in the unconditional model. A conditional model added the effect of study intervention to the model to determine if treatment moderated risk taking over time. In this sample, no effect of treatment was found. These results are not unexpected as the multidimensional feedback treatment for the study was designed to intervene on alcohol related problems. The failure to find treatment differences may be due to other factors that affect both treatment conditions, including

repeated assessment of variables of interest. Although no effect of treatment was found in this study, evidence of change in risk taking over time provides clinical implications for treatment. The present study demonstrated that scores on the risk taking measure decreased over time, which implies that intervention could target risk taking behaviors.

6.2 Limitations

The present study used a measure specific to the PARR study and cannot be generalized to all alcohol-related risk and consequences scales. The sample of non-dependent adult alcohol drinkers was predominantly White and cannot be generalized across racial and ethnic groups. Gender was measured as a binary option of "Male" and "Female" thus cannot be generalized to non-binary genders. The treatment was aimed at problems and not risk taking, so it is unknown if a randomized brief intervention study would show change in broad alcohol-related risk taking behaviors.

6.3 Future Directions

Future studies should identify a risk taking subscale in established alcohol-related risk and consequences scales such as the DrInC. By identifying a scale directly measuring alcohol-related risk taking behaviors, studies can evaluate general risk taking behavior as a risk factor for alcohol use. Since brief interventions have been effective in targeting certain risky behaviors, a brief intervention study targeting overall risk taking behaviors could add to the literature. Future studies should also assess factors related to risk taking behaviors that can be targeted clinically such.

Appendix 1. Model building table for Phase III growth curve using Poisson distribution.

Appendix 1: Unconditional GLMM Poisson Growth Model Results										
Model	**Fixed Effects**	**Random Effects**	**LL**	**df**	**AIC**	**BIC**	**LL Ratio Test χ2 (Δdf)**			
							Models*	**χ2 diff**	Δdf	***p-value***
1	Intercept, Nominal Time	NA	-4375.81	7	8763.62	8797.89				
2	Intercept, Nominal Time	Intercept	-3693.5	8	7400.1	7440.98	1 vs 2	-682.31	-1	0.000
3	Intercept, Nominal Time	Intercept, Time	-3581.03	10	7180.06	7231.47	2 vs 3	-112.47	-2	0.000
4	Intercept, Time	Intercept	-3697.39	3	7400.78	7417.91	3 vs 4	NA	NA	NA
5	Intercept, Time	Intercept, Time	-3581.83	5	7173.66	7202.22	4 vs 5	-115.56	-2	0.000
6	Intercept, Time, Time^2	Intercept	-3693.58	4	7397.15	7425.71	5 vs 6	111.75	-1	0.000
7	Intercept, Time, Time^2	Intercept, Time	-3581.07	6	7174.13	7208.41	5 vs 7	-0.76	-1	0.383
8	Intercept, Time, Time^2	Intercept, Time, Time^2	-3567.16	9	7152.31	7203.72	5 vs 8	-14.67	-4	0.005
9	Intercept, Time, Time2, Time^3	Intercept	-3693.57	5	7397.15	7425.71	8 vs 9	126.41	-1	0.000

Note. LL= -2 Log Likelihood, df = degrees of freedom, AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion

Bibliography

Afshar, M., Netzer, G., Salisbury-Afshar, E., Murthi, S., & Smith, G. S. (2016). Injured patients with very high blood alcohol concentrations. *Injury, 47*(1), 83-88.

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In B. N. Petrov & B. F. Csaki (Eds.), Second International Symposium on Information Theory, (pp. 267-281). Academiai Kiado: Budapest.

Allen, J. P., & Columbus, M. (Eds.). (1997). *Assessing alcohol problems: A guide for clinicians and researchers*. Diane Publishing.

Aseltine, R.H., Jr. (2010). Screening, brief intervention and referral for treatment in emergency department patients' alcohol use: A 3-, 6-, and 12-month follow-up. *Alcohol and Alcoholism, 45*, 514-519.

Babor, T.F., de la Fuente, J.R., Saunders, J., & Grant, M. (1992). AUDIT. The Alcohol Use Disorders Identification Test. Guidelines for use in primary health care. Geneva, Switzerland: World Health Organization.

Baglin, J. (2014). Improving your exploratory factor analysis for ordinal data: A demonstration using FACTOR. *Practical Assessment, Research & Evaluation, 19*(5), 2.

Barry, A. E., & Piazza-Gardner, A. K. (2012). Drunkorexia: understanding the co-occurrence of alcohol consumption and eating/exercise weight management behaviors. *Journal of American College Health*, *60*(3), 236-243.

Bartlett, M. S. (1950). Tests of significance in factor analysis. *British Journal of Statistical Psychology, 3*(2), 77-85.

Beavers, D., Bechara, A., Cleeremans, A., Kornreich, C., Verbanck, P. &Noël, X. (2014). Impaired decision-making under risk in individuals with alcohol dependence. *Alcoholism: Clinical and Experimental Research, 38*(7), 1924-1931.

Blow, F., Ilgen, M., Walton, M., Czyz, E., McCammon, R., Chermack, S., … Barry, K. (2009). Severity of baseline alcohole use as a moderator of brief interventions in the emergency department. *Alcohol and Alcoholism, 44*, 486-490.

Blow, F.C., Walton, M.A., Barry, K.L., Murray, R.L., Cunningham, R.M., Massey, L.S., … Booth, B.M. (2011). Alcohol and drug use among patients presenting to an inner city emergency department: A latent class analysis. *Addictive Behaviors, 36*, 793-800.

Carey, K. B., Guthrie, K. M., Rich, C. M., Krieger, N. H., Norris, A. L., Kaplan, C., & Carey, M. P. (2018). Alcohol Use and Sexual Risk Behavior in Young Women: A Qualitative Study. *AIDS and Behavior*, 1-9.

Cochran, G., Field, C., & Caetano, R. (2015). Changes in classes of injury-related risks and consequences of alcohol misuse: A latent transition analysis. *Journal of Behavioral Health Services and Research*, *42*(3), 355-366.

Cunningham, R. M., Chermack, S. T., Ehrlich, P. F., Carter, P. M., Booth, B. M., Blow, F. C., ... & Walton, M. A. (2015). Alcohol interventions among underage drinkers in the ED: A randomized controlled trial. *Pediatrics*, 136(4), e783-e793.

Curry, S.J., Ludman, E.J., Grothaus, L.C., Donovan, D., & Kim, E. (2003). A randomized trial of a brief primary-care-based intervention for reducing at-risk drinking practices. *Health Psychology*, *22*(2), 156-165.

Cyders, M. A., Flory, K., Rainer, S., & Smith, G. T. (2009). The role of personality dispositions to risky behavior in predicting first-year college drinking. *Addiction*, *104*(2), 193-202.

de Haan, L., Egberts, A.C.G., & Heerdink, E.R. (2015). The relationship between risk-taking behavior and alcohol use in young adults is different for men and women. *Drug and Alcohol Dependence*, *155*, 222-227.

D'onofrio, G., Pantalon, M. V., Degutis, L. C., Fiellin, D. A., Busch, S. H., Chawarski, M. C., ... & O'connor, P. G. (2008). Brief intervention for hazardous and harmful drinkers in the emergency department. *Annals of emergency medicine*, *51*(6), 742-750.

Donoghue, K., Patton, R., Phillips, T., Deluca, P., & Drummond, C. (2014). The effectiveness of electronic screening and brief intervention for reducing levels of alcohol consumption: A systematic review and meta-analysis. *Journal of Medical Internet Research*, *16*(6), e142.

Duncan, T.E., & Duncan, S.C., (1995). Modeling the processes of development via latent variable growth curve methodology. *Structural Equation Modeling*, *2*(3), 187–213.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological methods*, *4*(3), 272.

Ferriter, C., & Ray, L. A. (2011). Binge eating and binge drinking: An integrative review. *Eating Dehaviors*, *12*(2), 99-107.

Field, A. P., Miles, J., & Field, Z. (2012). *Discovering statistics using R*. London: Sage.

Fitzmaurice, G.M., Laird, N.M., & Ware, J.H. (2011). *Applied longitudinal analysis*. Hoboken, NJ: John Wiley & Sons.

Franzen, M., Sadikaj, G., Moskowitz, D. S., Ostafin, B. D., & aan het Rot, M. (2018). Intra-and Interindividual Variability in the Behavioral, Affective, and Perceptual

Effects of Alcohol Consumption in a Social Context. *Alcoholism: Clinical and Experimental Research*, *42*(5), 952-961.

Furby, L., & Beyth-Marom, R. (1992). Risk taking in adolescence: A decision-making perspective. *Developmental Review*, *12*(1), 1-44.

Gentilello, L. M., Rivara, F. P., Donovan, D. M., Jurkovich, G. J., Daranciang, E., Dunn, C. W., ... & Ries, R. R. (1999). Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. *Annals of Surgery*, *230*(4), 473.

Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. *Educational and Psychological measurement*, *66*(3), 393-416.

Horn JL. (1965) A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*(2):179-85

Jupp, B. & Dalley, J.W. (2014). Behavioral endophenotypes of drug addiction: Etiological insights from neuroimaging studies. *Neuropharmacology*, *76*, 487-497.

Kline, R.B. (2011). *Principles and practice of structural equation modeling*. Third Edition. New York, NY: Guilford Press.

Krause, A. J., Simon, E. B., Mander, B. A., Greer, S. M., Saletin, J. M., Goldstein-Piekarski, A. N., & Walker, M. P. (2017). The sleep-deprived human brain. *Nature Reviews Neuroscience*, *18*(7), 404.

Kutner, M.H., Nachtsheim, C.J., Netter, J. & Li, W. (2004). *Applied Statistical Linear Models*. New York, NY: McGraw-Hill/Irwin.

Laforge, RG, Schneider, R, Larson, M-J, Zwick, W & Schlicting, BN. (2003). The Population Alcohol Risk Reduction (Parr) Trial: Baseline Results Of Proactive Telephone Recruitment Of Managed Care Member, Research Society on Alcohol, Fort Lauderdale, FL, June 2003.

Littlefield, A. K., & Sher, K. J. (2010). The multiple, distinct ways that personality contributes to alcohol use disorders. *Social and Personality Psychology Compass*, *4*(9), 767-782.

Longabaugh, R., Woolard, R. E., Nirenberg, T. D., Minugh, A. P., Becker, B. R. U. C. E., Clifford, P. R., ... & Gogineni, A. (2001). Evaluating the effects of a brief motivational intervention for injured drinkers in the emergency department. *Journal of Studies on Alcohol*, *62*(6), 806-816.

Magid, V., MacLean, M. G., & Colder, C. R. (2007). Differentiating between sensation seeking and impulsivity through their mediated relations with alcohol use and problems. *Addictive Behaviors*, *32*(10), 2046-2061.

Massa, A. A., Subramani, O. S., Eckhardt, C. I., & Parrott, D. J. (2018). Problematic alcohol use and acute intoxication predict anger-related attentional biases: A test of the alcohol myopia theory. *Psychology of Addictive Behaviors*, *33*(2), 139.

Mello, M. J., Longabaugh, R., Baird, J., Nirenberg, T., & Woolard, R. (2008). DIAL: a telephone brief intervention for high-risk alcohol use with injured emergency department patients. *Annals of Emergency Medicine*, *51*(6), 755-764.

Merrill, J.E., Read, J.P., & Colder, C.R. (2013). Normative perceptions and past-year consequences as predictors of subjective evaluations and weekly drinking behavior. *Addictive Behaviors*, *38*(11), 2625-2634.

Miller, W.R. (1996). Form 90: A structured assessment interview for drinking and related behaviors. Test manual. Project MATCH Monograph Series, Vol. 5. DHHS Publication No. 96-4004. Rockville, MD: NIAAA.

Miller, W.R., Tonigan, J.S., & Longabaugh, R. (1995). The Drinker Inventory of Consequences (DrInC): An instrument for assessing adverse consequences of alcohol abuse (test manual). NIAAA Project MATCH Monograph Series Volume 4.

Monti, P. M., Colby, S. M., Barnett, N. P., Spirito, A., Rohsenow, D. J., Myers, M., ... & Lewander, W. (1999). Brief intervention for harm reduction with alcohol-positive older adolescents in a hospital emergency department. *Journal of Consulting and Clinical Psychology*, *67*(6), 989.

Morris, D. H., Treloar, H. R., Niculete, M. E., & McCarthy, D. M. (2014). Perceived danger while intoxicated uniquely contributes to driving after drinking. *Alcoholism: Clinical and Experimental Research*, *38*(2), 521-528.

Norris, J., Davis, K. C., George, W. H., Martell, J., & Heiman, J. R. (2002). Alcohol's direct and indirect effects on men's self-reported sexual aggression likelihood. *Journal of Studies on Alcohol*, *63*(6), 688-695.

O'Donnell, A., Anderson, P., Newbury-Birch, D., Schulte, B., Schmidt, C., Reimer, J., & Kaner, E. (2014). The impact of alcohol interventions in primary healthcare: A systematic review of reviews. *Alcohol and Alcoholism*, *49*(1), 66-78.

O'donnell, A., Anderson, P., Newbury-Birch, D., Schulte, B., Schmidt, C., Reimer, J., & Kaner, E. (2013). The impact of brief alcohol interventions in primary healthcare: a systematic review of reviews. *Alcohol and alcoholism*, *49*(1), 66-78. doi: doi.org/10.1093/alcalc/agt170

PARR (2001). "A Stage Matched Alcohol Program for Managed Care", R01 AA12341, (Principal Investigator: RG Laforge).

Pett, M.A., Lackey, N.R., & Sullivan, J.J. (2003). *Making sense of Factor Analysis: The use of factor analysis for instrument development in health care research.* California: Sage Publications Inc.

Ridout, M., Hinde, J., & DeméAtrio, C. G. (2001). A score test for testing a zero-inflated Poisson regression model against zero-inflated negative binomial alternatives. *Biometrics*, *57*(1), 219-223.

Saitz, R., Svikis, D., D'Onofrio, G., Kraemer, K.L., & Pearl, H. (2006). Challenges applying alcohol brief interventions in diverse practice settings: Populations, outcomes, and costs. *Alcoholism: Clinical and Experimental Research*, *30*, 332-338.

Saunders, J. B., Aasland, O. G., Babor, 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*(6), 791-804.

Schermer, C. R., Moyers, T. B., Miller, W. R., & Bloomfield, L. A. (2006). Trauma center brief interventions for alcohol disorders decrease subsequent driving under the influence arrests. *Journal of Trauma and Acute Care Surgery*, *60*(1), 29-34.

Schwarz, G. 1978. Estimating the dimension of a model. Annals of Statistics 6:461–464.

Scott, S., Beyer, F., Parkinson, K., Muir, C., Graye, A., Kaner, E., ... & Wrieden, W. (2018). Non-Pharmacological Interventions to Reduce Unhealthy Eating and Risky Drinking in Young Adults Aged 18–25 Years: A Systematic Review and Meta-Analysis. *Nutrients*, *10*(10), 1538.

Singer, J.D. & Willett, J.B. (2003). *Applied longitudinal data analysis: modeling change and event occurrence*. New York, NY: Oxford University Press.

Smith, A. J., Hodgson, R. J., Bridgeman, K., & Shepherd, J. P. (2003). A randomized controlled trial of a brief intervention after alcohol-related facial injury. *Addiction*, *98*(1), 43-52.

Sommers, M. S., Lyons, M. S., Fargo, J. D., Sommers, B. D., McDonald, C. C., Shope, J. T., & Fleming, M. F. (2013). Emergency department–based brief intervention to reduce risky driving and hazardous/harmful drinking in young adults: a randomized controlled trial. *Alcoholism: Clinical and Experimental Research*, *37*(10), 1753-1762.

Steele, C. M., & Josephs, R. A. (1990). Alcohol myopia: its prized and dangerous effects. *American Psychologist*, *45*(8), 921.

Stout, RL, Wirtz, PW. Carbonari, JP, & Del Boca, FK. (1994). Ensuring balanced distribution of prognostic factors in treatment outcome research. *Journal of Studies on Alcohol and Drugs, Supplement*, (s12), 70-75.

Suffoletto, B., Callaway,C., Kristan, J, Kraemer, K., Clark, D.B. (2012). Text-message-based drinking assessments and brief interventions for young adults discharged from the emergency department. *Alcoholism: Clinical and Experimental Research*. *36*(3), 552-560.

Thompson B, Daniel LG. (1996). Factor analytic evidence for the construct validity of scores: A historical overview and some guidelines. *Educational and Psychological Measurement, 56*(2):197-208.

Thompson B. (2004). *Exploratory and confirmatory factor analysis: understanding concepts and applications.* Washington, DC: American Psychological Association.

Trinks, A., Festin, K., Bendsten, P., & Nilsen, P. (2010). Reach nd effectiveness of a computer based alcohol intervention in a Swedish emergency room. *International Emergency Nursing, 3*, 138-146.

Twisk, J.W.R. (2003). *Applied longitudinal data analysis for epidemiology: A practical guide*. New York, NY: Cambridge University Press.

Tyszka, T., Macko, A., & Stańczak, M. (2015). Alcohol reduces aversion to ambiguity. *Frontiers in Psychology, 5*, 1578.

Walton, M.A., Goldstein, A.L., Chermack, S.T.,McCammon, R.J., Barry, K.L., & Blow, F.C. (2008). Brief alcohol intervention in the emergency department: moderators of effectiveness. *Journal of Studies on Alcohol and Drugs, 69*(4), 550-560.

White, A. M. (2003). What happened? Alcohol, memory blackouts, and the brain. *Alcohol Research & Health*, *27*(2), 186-197.

White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol, 50*(1), 30-37.

White, H.R. & Labouvie, E.W. (1989) Towards the assessment of adolescent problem drinking. *Journal of the Study of Alcohol*, *50*(1), 30-37

Williams, B., Onsman, A., & Brown, T. (2010) Exploratory factor analysis: A five-step guide for novices. *Journal of Emergency Primary Healthcare*, *8*(3), published online.

Zoorob, R., Snell, H., Kihlberg, C., & Senturias, Y. (2014). Screening and brief intervention for risky alcohol use. *Current Problems in Pediatric and Adolescent Health Care*, *44*(4), 82-87.