A LONGITUDINAL EXAMINATION

OF DRINKING MOTIVES

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

A LONGITUDINAL EXAMINATION
OF DRINKING MOTIVES

presented by Brooke J. Arterberry,

a candidate for the degree of doctor of philosophy,

and hereby certify that, in their opinion, it is worthy of acceptance.

Professor Matthew P. Martens

Professor Douglas Steinley

Professor Keith Herman

Professor Patrick Rottinghaus

DEDICATION

This dissertation is dedicated to my loving husband, Tony Arterberry. Your love and

support have been invaluable in my life. I would not be here without you. To my family,

thank you for your support and encouragement. Dr. Hayely Treloar, Jessica Harvath, and

Leslie Fasone, I could not have made it through graduate school without you. Your

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Finally, to my Grandmother Jean Elizabeth Ferguson (1921-2012) and closest friend

Rebecca Ann Curl (1977-2014) – I love you both so much. I wish you could have seen

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Abstract

Drinking motives have been associated with alcohol use and alcohol-related problems among young adult drinkers (Kuntsche et al., 2005). We included a sample of 360 college students and fit latent profile models at each time point using 12-items from the Drinking Motives Questionnaire-Revised (DMQ-R: Cooper, 1994), which were determined the most discriminating items via Item Response Theory. Patterns of motives were identified using Latent Transition Analysis and included alcohol quantity and problems as covariates with quantity as a moderator to examine transitions. A 3-class model provided the best fit and parsimony: a) *High Motive*, endorsed items highly (baseline: 11%, 6-month: 10%, 12-month: 14%), b) *Positive Reinforcement Motive*, endorsed positive affect/social interaction items (49%, 53%, 49%), c) *Low Motive*, had low motive endorsement (39%, 37%, 38%). These findings suggested High Motive and Positive Reinforcement Motive classes drank more (High Motive, baseline: OR = 1.05, p <0.05, 6-month OR = 1.07, $p < 0.05$; Positive Reinforcement Motive, baseline: OR = 1.08, $p < 0.001$, 6-month: OR = 1.04, $p < 0.05$) and experienced more problems (High Motive baseline: OR = 1.14, p < 0.00, 12-month: OR = 1.06, p < 0.001; Positive Reinforcement Motive, baseline: OR = 1.12, $p < 0.001$). Transitioning between 6- and 12-month follow-up was less likely for higher levels of alcohol use (+1 *SD*: ORs = 0.32-0.44, *ps* < .05). This study provided evidence for the stability of drinking motives and targeting the positive reinforcing beliefs of alcohol, as these individuals are at higher risk for experiencing problems.

Chapter I

Introduction

There continues to be a public health concern regarding the high rate of alcohol use and binge drinking that contributes to a variety of negative consequences within the college student population. Research has found that approximately 81% of college students have tried alcohol in their lifetime, 40% have drunk alcohol in the past 30-days, and 4% have drunk alcohol daily (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Furthermore, 36% - 40% of college students have reported engaging in binge drinking (i.e., 5+ drinks for men and 4+ drinks for females: Wechsler et al., 2002) and 14% reported engaging in excessive binge drinking (e.g., 10 or more drinks in a row: Johnston et al., 2011) in the preceding two weeks. A wide variety of consequences have been identified and shown to have a relation to excessive drinking within the college student population, where approximately 1,800 deaths, 600,000 injuries, 646,000 assaults, and 97,000 sexual assaults occur each year (Abbey, Saenz, & Buck, 2005; Hingson, Zha, & Weitzman, 2009; Park, 2004).

It is important to identify and understand variables that are associated with excessive alcohol use and alcohol-related negative consequences so as to inform the development of theoretical frameworks that can aid in the conceptualization of high-risk drinking among college students. How researchers have conceptualized and understood excessive drinking within this population has been to take an additive approach that identifies possible predictive factors (e.g., emerging adulthood, institutional culture, greek affiliation, subjective norms, motives) within theoretical frameworks (e.g., developmental theories, environmental models, cognitive theories), thus increasing

understanding of high-risk alcohol use (Jones, Corbin, & Fromme, 2001; Perkins, 2002; Presley, Meilman, & Leichliter, 2002; Schulenberg & Maggs, 2002). Researchers and clinicians have used this understanding to develop interventions (e.g., Brief Alcohol Screening and Intervention for College Students: Dimeff, Baer, Kivlahan, & Marlatt, 1999) that target specific factors associated with high-risk drinking to help reduce alcohol-use and alcohol-related negative consequences.

Motivational Model

Theoretical models related to cognitions such as expectancy theory and Cox and Klinger's (1988) motivational model of alcohol use have focused on the beliefs and attitudes individuals have regarding their drinking behaviors (Jones et al., 2001; Newcomb, Chou, & Bentler, 1988), where the motivational model explains expectancies as part of a larger model regarding the reasons individuals use alcohol. The motivational model was developed as a way to conceptualize drinking in terms of positive and negative reinforcement positing individuals drink to enhance positive affect and reduce negative affect. Research has suggested that motives regarding alcohol use have been shown to mediate the effects of both individual and environmental risk factors and have been considered the final common pathway to the decision to use alcohol (Cooper, Frone, Russell, & Mudar, 1995; Cooper, Russell, Skinner, Frone, & Mudar, 1992; Cox & Klinger, 1988; Newcomb et al., 1988; Wood, Read, Palfi, & Stevenson, 2001). Furthermore, several domains of drinking motives have been identified: to reduce negative affect, enhance positive affect, and social cohesion (Newcomb et al., 1988). These constructs have been conceptualized as coping motives, social motives, enhancement motives, and conformity motives (Cooper, 1994; Cooper et al., 1992).

In general, drinking motives have been associated with alcohol use, alcohol-related problems, and other drinking-related constructs among adolescent and young adult drinkers (e.g., Cooper et al., 2008; Kuntsche, Knibbe, Gmel, & Engels, 2005, 2006; MacLean & Lecci, 2000; Newcomb et al., 1988). Specifically, social motives have been associated with moderate alcohol use and have been shown to be less likely to have a relationship with alcohol related negative consequences (Cooper, 1994; Simons, Correia, & Carey, 2000; Windle, 1996). In contrast, high risk drinking such as increased quantity and frequency of use has been associated with enhancement motives and coping motives (Cooper, 1994; Cooper, Agocha, & Sheldon, 2000; Borsari & Carey, 2003; LaBouvie & Bates, 2002). Additionally, coping motives have been shown to be associated with alcohol related negative consequences (Carey & Correia, 1997; Cooper et al., 1995; Kassel, Jackson, & Unrod, 2000; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Simons et al., 2000; Stewart, Loughlin, & Rhyno, 2001). Enhancement motives, however, have been less consistently related to alcohol-related negative consequences, where some studies have found a strong relationship with alcohol-related problems (Cooper, 1994; LaBouvie & Bates, 2002) and others have not (Read, Wood, Kahler, Maddock, & Palfai, 2003; Simons et. al., 2000).

Although research has indicated strong associations between motives and alcohol-related outcomes using variable-centered analytic approaches, few studies have examined drinking motives utilizing person-centered analytic approaches such as latent class analysis or cluster analysis (Coffman, Patrick, Palen, Rhoades, & Ventura, 2007; Kuntsche, Knibbe, Engels, Gmel, 2010; Littlefield, Vergés, Rosinski, Steinly, & Sher, 2012). The focus on variable-centered approaches, although important in understanding

the theoretical underpinnings of alcohol motives, cannot distinguish how patterns of motives may differ across individuals. Furthermore, person-centered approaches can provide information regarding alcohol outcomes based on individual response patterns. For example, variable-centered approaches can help identify how the latent motive constructs are associated with alcohol outcomes, while person-centered approaches classify individuals based on endorsement of alcohol motives and how these relate to alcohol related outcomes.

Among the few studies conducted using this analytic technique, there have been inconsistent findings regarding motive classification. In one study conducted by Coffman and colleagues (2007), a four-class solution was identified, where Experimenters were more likely to endorse experimentation motives, Thrill-seekers were more likely to endorse social/enhancement motives, Multi-reasoners were more likely to endorse enhancement/coping motives, and Relaxers were more likely to endorse relaxation motives. High-risk drinking had the strongest association with the Multi-reasoners class. In contrast, Kuntsche and colleagues (2010) conducted a k-means cluster analysis and found a two-cluster solution with one class, Enhancement, composed of higher enhancement and social motives and one class, Coping, that consisted of higher coping and conformity motives. Finally, Littlefield and colleagues (2012) conducted a modified version of the k-means cluster analysis and found no latent class structure of coping and enhancement motives; rather, they found these motives existed on the same continuum and were associated with less severe to more severe alcohol related outcomes.

In sum, drinking motives have been identified as important predictors in understanding alcohol related outcomes within the college student population. Much of

the research to date has focused on variable-centered approaches that emphasize the alcohol motive construct of interest; however, person-centered approaches examine individual response patterns in regard to motivations for alcohol use. In essence, this approach examines the patterns that emerge among individuals based on shared attributes of a heterogeneous population, whereas the variable-centered approach is based on the assumption that the population is homogeneous and the variables of interest are described by their associations as studied across individuals. Due to the limited number of studies examining college student patterns of motive endorsement, there has been an inconsistency in conceptualizing motives at the individual level using cross-sectional methodology. Additionally, fewer studies have examined drinking motivations utilizing person-centered longitudinal methodology. The use of latent transition analysis can provide another perspective of the longitudinal trajectory of individual endorsement of motives.

The purpose of the present study was to identify groups based on patterns of drinking motives and examined these patterns over time using a person-centered analytic approach. After identifying the latent class structure of the motives, a latent transition analyses was conducted to examine changes in motive classification across three time points. Additionally, drinking quantity and alcohol problem scores were added as covariates at time 1, time 2, and time 3, while also assessing the moderation effect of drinking quantity in relation to transitioning among classes at time 1, 2, and 3. Drinking quantity and alcohol-related consequences were hypothesized to predict class membership at each time point. Furthermore, alcohol use was hypothesized to affect the probability of transitioning among classes from time 1 to time 2 and time 2 to time 3.

Chapter II

Method

Participants and Procedure

Participants. See Table 1 for demographic information. Participants were college students recruited from a Northeastern state university who received a judicial sanction for an alcohol-related offense. These college students were participating in a larger clinical trial that was being conducted to examine the efficacy of an alcohol intervention ($N = 709$: see Cimini, Martens, Kilmer, Neighbors, & Monserrat, 2009). All preliminary analyses included those participants who completed the Drinking Motives Questionnaire-Revised (DMQ-R: Cooper, 1994) on three measurement occasions ($n = 367$: 51%) with subsequent LTA analyses including those participants that also completed the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985) and the Rutgers Alcohol Problem Index (White & Labouvie, 1989) on three measurement occasions ($n = 345$: 48%). The majority of the sample was male (55.6%) and Caucasian (83.4%). Other ethnic representations within the sample were 6.5% Hispanic, 3.8% Asian/Asian-Americans, 3.8% multiracial, 1.9% Black, 0.3% American Indian, and 0.3% Native Hawaiian/Pacific Islander. Those who participated were primarily freshman (45%) and sophomore (37.1%) with a mean age of 18.90 years ($SD = 0.81$) and lived in on-campus residence halls (97.8%).

Procedure. Study procedures were reported in a previous publication (see Cimini et al., 2009) and will only be summarized here. Those students who committed an on-campus infraction involving alcohol use were eligible to participate. After receiving the infraction, students were then mandated by the university to complete an alcohol-

intervention program. Participants were recruited by being asked if they would like to complete either the university alcohol intervention program provided by the counseling center or the alcohol intervention associated with the research project. Both interventions required similar time commitments. Interested participants were asked to complete computer-based questionnaires including demographics, the DMQ-R (Cooper, 1994), the Daily Drinking Questionnaire (DDQ: Collins et al., 1985), and the Rutgers Alcohol Problem Index (RAPI: White & Labouvie, 1989). After completing baseline questionnaires, participants attended one of three 90-minute group intervention sessions. Participants completed 6-month and 12-month follow-up questionnaires and received $25 in compensation after completing each phase of the study. The Institutional Review Board approved these procedures. The interventions had no effect on alcohol use or alcohol-related problems (Cimini et al., 2009). There were no between-group differences on any DMQ-R subscales at follow-up; thus, for these analyses, participants were collapsed across conditions.

Measures

Demographics. Participants completed a measure that collected relevant demographic information such as gender, age, race, ethnicity, and year in school. In addition, participants indicated whether they lived on- or off-campus.

Daily Drinking Questionnaire (DDQ: Collins et al., 1985). The DDQ was developed as a calendar-based assessment to measure frequency and quantity of alcohol use. Respondents were provided standard definitions of alcoholic beverages: 12 oz. beer, 5 oz. wine, or 1.25 oz. of liquor. On a seven-day calendar, participants were asked to record the number of drinks they typically consumed on each day within a specified

timeframe (i.e., past 30 days). Additionally, participants indicated the peak number of drinks they consumed on one occasion in the past 30 days. Quantity and frequency of alcohol use were calculated by averaging the number of drinks per week (quantity) and averaging the number of drinking days per week (frequency). The DDQ has been a commonly used measure in research studies examining alcohol use in the college student population (Carey, Carey, Maisto, & Henson, 2006; Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990).

Drinking Motives Questionnaire-Revised (DMQ-R: Cooper, 1994). The DMQ-R was developed as a 20-item questionnaire used to assess motivations related to alcohol use. The measure has four subscales containing five items that assess the following motivations, Coping (e.g., "To forget your worries."), Social (e.g., "To celebrate special occasions with friends."), Enhancement (e.g., "Because it is fun."), and Conformity (e.g., "Because your friends pressure you to drink."). Respondents were asked to indicate how frequently they drink alcohol for specific reasons using a five-point Likert scale ranging from *Almost Never/Never* (1) to *Almost Always/Always* (5). In the present study, DMQ-R subscales were not composite scored as the analysis (discussed below) was used to examine specific item response patterns. Previous research among college student samples has indicated good overall fit for a four-factor model in factor analytic studies (MacLean & Lecci, 2000; Martens, Rocha, Martin, & Serrao, 2008). Furthermore, internal consistency estimates have been shown to be adequate (i.e., $\alpha > .80$ reported across subscales; Cooper, 1994; Cooper et al., 1992; MacLean & Lecci, 2000; Simons, Correia, Carey, & Borsari, 1998).

Rutgers Alcohol Problem Index (RAPI: White & Labouvie, 1989). The RAPI was

created to assess for frequency of alcohol-related negative consequences using 23-items.

Respondents were asked to indicate the frequency in which they experienced specific

alcohol-related negative consequences in the past year (e.g., "Passed out or fainted

suddenly.") using a Likert-type scale: 0 *(never)* to 4 *(more than 10 times)*. Research has

indicated good overall fit for a unidimensional model (White & Labouvie, 1989).

Additionally, internal consistency estimates (i.e., usually $\alpha > .80$ reported) have been

shown to be adequate (Devos-Comby & Lange, 2008; Marlatt et al., 1998; Neighbors,

Larimer, & Lewis, 2004).

Analytic Strategy

Preliminary analyses. The purpose of these analyses was to identify and retain the

three most discriminating items within each subscale of the Drinking Motives

Questionnaire-Revised (DMQ-R: Cooper, 1994). By identifying the most discriminating

items, only those items with adequate response rates that provide the most information

regarding the latent constructs were included in the analysis. This approach has the

potential to increase the likelihood of LTA convergence of complex models with less

parameter bias through selecting the highest quality indicators for the analysis.

Furthermore, variable-centered approaches have produced important theoretical

underpinnings in which to understand drinking motives. Through using variable-centered

approaches, the best fitting measurement model was determined to ensure the items used

were the most representative of the latent constructs. Therefore, a confirmatory factor

analysis (CFA) was conducted using Mplus version 7.2 (Muthén & Muthén, 2012) prior

to and after IRT analyses to compare model fit indices and verify the factor structure of

the DMQ-R. Once the factor structure of the DMQ-R was established using CFA, IRT analyses were performed using IRTPRO (Cai, Thissen, & du Toit, 2011). Since one of the assumptions of IRT asserts that measures maintain unidimensionality, each subscale was examined with separate IRT analyses. After examining all items in a subscale, two items were removed based on corresponding discrimination parameters. Another CFA and subsequent reliability of scores analyses were then conducted to verify that factor structure and model fit was maintained.

CFA was performed with the maximum likelihood estimator, as this is appropriate for continuous indicators (Muthén & Muthén, 2012). To examine model fit, the following fit indices were used: Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). In general, values of CFI and TLI ≥ 0.95, RMSEA ≤ 0.08, and SRMR ≤ 0.08 indicate adequate to good model fit (Hu & Bentler, 1999). Subsequent analyses assessing reliability of scores were conducted after each CFA using SPSS version 20.

After the CFA was performed, IRT analyses were conducted on DMQ-R subscales at each time point to estimate discrimination parameters for each item, remove two items from each subscale, and evaluate the total information provided by the remaining three items along the continuum of the latent trait (e.g., coping). The Graded Response Model (GRM: Samejima, 1969) was fit, as this model is appropriate when item responses are considered ordered, categorical responses (e.g., Likert rating scales). In the GRM, each item has one discrimination parameter and four difficulty parameters (i.e., number of response categories minus one: Embretson & Reise, 2000). The discrimination parameter is used to identify the strength of the relationship between an item and the

latent construct, where the difficulty parameters indicate the frequency at which an item category is endorsed such that the probability of endorsing above the category threshold of an item is 50%.

To assess item fit, the discrimination parameter (θ-Theta: Cai et al., 2011) was examined and those items with the lowest discrimination parameters were removed using the following guidelines: moderate = 0.65-1.34, high = 1.35-1.69 (Baker, 2001). In some instances, item discrimination parameters may all appear in the "high" range; thus, the lowest threshold parameter was identified and the item was removed from subsequent analyses. Additionally, overall model fit was assessed using the M_2 goodness-of-fit statistic (non-significant indicates adequate model fit), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Root Mean Square Error of Approximation (RMSEA: values $\leq$ 0.08 indicate good fit: Kline, 2011).

Person-centered analysis. The LPA and LTA were performed to determine the underlying person-centered patterns of drinking motives and understand to what extent these patterns change across measurement occasions. LPA and LTA have been designed to identify the latent structure underlying observed data, where LTA examines the stability/movement of individuals within the latent structure across measurement occasions (Collins & Lanza, 2010).

The LPA was used to estimate the latent structure of drinking motives using 12-indicators from the DMQ-R. This was a preliminary analysis to examine the latent class structure at each time point and provided confirmation and direction for the number of classes used in later longitudinal analyses (Collins & Lanza, 2010). Latent profile analysis was appropriate due to treating the ordered categorical response options for each

indicator (i.e., Likert scale responses from 1 to 5) as continuous. Latent class analysis was not performed, as the contingency table for five response options was too large a computation and resulted in model nonconvergence even after reducing the model to 12 indicators. LPA prevalence was produced through estimated probabilities that an individual would be in a specific latent class and parameters based on a set of item-response probabilities that were linked to a latent class (Collins & Lanza, 2010; Nylund, Asparouhov, & Muthén, 2007). In essence, latent class prevalence indicates the probability of an individual's membership in a given latent class and the item-response probabilities specify the probability that a specific response pattern within a variable is conditional on latent class membership. In this study, the membership probability for each latent class was based on the motive profile and the item-response probabilities were based on motive items while aiding in the interpretation and labeling of each latent class.

Selecting the latent class structure was based on a combination of several criteria including statistical information criteria (e.g., AIC, BIC; Adjusted BIC), Entropy (i.e., overall degree of classification uncertainty: Celeux & Soromenho, 1996), bootstrapped likelihood ratio test (BLRT: McLachlan & Peel, 2000; i.e., statistically significant values suggest current model is preferred over a model with one less class), Lo-Mendell-Rubin (LMR: Lo, Mendell, & Rubin, 2001; i.e., significant *p*-values suggest current model preferred to model with on less class), and theory. Additionally, fit indices such as BIC and AIC are considered better when values are lower. Although not a measure of fit, entropy is considered better when values are closer to 1 (Celeux & Soromenho, 1996). Research has suggested that BIC and BLRT are the best indicators for class structure above the others (Hagenaars & McCutcheon, 2002; Vermunt & Magidson, 2004; Nylund

et al., 2007). In the current study, the model was chosen using a balance between parsimony, theoretical interpretability, and goodness of fit.

After identifying the number of latent profiles at each time point, a LTA was conducted to estimate the probability of staying in or moving out of a latent class across measurement occasions (Collins & Lanza, 2010). The current study used baseline measures to conduct the LPA and added two additional measurement occasions, 6 month follow-up and 12-month follow-up, to the LTA. Measurement invariance (MI) was tested to identify if the profiles changed in size and number across time (Collins & Lanza, 2010; Wang & Wang, 2012). Full MI has the ability to ease the computational burden due to fewer parameters being estimated and interpretation, as the meaning of the classes does not change. With multiple time points, full MI can be difficult to obtain. Thus, partial MI tests have fewer restrictions by constraining only some of the parameters across time can provide important information regarding the stability of specific characteristics at each time point. Comparisons of each model were conducted using a modified Chi-square difference test based on loglikelihood values (Wang & Wang, 2012). The relation of motive classification across time was examined by adding alcohol problems and alcohol use as covariates. Additionally, moderation effects were assessed, where drinks per week (DPW) moderated the relation of latent class membership at each time point (see Appendix C, Figure 1). Since DPW was continuous, the probabilities were examined in relation to the mean and 1 standard deviation above the mean to determine the effect of high-risk drinking behaviors and transitioning between latent classes at each time point.

Chapter III

Results

Preliminary Analyses

Descriptive Statistics. Means, standard deviations, and correlations for measured variables at each time point are presented in Appendix B, Tables 2-4. On average, participants drank 16.95 (*SD* = 15.89) DPW at baseline, 17.47 (*SD* = 15.68) at 6-month follow-up, and 17.84 (*SD* = 15.72) at 12-month follow-up. Mean scores on the RAPI were 9.10 (*SD*=9.98) at baseline, 9.18 (*SD* = 13.04) at 6-month follow-up, and 10.45 (*SD* = 15.94) at 12-month follow-up. Bivariate correlations among drinking motive items, alcohol-related problems scores, and alcohol use were in the expected directions. Additionally, due to attrition at 6-month and 12-month follow-up, t-tests were conducted to determine differences in covariates DPW and RAPI scores. There were significant differences in DPW at 12-month follow-up: $t(424) = 2.48$, p < 0.05. No significant differences were found among RAPI scores.

Preliminary CFA. Prior to conducting IRT analyses, a CFA was performed using all 20 items of the DMQ-R (Cooper et al., 1994). Results indicated the four-factor model fit the data adequately across time points (see Appendix B, Table 5). Additionally, reliability of scores (see Appendix B, Table 6) were adequate across subscales with Cronbach's alphas ranging from 0.83 (Coping/Conformity) to 0.89 (Social) including all items across time points. Intraclass correlation coefficients with five items per subscale ranged from 0.70 (Conformity) to 0.90 (Enhancement) across time points.

IRT Analyses. Results for the coping subscale at each time point indicated that all items achieved moderate to high discrimination parameters (See Appendix B, Table 7)

ranging from 1.19 ("Because you feel more self-confident and sure of yourself",

Baseline) to 8.95 ("To forget about your problems", Baseline). Across all time points,

"Because you feel more self-confident and sure of yourself" had the lowest

discrimination parameter and was removed from further analyses. Additionally, "To

cheer up when you are in a bad mood" had the second lowest discrimination parameters

ranging from 2.27 (Baseline) to 2.92 (12-month follow-up). Thus, "To cheer up when

you are in a bad mood" was removed from subsequent analyses. Furthermore, overall

model fit statistics for the coping subscale were calculated for each analysis at each time

point (see Appendix B, Table 7). Results indicated inconsistent fit across time points as

coping items were removed, where the 3-item subscale AIC and BIC values decreased

across time points indicating better model fit. However, RMSEA values ranged from .05

(Baseline, 5-items) to 0.12 (12-month follow-up, 3-items). Upon further examination,

zero respondents endorsed "To forget your worries," category 5 (Almost

Always/Always) at 12-month follow-up. This lack of endorsement appeared to affect

overall model fit and caused it to be less than adequate at the third time point, as

indicated by RMSEA values ranging from 0.08 (adequate: 5 items) to 0.12 (poor: 3

items).

Results from the IRT analysis of 5-items within the social subscale discrimination

parameters ranged from 1.42 ("To celebrate a special occasion with friends," Baseline) to

5.83 ("Because it improves parties and celebrations," 12-month follow-up: see Appendix

B, Table 8). Although discrimination parameters were maintained at the "high" level, the

items with the lowest values (e.g., from Baseline = 1.42 to 12-month follow-up = 1.51)

across time points were removed: "To celebrate a special occasion with friends." and

"To be sociable". Additionally, overall fit indices such as RMSEA were inconsistent across time points ranging from 0.08 (adequate: Baseline, 3-items and 12-month follow-up, 5- and 3-items) to 0.19 (poor: 6-month follow-up, 5-items). RMSEA values were better when estimating the 3-item subscale, where values reached 0.08 at baseline and 12-month follow-up suggesting adequate fit. Moreover, AIC and BIC decreased after reduction to 3-items across time points.

For the enhancement subscale, discrimination values (see Appendix B, Table 9) with 5-items ranged from 1.15 ("To get high," 6-month follow-up) to 4.82 ("Because it gives you a pleasant feeling," Baseline). Across time points, the "To get high" item had the lowest discrimination parameters (1.15: 6-month follow-up to 1.38: Baseline) and was removed from the subscale. Next, the item "Because it is exciting" was removed as discrimination values ranged from 1.44 (12-month follow-up) to 1.55 (Baseline). Overall model fit indices at baseline indicated adequate fit (M_2 (367) = 457.48, $p \leq 0.001$; RMSEA = 0.07). However, model fit declined across subsequent time points for 5-item and 3-item subscales with RMSEAs ≥ 0.10. AIC and BIC decreased at each time point after removal of items suggesting better fit.

The conformity subscale results (see Appendix B, Table 10) suggested that item "Because your friends pressure you to drink" was the least discriminatory across time points with values ranging from 1.28 (Baseline) to 1.97 (12-month follow-up). Thus, this item was removed from all other analyses. Additionally, the item "So that others won't kid you about not drinking" had the next lowest discrimination values across time points ranging from 2.03 (Baseline) to 3.46 (12-month follow-up). Overall model fit indices suggested the 3-item subscale had inconsistent model fit with RMSEA values ranging

from 0.00 (good; Baseline, 3-items) to 0.09 (poor; 12-month follow-up). Furthermore, AIC and BIC decreased at each time point after reducing the subscale to 3-items, which indicated better overall model fit.

   Post-hoc CFA. After conducting IRT analyses and removing less discriminating items, the 12-item measure had better model fit than the original 20-item questionnaire across all time points (see Appendix B, Table 5). Internal consistency estimates for scores including three items increased for all subscales and ranged from 0.85 (Conformity) to 0.91 (Social) across time points. Intraclass correlation coefficients decreased slightly when using three items per subscale ranging from 0.69 (Conformity) to 0.88 (Enhancement).

   In sum, the purpose of the following IRT analysis was to identify the three most discriminating items within each subscale of the DMQ-R. Overall, results indicated the lowest discrimination parameters across subscales were in the moderate to high range. The two items with the lowest discrimination parameters were removed from each subscale resulting in a reduced 12-item measure. The overall model fit indices for the IRT models were inconsistent across subscales and time points, where the M_2 statistics were all significant indicating poor fit, RMSEA values ranged from good to poor fit, and AIC/BIC values decreased with the remaining 3-item subscales indicating better fit than 5-item subscales. However, CFA analyses suggested the 3-item subscales had better model fit and reliability of scores than the original 20-item measure. Although the intraclass correlation coefficients were lower on the coping, enhancement, and conformity subscales, the values only decreased by two points between the 5-item and 3-item subscales.

Person-Centered Analyses

  Latent Profile Analysis (LPA). LPA analyses were conducted using the 12-items

retained from the IRT analysis. See Appendix C, Figures 2-4 for standardized means of

item response probabilities at each time point, see Appendix B, Table 11 for fit indices

including 2- through 5-group solutions, and Appendix B, Table 12 for percent of sample

within each profile across time points. Results suggested the 3-group solution provided

the best balance of fit and parsimony across time points: baseline (entropy = 0.94, BLRT:

$p < 0.001$, LMR: $p = 0.113$); 6-month follow-up (entropy = 0.94, BLRT: $p < 0.001$,

LMR: $p < 0.001$), and 12-month follow-up (entropy = 0.94, BLRT: $p < 0.001$, LMR: $p <$

0.01). Although AIC, BIC, and Adjusted BIC continued to decline through analysis of 5-

group models, less than 5% of the sample was represented in the fourth/fifth group at a

minimum of one time point, which suggests instability of profiles within the LPA

(Muthén & Muthén, 2000). Additionally, profiles within the 3-group solutions yielded

better theoretical fit at Baseline, 6-month, and 12-month follow-up. There were

disagreements between BLRT and LMR values with a 2-group solution at Baseline

lacking clear theoretical delineations across time points. However, the 3-group solution

showed more consistent model fit at 6-month and 12-month follow-up, as indicated by

LMR values. At baseline, individuals who had lower endorsement across all motives

were identified as Low Motive endorsers and comprised 38.7% of the baseline sample,

34.5% at 6-month follow-up, and 39.4% at 12-month follow-up. Another 50.4% of the

sample at baseline had high endorsement of social and enhancement motives (i.e.,

motives that reinforce positive affect and social interactions) and low endorsement of

coping and conformity motives and labeled Positive Reinforcing Motive, with 54.6% at

6-month follow-up and 47% at 12-month follow-up. Finally, at baseline/6-month follow-up 10.9% and at 12-month follow-up 13.6% of the sample highly endorsed all motives and was termed High Motive.

Latent Transition Analysis. Initially, LTA models were conducted without covariates to examine model fit. Results indicated a 3-class solution at each time point fit the data best. Models with more than three classes resulted in model nonconvergence.

Findings indicated that full MI (i.e., latent class probabilities constrained to be equal over time) was not appropriate (modified Chi-square difference test: χ^2=131.19, *df* = 72, *p* < .01). Thus, additional analyses were conducted to examine partial MI by constraining specific classes across time. For example, the Low Motive class was constrained at each time point while the other two classes were freely estimated. Results suggested that the partial MI and full MI restricted models did not fit the data above and beyond full measurement noninvariance (*ps* < 0.05). Due to the finding in the cross-sectional evaluation of latent profiles at each time point, the results related to measurement noninvariance were consistent considering the finding of a fourth profile at Time 2 and Time 3 that did not have a strong theoretical underpinning in relation to the other classes. Thus, subsequent analyses were conducted with full measurement noninvariance.

Model excluding covariates. Results indicated that 56% of the sample remained in the same latent class from Time 1 through Time 3: 3% High Motive, 31% Positive Reinforcing Motive, and 22% Low Motive. Estimated transition probabilities across classes of drinking motives at each time point are presented in Appendix B, Table 13. The probabilities on the diagonal represent no change across time points. Overall, the

Low Motive and Positive Reinforcing Motive classes were more stable across time, where between 73%-78% remained stationary between two consecutive intervals: Baseline to 6-month follow-up, 78% of the Positive Reinforcing Motive class 0.78 (OR = 2.57, 95% CI, 1.76, 3.38, p < .01), 31% in the High Motive class (OR = 3.71, 95% CI, 1.26, 6.17, p < .05), and 74% Low Motive class. Similarly, between 6-month follow-up and 12-month follow-up 75% of the Positive Reinforcing Motive class (OR = 3.06, 95% CI 1.91, 4.21, p < .01), 68% of the High Motive class (OR = 5.99, 95% CI, 2.45, 9.53, p < .01), and 73% of the Low Motive class did not transition. In contrast, 57% transitioned from the High Motive class to the Positive Reinforcing Motive class and 12% to the Low Motive class from Baseline to 6-month follow-up, but 24% of the Positive Reinforcing Motive and 8% of the Low Motive classes transitioned from High Motive class between 6-month follow-up and 12-month follow-up.

Main effects of covariates. Covariates were added next to examine whether alcohol use and alcohol related problems predicted class membership at each time point with Low Motive as the reference class (see Appendix B, Table 14). Results suggested that alcohol problem scores predicted increased odds of being in the High Motive class (Baseline: OR = 1.12, $p < 0.001$; 12-month follow-up: OR = 1.07, $p < 0.001$) and Positive Reinforcing Motive class (Baseline: OR = 1.08, $p < 0.05$). Additionally, more drinks per week increased the odds of being in the Positive Reinforcing Motive class at Baseline (OR = 1.05, $p < .001$).

Interaction effects. See Appendix B, Tables 15-16 for the moderation effect of DPW on transition probabilities. In general, DPW at 6-month follow-up was associated with being in the High Motive class at 12-month follow-up (OR = 0.93, $p < 0.05$).

Transition probabilities were examined based on DPW mean versus +1 standard deviation above the mean. Findings suggested that transition probabilities from Baseline to 6-month follow-up were not associated with level of drinking. However, the transition from 6-month follow-up and 12-month follow-up yielded significant effects related to higher levels of drinking. Those with reported higher levels of drinking in the High Motive class at 6-month follow-up were less likely to transition out of that class (OR = 0.32, $p < 0.001$) or into the Positive Reinforcing Motive class (OR = 0.43, $p < 0.05$) at 12-month follow-up. For the Positive Reinforcing class, those who indicated higher levels of drinking at 6-month follow-up were also less likely to transition into the High Motive class at 12-month follow-up (OR = 0.44, $p < 0.05$).

Chapter 4

Discussion

The purpose of this study was to examine patterns of drinking motives using a longitudinal person-centered analytic approach. In general, individuals were classified as High, Low, and Positive Reinforcing Motive endorsers. Individuals that endorsed all motives and those endorsing positive reinforcing motives were more likely to drink more per week and experience alcohol related consequences than those in the Low motive class. Moreover, transitioning between High motive and Positive Reinforcing motive classes at 6-month follow-up and 12-month follow-up was significantly less likely for those reporting high levels of alcohol use. These findings also suggested individuals that endorse higher levels of positive reinforcing motives (e.g., High Motive and Positive Reinforcing Motive classes) have more stable beliefs and may be at risk for drinking more and experiencing negative consequences. By examining drinking motive patterns, this study provided evidence that motive classifications are relatively stable across time even when examining the effect of alcohol use.

Due to the extensive research regarding the motivational model using variable-centered approaches and the confirmation of the four-factor structure of the DMQ-R within the current study, the LTA extended the conceptual framework to include a continuum of beliefs about alcohol at the individual level. Results suggested that increased alcohol intake is associated with increased motive endorsement and more stable beliefs regarding the effects of alcohol. For example, as alcohol use increased High Motive and Positive Reinforcing Motive classes were associated with a higher likelihood

of staying in their respective class across time. Furthermore, both High and Positive

Reinforcing Motive classifications had higher endorsement for items reinforcing the

positive aspects of alcohol, which may be related to the increased likelihood of staying in

the same class across time. Another possible explanation could be that the High Motive

class encompasses more positive beliefs in regard to the effects of alcohol than those in

the Positive Reinforcing class, thus, the stronger the belief becomes in alcohol's ability to

ameliorate negative affect and increase positive affect. Indeed, this was represented by

the largest percentage of individuals transitioning across time between High and Positive

Reinforcing Motive classes as opposed to transitioning into or out of the Low Motive

class.

Although studies have been inconsistent when examining drinking motives

regarding enhancing positive mood and coping with negative mood in relation to alcohol

consumption (Anderson, Briggs, & White, 2013; Crutzen, Kuntsche, & Schelleman-

Offermans, 2013; Kuntsche et al., 2005), one consistent finding in person-centered

approaches has been that positive reinforcing motives are associated with alcohol-related

outcomes (Coffman et al., 2007 & Kuntsche et al., 2010). Similarly, the current study

found that endorsement of positive reinforcing motives from the enhancement and social

subscales were associated with higher levels of alcohol use and experience of negative

consequences, as indicated by those in the High and Positive Reinforcing Motive classes.

Although results were similar across studies, the current study provided a nuanced

understanding of alcohol motives, where items were included in the analyses as opposed

to using sum/composite scores for each subscale. Additionally, through using this

approach the classes represented a full continuum of motives including social and

conformity motives, which have been excluded in other studies (e.g., Kuntsche et al., 2010; Littlefield et al., 2011). This study has provided support for inclusion of these subscale items (social and conformity) in future research, as they may be indicative of high risk alcohol use and increase stability of beliefs when conceptualized as existing on a motive continuum. Extant research has used variable-centered approaches and yielded few unique relationships with social and conformity subscales to alcohol outcomes. However, when examined on a continuum, these motive items could have predictive utility, as they represent motives within a more holistic theoretical context. For example, social and enhancement motive items, when studied together appear to be more closely related to positive reinforcing aspects of alcohol and may be better conceptualized on a continuum. This could be one explanation for the inconsistent findings related to alcohol outcomes when using variable-centered approaches. In essence, studying motive items using person-centered approaches has highlighted the subtler effects of conformity and social motive items in relation to alcohol-related outcomes that are not as evident when examining them as separate motive domains.

Results from the current study also provided a more nuanced picture of the DMQ-R subscale properties. The psychometric properties of the DMQ-R in terms of traditional measures of reliability and validity have been well documented (e.g., Cooper et al., 1992; Cooper, 1994). Findings of the IRT analyses were inconsistent regarding overall model fit, where the full measure had better fit than the reduced measure across subscales and time-points. However, the results varied across subscales. Hypothetically, the reduction of the subscale to include only those items that best represent the construct would result in better fit, but this was not obtained as indicated by overall model fit indices. In

contrast, the CFA suggested the reduced item subscales resulted in a better fitting measurement model than the full item subscales. This has provided an example of how our current psychometric analytic frameworks have limitations in providing robust, holistic understanding of the construct(s) being measured. Additionally, the purpose of these analyses was to develop a measurement model that would provide a more stable person-centered longitudinal analysis. Results, though, indicated measurement invariance was not supported. This could be a representation of the differences in response patterns at the first time point that yielded one less profile, was less theoretically interpretable, and may represent the "maturing out" process, where young adulthood is a time of high risk drinking that decreases as individuals enter adulthood (e.g., Littlefield, Sher, & Wood, 2009). The changing pattern in alcohol use from adolescence to adulthood has implications in how we establish valid/reliable assessments to help with the development and implementation of interventions especially during the transition period to adulthood that occurs within the college student population.

Limitations. Several factors have affected the generalizability of the current results to a broader population. First, this was a high-risk sample that had been mandated to an alcohol intervention. Although understanding high-risk populations has important implications for development of interventions, the broader population may not endorse motives in the same pattern. Considering the analyses conducted were also exploratory, there could be more models that would fit the data better than what was found in this study. Finally, a majority of the sample was Caucasian, male, and freshman/sophomores living on campus. Again, this sample highlights a higher-risk population in general due to living on campus and consisting of a younger cohort that has been shown to engage in

increased levels of alcohol use leading to an increase in alcohol related negative

consequences (White, McMorris, Catalano, Fleming, Haggerty, et al., 2006). For the

purpose of the current study, the measurement model fit the data well using three items

per subscale, but should not be considered as support for solely using this as an

assessment tool. The results of the LPA and LTA would benefit from future

confirmatory studies, as there could be better fitting models when using a more diverse

sample.

   Clinical implications and future directions. There are important clinical

implications regarding the findings of this study. Specifically, drinking motives appear to

be relatively stable across time for this high-risk sample. In intervention programs,

clinicians and researchers would benefit from using motives to inform conceptualizations

of high-risk college drinkers. Instead of personalized feedback provided via pdf or

computer, conducting face-to-face brief motivational interventions could be more

effective for those individuals with a higher risk, more stable motive profile. These

beliefs could be challenged and discussed with the use of Motivational Interviewing

(Miller & Rollnick, 2012) interventions such as highlighting discrepancy among motives

and negative consequences. Another possible direction for clinicians and researchers

includes intervening with adolescents and young adults while they are still in

primary/secondary school. For example, in college student samples, the motives related

to alcohol use might be more stable. Thus, incorporating motives in prevention and

intervention programs for adolescents and young adults when beliefs regarding the

effects of alcohol on mood and social interactions are more malleable could have more

impact on alcohol outcomes.

In the future, researchers would benefit from continuing to explore the stability of drinking motives over a longer period of time. For example, following college students upon entering college until graduation may provide a more robust understanding regarding the stability of drinking motives during this high risk time period. Additionally, extending these findings to predict adult health outcomes may provide insight into the beliefs that may affect the trajectory of alcohol dependence. Although longitudinal analyses provide important implications regarding trajectories, using person-centered approaches to replicate these findings in cross-sectional analysis can enhance and support the theoretical underpinnings of alcohol motives existing on a continuum, especially in regard to extant research identifying those motives that attenuate negative affect and enhance positive affect/interactions.

Conclusion. This study has implications regarding the longitudinal trajectory of drinking motives. Although the data were confined to a limited time period (e.g., 1 year), the information provided has implications regarding the stability of drinking motives across time. Additionally, the theoretical underpinnings regarding drinking motives would benefit from incorporating person-centered analytic approaches as it broadens our understanding through conceptualizing along a continuum as opposed to variable-centered approaches that are limited to specific domains. By extending this framework to include a continuum, we can better understand how to intervene and examine cognitions related to high risk drinking. Overall, we have the opportunity to create more effective interventions through identifying the developmental trajectory of those cognitions/beliefs/behaviors when they appear the most malleable.

Appendix A

Literature Review

Introduction

There continues to be a public health concern regarding the high rate of alcohol use and binge drinking that contributes to a variety of negative consequences within the college student population. Findings have suggested that college-bound students tend to increase frequency and quantity of drinking after their first year of college (Bingham, Shope, & Tang, 2005; Merline, Jager, & Schulenberg, 2008; White, Fleming, Kim, Catalano, & McMorris, 2008). Approximately 81% of college students have tried alcohol in their lifetime, 40% have drunk alcohol in the past 30-days, and 4% have drunk alcohol daily (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Furthermore, 36% - 40% of college students have reported engaging in binge drinking (i.e., 5+ drinks for men and 4+ drinks for females: Wechsler et al., 2002) and 14% reported engaging in excessive binge drinking (i.e., 10 or more drinks in a row: Johnston et al., 2011) in the preceding two weeks.

Excessive drinking among college students resulting in negative consequences has been shown to be widespread. A wide variety of consequences have been identified as well as shown to have a relation to excessive drinking within the college student population (Abbey, Saenz, & Buck, 2005; Hingson, Zha, & Weitzman, 2009; Park, 2004). Students who engage in such drinking practices have been shown to be at increased risk for negative consequences including assault, injury, and even death, where approximately 1,800 deaths, 600,000 injuries, 646,000 assaults, and 97,000 sexual assaults occur each year in this population as a result of alcohol use (Hingson et al.,

2009). In addition to these severe negative consequences, college students who binge

drink have been shown to be more likely to engage in illicit drug use (Herman-Stahl,

Krebs, Kroutil, & Heller, 2007; Mohler-Kuo, Lee, & Wechsler, 2003). Research has also

suggested that college students who use alcohol excessively are at increased risk of

meeting diagnostic criteria for an alcohol use disorder (Dawson, Grant, Stinson, Chou,

2004; Knight et al., 2004; Slutske, 2005; Wu, Pilowsky, Schlenger, & Hasin, 2007),

where one study found 21% of full-time college students and 19% of part-time college

students met criteria for an alcohol use disorder (Wu et al., 2007). In sum, college

students have been shown to be a high-risk population for alcohol use and alcohol-related

negative consequences.

Identifying possible predictor variables associated with excessive alcohol use and

alcohol-related negative consequences is important in informing the development of

theoretical frameworks that can aid in the conceptualization of high-risk drinking among

college students. By understanding the possible predictors of high risk drinking within a

theoretical framework, researchers and clinicians can create targeted interventions to

reduce alcohol-related negative consequences. There are specific predictor variables

associated with excessive alcohol use and negative consequences in the college student

population including individual factors, environmental factors, and social factors (Cox &

Klinger, 2002; Hawkins, Catalano, & Arthur, 2002; Hawkins, Catalano, & Miller, 1992;

Wechsler, Dowdall, Davenport, & Castillo, 1995). Identification of factors such as these

that can be targeted to ameliorate the effects of excessive alcohol use has led to the

development of interventions such as the Brief Alcohol Screening and Intervention for

College Students (BASICS: Dimeff, Baer, Kivlahan, & Marlatt, 1999), which have been

shown to reduce alcohol-use and alcohol-related negative consequences. How we conceptualize and understand excessive drinking within this population is to take an additive approach by combining our understanding of predictive factors within theoretical frameworks.

Several theories have been posited in order to better understand high-risk drinking among college students. Developmental theories have postulated the transition from high school to college as a time of exploration and growing autonomy for adolescents (Arnett, 2005; Schulenberg & Maggs, 2002; Schulenberg et al., 2001). Possible risk factors for alcohol use that have been associated with this developmental transition have been identified as increased stress, which can lead to the development of psychological disorders as well as the belief in a cultural norm that excessive alcohol use is a rite of passage in college (Prentice & Miller, 1993; Schulenberg & Maggs, 2002). Additionally, environmental models have indicated that the institutional culture has an impact on excessive alcohol use (Presley, Meilman, & Leichliter, 2002; Weitzman, Folkman, Folkman, & Wechsler, 2003). Research has suggested environmental factors such as greek affiliation, athletics, on-campus living, pricing, and availability of alcohol are associated with students that participate in heavier alcohol consumption.

Furthermore, cognitive theories like the theory of planned behavior focus more on the attitudes toward the behavior and subjective norms, which are mediated by perceived behavioral control and occur as determinants of the behavior itself (Ajzen 1991; Armitage & Christian, 2003). In essence, an individual's attitude toward their own alcohol use and their perception of peer alcohol use will impact the quantity and frequency of their own alcohol use. For example, findings have suggested that students

who drink alcohol are more likely to believe their peers are more accepting of alcohol use and drink more alcohol than they do, while also believing they drink less than their peers, thus believing their own drinking is less problematic (Baer, 1994; Borsari & Carey, 2003; Perkins, 2002; Perkins & Wechsler, 1996). Research has indicated these biases regarding drinking may actually lead students to believe excessive alcohol use is normal within the college context, which leads to more problematic behavior and increased likelihood of alcohol-related negative consequences (Larimer, Turner, Mallett, & Geisner, 2004; Mattern & Neighbors, 2004; Neighbors, Larimer, & Lewis, 2004; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Neighbors et al., 2010; Neighbors, Lewis, Bergstrom, & Larimer, 2006; White, Fleming, Kim, Catalano, & McMorris, 2008). Additionally, expectancy theory has utilized a social learning framework from which to examine the motivations regarding substance use, where expectancies encompass the positive and negative beliefs (i.e., use experiences, perceived use experiences) that affect quantity and frequency of substance use (Jones, Corbin, & Fromme, 2002). Theoretical models related to cognitions such as attitudes and beliefs regarding alcohol use have been shown to mediate the effects of both individual and environmental factors and have been considered the final common pathway to the decision to use alcohol (Cooper, Frone, Russell, & Mudar, 1995; Cooper, Russell, Skinner, Frone, & Mudar, 1992; Cox & Klinger, 1988; McCarthy, Brown, Carr, & Wall, 2001; Wood, Read, Palfi, & Stevenson, 2001).

In sum, many factors have been associated with alcohol use within the college student population as identified through several theoretical frameworks. The transition from adolescence to emerging adulthood may be a potential risk factor for increased

alcohol use (Schulenberg et al., 2001). In combination with the institutional culture, the college student population has been shown to engage in high-risk drinking, which leads to alcohol-related negative consequences. Moreover, the biased attitudes and beliefs regarding alcohol in the social environment of college, adds to the risk of excessive alcohol use.

Motivational Model

To better understand the underlying motivations of college student drinking, a more thorough examination of the theoretical underpinnings of cognitions related to positive and negative reinforcement in relation to alcohol use is necessary. Theoretical models related to cognitions such as expectancy theory and the motivational model have focused on the beliefs and attitudes individuals have regarding their alcohol use (Cox & Klinger, 1988; Jones et al., 2002; Newcomb, Chou, Bentler, & Huba, 1988). Although expectancy theory has important implications on alcohol use and related negative consequences, the motivational model explains expectancies as part of a larger model regarding the reasons individuals use alcohol. Drinking motives specifically have been shown to be associated with adolescent and college student alcohol use, alcohol-related negative consequences, and other drinking-related constructs such as protective behavioral strategies (e.g., Cooper et al., 2008; Kuntsche, Knibbe, Gmel, & Engels, 2005, 2006; Martens, Ferrier, & Cimini, 2007; MacLean & Lecci, 2000; Newcomb et al., 1988). The development of the motivational model was led by two seminal studies that identified how affect, incentives, and expectancies interact and lead to an individual's decision to use alcohol (Cox & Klinger, 1988) and the identification of specific motives associated with frequency of substance use (Newcomb et al., 1988).

Cox and Klinger (1988) indicated that addiction included a chemical aspect and a non-chemical aspect, where the non-chemical aspect referred to both positive and negative reinforcement in the context of motivation and emotion. Positive and negative reinforcement, known as incentive motivation, provided a theoretical framework targeting the cognitive and affective components of addiction. In essence, this model had conceptualized motives from the viewpoint of positive and negative reinforcement, where the motivation to drink arises due to the individual attempting to enhance positive affect or to reduce negative affect. One important aspect of the model was the idea of incentives. Individuals place value on and have expectancies about the incentives they will receive from their alcohol use. In this model, incentives are based on expectancies related to affective change, where individuals attempt to achieve positive incentives (e.g., alcohol use feels good) and avoid negative incentives (e.g., alcohol-related negative consequences). The motivational model posited by Cox and Klinger (1988) claimed individuals choose to drink based on a cost/benefit analysis of the expected affective consequences of drinking and not drinking. By combining cognitive factors related to social learning like reinforcement, incentive, and expectancy, a new perspective of underlying cognitions beyond the chemical component of addiction had been developed.

Moreover, Newcomb and colleagues (1988) specified more precisely the possible motivations involved in the decision to use alcohol. Although a theoretical motivational model had been developed (Cox & Klinger, 1988), research had not examined the predictive utility of a motivational model. In order to examine the construct of motivation, Newcomb and colleagues (1998) developed a measure to determine whether motivations were related to substance use. Four specific motivations were identified for

alcohol use: to reduce negative affect (i.e., "get rid of anxiety or tension"), enhance

positive affect and creativity (i.e., "feel better about myself"), social cohesion (i.e., "feel

good around people), and addiction (i.e., "helps me get through the day"). Findings

suggested individuals who reported more motives for using were more likely to use more

frequently. More recently, researchers have continued to refer to the motivational model

developed by Cox and Klinger (1988) and have continued to refine the construct of

alcohol motives within the context of college student drinking (Cooper, 1994; Cooper et

al., 1995; Cooper et al., 2008; Kuntsche et al., 2005, 2006; MacLean & Lecci, 2000).

Variable-centered approaches

In general, drinking motives have been examined extensively using variable-

centered approaches. When using variable-centered approaches, the variable of concern

becomes the main focus of the theoretical and analytical unit (Bergman & Magnusson,

1997). This approach is based on the assumption that the population is homogeneous and

the variables of interest are described by their associations as studied across individuals.

For example, one of the most commonly used measures for assessing motives, the

Drinking Motives Questionnaire (Cooper et al., 1992; Cooper, 1994) was developed and

validated using exploratory and confirmatory factor analysis. Four latent variables were

identified – coping, enhancement, social, and conformity – and have been the analytic

unit of focus, which has been the leading approach to drinking motive theory

development to date. The four latent variables have been represented as both positive

(social and enhancement) and negative (coping and conformity) reinforcing reasons for

drinking. This line of research has found that drinking motives are associated with

alcohol use, alcohol-related problems, and other alcohol-related constructs such as

protective behavioral strategies and personality (Cooper et al., 2008; Kuntsche et al., 2005, 2006; Martens et al., 2007; MacLean & Lecci, 2000; Newcombe et al., 1988; Stewart, Zvolensky, & Eifert, 2001). Findings have suggested social motives, coping motives, and enhancement motives are associated with alcohol use in general. Additionally, studies have identified weak associations between conformity motives and alcohol use and alcohol-related problems (Ham, Zamboanga, Bacon, & Garcia, 2009; Kuntsche & Cooper, 2010; Martens, et al., 2008).

  Social and Conformity Motives. Social motives have been defined as drinking motives that represent the positive, external social rewards gained when drinking (Cox & Klinger, 1990). Items within the DMQ-R used to assess social motives include phrases that focus on the enjoyment of being in social situations while consuming alcohol (Cooper, 1994). Findings have indicated that social motives are associated with moderate alcohol use and individuals who are more likely to endorse social motives have been shown to be less likely to experience alcohol related negative consequences (Cooper, 1994; Kuntsche & Cooper, 2010; Labouvie & Bates, 2002; Simons et al., 2000; Windle, 1996). In a review conducted by Kuntsche and colleagues (2005), social motives were the most often reported reason in engaging in alcohol use among adolescents and were most associated with moderate drinking. Thus, research has consistently shown that social motives are related to alcohol use that is less likely to result in alcohol related negative consequences. In order to assess the external, negative reinforcement of social interactions, conformity motives such as social pressure to drink alcohol were developed (Cox & Klinger, 1990). Cooper (1994) developed items to measure conformity with phrases such as "To be liked" or "So you won't feel left out". The research regarding

conformity motives and their association with alcohol-related outcomes has been inconsistent (Cooper, 1994; Ham et al., 2009; Kuntsche & Cooper, 2010; Merrill & Read, 2010; Martens et al., 2008).   Studies have indicated that conformity motives are less likely to be endorsed and are weakly associated with alcohol-related outcomes (e.g., Kuntsche & Cooper, 2010; Martens et al., 2008). In one study, though, conformity motives were associated with specific alcohol-related problems such as poor self-care, physiological dependence, diminished self-perception, and impaired control, but not alcohol use (Merrill & Read, 2010).

    Coping and Enhancement Motives. To examine the negative, internal reinforcement associated with alcohol use, coping motives were designed to assess the reasons to drink that attenuate negative affect (Cox & Klinger, 1990). In contrast to social and conformity motives, coping motives are related to high risk drinking such as increased quantity and frequency of use (Cooper, 1994; Cooper et al., 2000; Borsari & Carey, 2003; Kassell et al., 2000; LaBouvie & Bates, 2002; Windle, 1996). Furthermore, coping motives have been consistently associated with alcohol related negative consequences (Carey & Correia, 1997; Cooper et al., 1995; Kassel et al., 2000; Neighbors et al., 2007; Simons et al., 2000; Stewart et al., 2001). Kuntsche and colleagues (2005) noted that coping motives were more likely to be associated with heavy drinking and alcohol related negative consequences above and beyond other motives. In one study, coping motives were related to alcohol problems, even after controlling for age, gender, and alcohol use quantity and frequency (Kassel et al., 2000).   Additionally, the external, positive reinforcement associated with reasons to use alcohol use has been identified as enhancement motives (Cox & Klinger, 1990). These motives represent the use of alcohol

to increase positive affect such as to have fun (Cooper et al., 1992). Research has indicated enhancement motives are related to alcohol use (Cooper, 1994; Cooper et al., 2000; Borsari & Carey, 2003; LaBouvie & Bates, 2002; Windle, 1996). However, they have been less consistently related to alcohol-related negative consequences, where some studies have found a strong relationship with alcohol-related problems (Cooper, 1994; LaBouvie & Bates, 2002) and others have not (Read et al., 2003; Simons et. al., 2000).

 Longitudinal Analyses. Studies to date that have examined motives longitudinally in college students have yielded inconsistent results in predicting changes in alcohol-related outcomes (Armeli, Conner, Cullum, & Tennen, 2010; Beseler, Aharonovich, Keyes, & Hasin, 2008; Kuntsche, Knibbe, Gmel, & Engels, 2005; Littlefield, Sher, & Wood, 2010; Read et al., 2003). In one study examining the moderating effects of social, enhancement, and coping motives between changes in negative affect and drinking frequency, the moderating effects of coping motives had the weakest association with drinking frequency (Armeli et al., 2010). Findings for the moderating effects of social motives and enhancement motives indicated there were positive associations between negative affect and drinking frequency across time. Another study examining the mediational effects of motives suggested cognitive-affective and social-environmental variables have direct relations to alcohol use and alcohol-related negative consequences, where enhancement motives partially mediated the relationship with alcohol-use (Read et al., 2003). When examining changes in coping and enhancement motives in a first-year college cohort across 11 years, Littlefield and colleagues (2010) found changes in coping motives were predictive of alcohol problems and partially mediated the relationship between personality and alcohol-related negative consequences. These findings also

suggest motives along with personality may be instrumental in the developmental change in alcohol-related problems as college students move into adulthood.

In sum, variable-centered approaches have provided support for the Cox and Klinger (1988) model. Additionally, research has found that coping motives, enhancement motives, and social motives are consistently associated with alcohol-related outcomes. Conformity motives, however, have inconsistent relationships with alcohol-related outcomes despite their endorsement as a reason for drinking. In longitudinal analyses, there remains a paucity of research examining motives across time within the college student population. Of the studies conducted, findings have been inconsistent as to the affect motives have on drinking-related outcomes. Considering the transitional period of college and the 'maturing-out' (Littlefield et al., 2010) process of drinking in this time period, more research may aid in understanding what affect changes in drinking motives has in this population.

Person-centered Approaches

Although research has indicated strong associations between motives and alcohol-related outcomes using variable-centered analytic approaches, few studies have examined college student drinking motives utilizing person-centered analytic approaches such as latent class analysis or cluster analysis (Coffman, Patrick, Palen, Rhoades, & Ventura, 2007; Kuntsche, Knibbe, Engels, Gmel, 2010; Littlefield, Vergés, Rosinski, Steinly, & Sher, 2012). Person-oriented approaches examine the theoretical analytical unit as a pattern of operating factors (Bergman & Magnusson, 1997). In essence, this approach examines the patterns that emerge among individuals based on shared attributes of a heterogeneous population. Among the studies conducted, there have been inconsistent

findings regarding patterns of motive endorsement. These inconsistencies could be related to the use of multiple measures to assess motives, the use of latent variable mixture modeling, and the examination of specific latent variables such as coping and enhancement.

In one study conducted by Coffman and colleagues (2007), the authors utilized eight dichotomous items (e.g., "Experiment", "Good time", "Relax") assessed in the Monitoring the Future Survey to exemplify drinking motives. The latent class analysis suggested a four-class solution with the groups identified as Experimenters (i.e., more likely to endorse experimentation as a motive), Thrill-seekers (i.e., more likely to endorse items associated with social/enhancement motives), Multi-reasoners (i.e., more likely to endorse enhancement/coping type motives), and Relaxers (i.e., more likely to endorse relaxation motives), where high risk drinking was most associated with the Multi-reasoners class. Furthermore, drinking behaviors such as grade at initial use of alcohol, past-year frequency of drunkenness, and drinking before 4 PM, were included as covariates in the analysis. Findings suggested Experimenters were more likely to delay their initial use of alcohol, have fewer days of drunkenness, and less likely to drink before 4 PM. Multi-reasoners were the most likely to have an earlier initiation of alcohol use, most likely to get drunk, and most likely to report drinking early in the day.

In contrast, Kuntsche and colleagues (2010) conducted a k-means cluster analysis utilizing drinking motives assessed by the DMQ-R (Cooper, 1994). In this study, composite scores for coping and enhancement motives were utilized in the analysis. Findings suggested a two-cluster solution adequately identified risky drinking among adolescents based solely on enhancement and coping motives. Furthermore, coping

motives were associated with unsatisfactory relationships with family/peers and drinking alone; enhancement motives were associated with a higher frequency of risky drinking and increased likelihood for drinking with peers. However, Littlefield and colleagues (2012) conducted a modified version of the k- means cluster analysis similar to Kuntsche and colleagues (2010) and found no latent class structure of coping and enhancement motives, rather, they found these motives exist on a continuum associated with less severe to more severe alcohol related outcomes.

In conclusion, drinking motives have been identified as important predictors in understanding alcohol related outcomes within the college student population. Much of the research to date has focused on variable-centered approaches, which have provided theoretical frameworks in which to understand reasons for drinking. Motives associated with enhancement and coping reasons for drinking have been related to at-risk behaviors and alcohol-related outcomes (Kuntsche et al., 2005). Additionally, social motives have been associated with less severe drinking and conformity motives, although endorsed by adolescents, have not been shown to consistently relate to alcohol-related outcomes. However, person-centered approaches provide a more holistic analysis of individual response patterns in regard to possible motivations for alcohol use. Due to the limited number of studies examining college student patterns of motive endorsement, there has been an inconsistency in conceptualizing motives at the individual level using person-centered analytic methods. Additionally, fewer studies have examined drinking motivations utilizing person-centered longitudinal methodology. The use of latent transition analysis can provide another perspective of the longitudinal trajectory of individual endorsement of motives.

Appendix B

Tables

Table 1

Demographics

	Percent of Sample
Age	
18	34.3 (*n*=125)
19	45.0 (*n*=165)
20	17.4 (*n*=64)
21	3.0 (*n*=12)
22	0.3 (*n*=1)
Mean	18.90
Standard Deviation	0.81
Gender	
Male	55.6 (*n*=204)
Female	44.4 (*n*=163)
Class	
Freshman	45.0 (*n*=165)
Sophomore	37.1 (*n*=136)
Junior	16.3 (*n*=60)
Senior	1.6 (*n*=6)
Ethnicity	
Caucasian	83.4 (*n*=306)
Hispanic	6.5 (*n*=24)
Asian/Asian-American	3.8 (*n*=14)
Multiracial	3.8 (*n*=14)
Black	1.9 (*n*=7)
American Indian	0.3 (*n*=1)
Hawaiian/Pacific Islander	0.3 (*n*=1)

Table 2
DMQ-R item correlations, means, and standard deviations time 1

Items	Mean	SD	1	2	3	4	5	6	7	8	9
1 To forget your worries.	1.62	0.92	1.00								
2 Because your friends pressure you to drink.	1.43	0.75	0.30**	1.00							
3 Because it helps you enjoy a party.	3.21	1.24	0.17**	0.19**	1.00						
4 Because it helps you when you feel depressed or nervous.	1.59	1.00	0.68**	0.26**	0.17**	1.00					
5 To be sociable.	3.05	1.31	0.18**	0.19**	0.61**	0.19**	1.00				
6 To cheer up when you are in a bad mood.	1.94	1.11	0.51**	0.22**	0.29**	0.50**	0.31**	1.00			
7 Because you like the feeling.	3.44	1.29	0.09	-0.03	0.48**	0.11*	0.36**	0.32**	1.00		
8 So that others won't kid you about *not* drinking.	1.19	0.55	0.20**	0.48**	0.13*	0.22	0.15	0.24**	0.48**	1.00	
9 Because it's exciting.	2.60	1.32	0.12*	0.07	0.34**	0.12*	0.25**	0.27**	0.39**	0.11*	1.00
10 To get high.	1.95	1.29	0.24**	0.14**	0.30**	0.24**	0.25**	0.34**	0.48**	0.05	0.46**
11 Because it makes social gatherings more fun.	3.41	1.25	0.10	0.13*	0.71**	0.10*	0.59**	0.27**	0.54**	0.05	0.43**
12 To fit in with a group you like.	1.44	0.88	0.25**	0.38**	0.26**	0.27**	0.30**	0.28**	0.02	0.51**	0.19**
13 Because it gives you a pleasant feeling.	3.32	1.26	0.06	-0.02	0.49**	0.08	0.35**	0.30**	0.78**	-0.07	0.51**
14 Because it improves parties and celebrations.	3.35	1.26	0.11*	0.12*	0.72**	0.10	0.49**	0.30**	0.52**	0.06	0.47**
15 Because you feel more self-confident and sure of yourself.	2.16	1.29	0.31**	0.21**	0.41**	0.36**	0.44**	0.39**	0.31**	0.27**	0.35**
16 To celebrate a special occasion with friends.	3.54	1.10	0.01	0.06	0.41**	0.01	0.27**	0.21**	0.40**	-0.10	0.37**
17 To forget about your problems.	1.62	0.98	0.73**	0.21**	0.21**	0.64**	0.22**	0.67**	0.20**	0.22**	0.22**
18 Because it's fun.	3.70	1.22	0.09	0.08	0.48**	0.06	0.39**	0.27**	0.66**	-0.04	0.53**
19 To be liked.	1.28	0.72	0.24**	0.36**	0.17**	0.32**	0.25**	0.27**	0.04	0.41**	0.18**
20 So you won't feel left out.	1.44	0.88	0.33**	0.47**	0.25**	0.36**	0.33**	0.36**	0.11*	0.44**	0.23**
RAPI	9.03	9.88	0.26**	0.14**	0.33**	0.23**	0.23**	0.29**	0.29**	0.00	0.21**
DPW	16.80	15.66	-0.03	-0.04	0.26**	-0.05	0.18**	0.12*	0.28**	-0.05	0.20**
Gender			0.03	-0.01	0.08	-0.03	0.05	0.00	0.03	0.04	-0.02

Note: DPW = Drinks per week; SD = Standard Deviation; RAPI = Rutgers Alcohol Problem Index; **p < .01; *p < .05

Table 2 Continued
DMQ-R item correlations, means, and standard deviations time 1

Items	10	11	12	13	14	15	16	17	18	19	20	DPW	RAPI	Gender
10 To get high.	1.00													
11 Because it makes social gatherings more fun.	0.38**	1.00												
12 To fit in with a group you like.	0.21**	0.22**	1.00											
13 Because it gives you a pleasant feeling.	0.41**	0.61**	0.10*	1.00										
14 Because it improves parties and celebrations.	0.38**	0.83**	0.24**	0.61**	1.00									
15 Because you feel more self-confident and sure of yourself.	0.31**	0.43**	0.38**	0.39**	0.46**	1.00								
16 To celebrate a special occasion with friends.	0.18**	0.50**	0.09	0.45**	0.52**	0.19**	1.00							
17 To forget about your problems.	0.30**	0.19**	0.27**	0.16**	0.21**	0.40**	0.09	1.00						
18 Because it's fun.	0.41**	0.59**	0.10	0.72**	0.60**	0.36**	0.47**	0.17**	1.00					
19 To be liked.	0.17**	0.20**	0.63**	0.14**	0.22**	0.45**	0.06	0.27**	0.14**	1.00				
20 So you won't feel left out.	0.26**	0.28**	0.62**	0.16**	0.27**	0.44**	0.13*	0.35**	0.17**	0.73**	1.00			
DPW	0.21**	0.32**	-0.03	0.28**	0.24**	0.15**	0.24**	0.11*	0.28**	0.17**	-0.01	1.00		
RAPI	0.30**	0.29**	0.13*	0.26**	0.31**	0.00	0.21**	0.32**	0.26**	0.08	0.16**	0.47**	1.00	
Gender	0.01	0.12*	0.13*	0.09	0.14**	0.00	0.03	0.01	-0.03	0.13*	0.06	-0.03	-0.01	1.00

Note: DPW = Drinks per week; SD = Standard Deviation; RAPI = Rutgers Alcohol Problem Index, **p < .01; *p < .05

Table 3
DMQ-R item correlations, means, and standard deviations time 2

	Items	Mean	SD	1	2	3	4	5	6	7	8	9
1	To forget your worries.	1.67	0.93	1.00								
2	Because your friends pressure you to drink.	1.53	0.80	0.26**	1.00							
3	Because it helps you enjoy a party.	3.14	1.22	0.28**	0.08	1.00						
4	Because it helps you when you feel depressed or nervous.	1.57	0.95	0.70**	0.41**	0.24**	1.00					
5	To be sociable.	3.01	1.26	0.25**	0.12*	0.59**	0.23**	1.00				
6	To cheer up when you are in a bad mood.	1.97	1.10	0.55**	0.34**	0.31**	0.59**	0.33**	1.00			
7	Because you like the feeling.	3.47	1.28	0.19**	-0.07	0.47**	0.14**	0.30**	0.27**	1.00		
8	So that others won't kid you about *not* drinking.	1.29	0.73	0.24**	0.58**	0.08	0.39**	0.17*	0.32**	-0.06	1.00	
9	Because it's exciting.	2.75	1.31	0.20**	0.08	0.41**	0.18**	0.42**	0.25**	0.52**	0.13**	1.00
10	To get high.	2.17	1.32	0.27**	0.11*	0.31**	0.29**	0.24**	0.38**	0.40**	0.16**	0.47**
11	Because it makes social gatherings more fun.	3.29	1.23	0.15**	0.06	0.67**	0.20**	0.54**	0.27**	0.54**	0.10*	0.47**
12	To fit in with a group you like.	1.48	0.89	0.23**	0.46**	0.25**	0.39**	0.36**	0.30**	0.03	0.56**	0.22**
13	Because it gives you a pleasant feeling.	3.29	1.28	0.15**	-0.01	0.46**	0.15**	0.31**	0.25**	0.75**	0.07	0.53**
14	Because it improves parties and celebrations.	3.23	1.26	0.19**	0.08	0.68**	0.22**	0.48**	0.29**	0.56**	0.12*	0.54**
15	Because you feel more self-confident and sure of yourself.	2.24	1.25	0.42**	0.22**	0.43**	0.44**	0.47**	0.39**	0.33**	0.25**	0.36**
16	To celebrate a special occasion with friends.	3.39	1.14	0.05	0.04	0.41**	0.06	0.37**	0.22**	0.41**	0.09	0.38**
17	To forget about your problems.	1.66	0.96	0.72**	0.30**	0.26**	0.68**	0.26**	0.64**	0.21**	0.29**	0.26**
18	Because it's fun.	3.75	1.18	0.11*	-0.03	0.45**	0.07	0.29**	0.21**	0.69**	-0.02	0.55**
19	To be liked.	1.35	0.81	0.32**	0.48**	0.17**	0.51**	0.25**	0.36**	0.04	0.63**	0.25**
20	So you won't feel left out.	1.46	0.85	0.32**	0.53**	0.22**	0.43**	0.33**	0.36**	0.04	0.64**	0.24**
	DPW	17.41	15.49	0.10	-0.02	0.22**	0.10*	0.15**	0.13*	0.26**	0.04	0.23**
	RAPI	9.17	12.88	0.14**	0.15**	0.15**	0.21**	0.08	0.19**	0.13*	0.17**	0.15**
	Gender			-0.05	0.03	0.12*	0.03	0.04	-0.08	0.02	0.08	0.01

Note: DPW = Drinks Per Week; SD = Standard Deviation; RAPI = Rutgers Alcohol Problem Index; **p < .01; *p < .05

Table 3 Continued
DMQ-R item correlations, means, and standard deviations time 2

Items	10	11	12	13	14	15	16	17	18	19	20	DPW	RAPI	Gender
10 To get high.	1.00													
11 Because it makes social gatherings more fun.	0.35**	1.00												
12 To fit in with a group you like.	0.22**	0.22**	1.00											
13 Because it gives you a pleasant feeling.	0.42**	0.56**	0.12*	1.00										
14 Because it improves parties and celebrations.	0.35**	0.78**	0.24**	0.59**	1.00									
15 Because you feel more self-confident and sure of yourself.	0.31**	0.41**	0.40**	0.43**	0.52**	1.00								
16 To celebrate a special occasion with friends.	0.18**	0.48**	0.14**	0.43**	0.51**	0.27**	1.00							
17 To forget about your problems.	0.31**	0.20**	0.35**	0.20**	0.23**	0.41**	0.12*	1.00						
18 Because it's fun.	0.34**	0.53**	0.07	0.70**	0.61**	0.34**	0.53**	0.15**	1.00					
19 To be liked.	0.24**	0.14**	0.64**	0.12*	0.15**	0.40**	0.05	0.42**	0.02	1.00				
20 So you won't feel left out.	0.23**	0.21**	0.72**	0.11	0.22**	0.37**	0.11*	0.39**	0.05	0.77**	1.00			
DPW	0.25**	0.26**	0.11	0.28**	0.25**	0.18**	0.16**	0.21**	0.25**	0.12*	0.08	1.00		
RAPI	0.14**	0.14**	0.21**	0.15**	0.18**	0.22**	0.09	0.28**	0.13*	0.26**	0.28**	0.44**	1.00	
Gender	0.04	0.08	0.12*	0.01	0.09	0.01	-0.03	0.03	-0.03	0.09	0.06	-0.02	-0.09	1.00

Note: DPW = Drinks Per Week; SD = Standard Deviation; RAPI = Rutgers Alcohol Problem Index; **p < .01; *p < .05

Table 4
DMQ-R item correlations, means, and standard deviations time 3

	Items	Mean	SD	1	2	3	4	5	6	7	8	9
1	To forget your worries.	1.62	0.92	1.00								
2	Because your friends pressure you to drink.	1.43	0.75	0.36**	1.00							
3	Because it helps you enjoy a party.	3.21	1.24	0.23**	0.21**	1.00						
4	Because it helps you when you feel depressed or nervous.	1.59	1.00	0.65**	0.34**	0.66**	1.00					
5	To be sociable.	3.05	1.31	0.22**	0.24**	0.32**	0.20**	1.00				
6	To cheer up when you are in a bad mood.	1.94	1.11	0.59**	0.36**	0.49**	0.61**	0.34**	1.00			
7	Because you like the feeling.	3.44	1.29	0.15**	0.08	0.12*	0.12*	0.50**	0.28**	1.00		
8	So that others won't kid you about *not* drinking.	1.19	0.55	0.39**	0.54**	0.46**	0.40**	0.35**	0.31**	0.47**	1.00	
9	Because it's exciting.	2.60	1.32	0.19**	0.15**	0.38**	0.17**	0.30**	0.27**	0.38**	0.19**	1.00
10	To get high.	1.95	1.29	0.23**	0.20**	0.72**	0.23**	0.66**	0.28**	0.54**	0.13*	0.47**
11	Because it makes social gatherings more fun.	3.41	1.25	0.16**	0.17**	0.72**	0.12*	0.30**	0.28**	0.54**	0.01	0.48**
12	To fit in with a group you like.	1.44	0.88	0.32**	0.47**	0.25**	0.34**	0.23**	0.34**	0.03	0.55**	0.21**
13	Because it gives you a pleasant feeling.	3.32	1.26	0.14**	0.11*	0.51**	0.15**	0.47**	0.30**	0.78**	0.01	0.47**
14	Because it improves parties and celebrations.	3.35	1.26	0.15**	0.17**	0.73**	0.14**	0.63**	0.31**	0.58**	0.02	0.48**
15	Because you feel more self-confident and sure of yourself.	2.16	1.29	0.40**	0.30**	0.54**	0.42**	0.55**	0.45**	0.39**	0.13*	0.37**
16	To celebrate a special occasion with friends.	3.54	1.10	0.09	0.08	0.45**	0.07	0.46**	0.22**	0.50**	-0.05	0.37**
17	To forget about your problems.	1.62	0.98	0.64**	0.40**	0.24**	0.74**	0.22**	0.69**	0.15**	0.51**	0.25**
18	Because it's fun.	3.70	1.22	0.04	0.05	0.50**	0.04	0.47**	0.18**	0.70**	-0.06	0.50**
19	To be liked.	1.28	0.72	0.39**	0.44**	0.17**	0.48**	0.18**	0.37**	0.04	0.64**	0.22**
20	So you won't feel left out.	1.44	0.88	0.37**	0.55**	0.29**	0.41**	0.30**	0.33**	0.12*	0.55**	0.23**
	DPW	16.80	15.66	0.05	0.10*	0.25**	0.12*	0.18**	0.10	0.28**	-0.01	0.26**
	RAPI	9.03	9.88	0.18**	0.23**	0.19**	0.23**	0.17**	0.20**	0.15**	0.29**	0.25**
	Gender			-0.04	0.13*	0.07	0.05	0.05	-0.05	-0.07	0.14**	-0.02

Note: DPW = Drinks Per Week; SD = Standard Deviation; RAPI = Rutgers Alcohol Problem Index; **p < .01; *p < .05

Table 4 Continued
DMQ-R item correlations, means, and standard deviations time 3

Items	10	11	12	13	14	15	16	17	18	19	20	DPW	RAPI	Gender
10 To get high.	1.00													
11 Because it makes social gatherings more fun.	0.39**	1.00												
12 To fit in with a group you like.	0.21**	0.21**	1.00											
13 Because it gives you a pleasant feeling.	0.47**	0.60**	0.18**	1.00										
14 Because it improves parties and celebrations.	0.37**	0.86**	0.22**	0.64**	1.00									
15 Because you feel more self-confident and sure of yourself.	0.31**	0.49**	0.33**	0.40**	0.50**	1.00								
16 To celebrate a special occasion with friends.	0.27**	0.51**	0.11*	0.52**	0.55**	0.35**	1.00							
17 To forget about your problems.	0.26**	0.19**	0.45**	0.23**	0.18**	0.44**	0.09	1.00						
18 Because it's fun.	0.36**	0.64**	0.07	0.71**	0.65**	0.29**	0.54**	0.11*	1.00					
19 To be liked.	0.24**	0.11*	0.61**	0.10*	0.12*	0.31**	0.05	0.61**	0.04	1.00				
20 So you won't feel left out.	0.23**	0.21**	0.64**	0.19**	0.22**	0.39**	0.16**	0.49**	0.08	0.73**	1.00			
DPW	0.25**	0.26**	0.01	0.24**	0.29**	0.19**	0.20**	0.11*	0.26**	0.05	0.00	1.00		
RAPI	0.32**	0.19**	0.22**	0.15**	0.15**	0.23**	0.10	0.37**	0.16**	0.35**	0.22**	0.28**	1.00	
Gender	0.11*	0.03	0.18**	-0.03	0.06	0.00	-0.11*	0.02	-0.05	0.10	0.04	-0.02	-0.03	1.00

Note: DPW = Drinks Per Week; SD = Standard Deviation; RAPI = Rutgers Alcohol Problem Index; **p < .01; *p < .05

Table 5

Confirmatory Factor Analysis 4-factor solution fit indices for the DMQ-R

	Number of Items	χ^2	DF	RMSEA	CFI	TLI	SRMR
Baseline	20	580.47*	164.00	0.08	0.90	0.88	0.09
	12	90.27*	48.00	0.05	0.98	0.98	0.03
6-month Follow-up	20	586.52*	164.00	0.08	0.90	0.89	0.09
	12	111.46*	48.00	0.06	0.98	0.97	0.04
12-month Follow-up	20	613.86*	164.00	0.09	0.90	0.89	0.09
	12	144.66*	48.00	0.07	0.97	0.96	0.04

Note: χ^2 = Chi-squared; DF = Degrees of Freedom; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; SRMR = Standardized Root Mean Square Residual, * p < .001

Table 6

Internal consistency and test-retest reliability

Subscale	Number of Items	α			ICC
		Baseline	6-month Follow-up	12-month Follow-up	
Coping	5 Items	0.83	0.85	0.85	0.75
	3 items	0.85	0.88	0.86	0.72
Social	5 Items	0.87	0.86	0.89	0.78
	3 items	0.90	0.88	0.91	0.78
Enhancement	5 Items	0.85	0.85	0.85	0.90
	3 items	0.89	0.88	0.89	0.88
Conformity	5 Items	0.83	0.88	0.87	0.70
	3 items	0.85	0.88	0.85	0.69

Note: α = Cronbach's Alpha; ICC = Intraclass Correlation Coefficient.

Table 7

Item Response Theory discrimination parameters and fit indices for Coping Subscale

Item	Baseline		6-month Follow-up		12-month Follow-up	
	5-items	3-items	5-items	3-items	5-items	3-items
θ - To forget your worries	3.18	4.41	3.63	4.01	2.94	2.89
θ - Because it helps you when you feel depressed or nervous	2.31	2.62	3.59	3.32	4.46	5.74
θ - To cheer up when you are in a bad mood	2.27		2.37		2.92	
θ - Because you feel more self-confident and sure of yourself	1.19		1.23		1.22	
θ - To forget about your problems	8.95	4.34	4.40	3.91	4.97	4.00
M_2	289.53**	117.88**	330.45**	93.39**	488.09**	228.71**
RMSEA	0.05	0.07	0.06	0.05	0.08	0.12
AIC	3625.84	1889.82	3644.58	1922.46	3494.09	1845.26
BIC	3723.47	1948.40	3742.21	1981.04	3587.82	1899.94

Note: θ = Theta, Discrimination Parameter; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; ** p < 0.01

Table 8

Item Response Theory discrimination parameters and fit indices for Social Subscale

Item	Baseline		6-month Follow-up		12-month Follow-up	
	5-items	3-items	5-items	3-items	5-items	3-items
θ – Because it helps you enjoy a party	2.75	2.61	2.79	2.64	2.82	2.68
θ – To be sociable	1.65		1.58		2.19	
θ – Because it makes social gatherings more fun	5.48	4.85	4.60	4.61	5.67	5.93
θ – Because it improves parties and celebrations	4.69	5.40	4.34	4.50	5.83	5.72
θ – To celebrate a special occasion with friends	1.42		1.44		1.51	
M_2	613.41**	141.71**	2107.78**	362.25**	482.01**	152.76**
RMSEA	0.09	0.08	0.19	0.14	0.08	0.08
AIC	4640.35	2701.42	4709.51	2760.90	4549.46	2671.94
BIC	4737.96	2760.00	4807.15	2819.48	4647.09	2730.52

Note: θ = Theta, Discrimination Parameter; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; **p < 0.01

Table 9

Item Response Theory discrimination parameters and fit indices for Enhancement Subscale

Item	Baseline		6-month Follow-up		12-month Follow-up	
	5-items	3-items	5-items	3-items	5-items	3-items
θ – Because you like the feeling	3.54	3.51	4.06	4.06	4.10	4.29
θ – Because it is exciting	1.55		1.81		1.44	
θ – To get high	1.38		1.15		1.22	
θ – Because it gives you a pleasant feeling	4.82	5.88	4.15	4.26	4.74	4.60
θ – Because it's fun	3.06	2.76	3.25	3.15	3.16	3.13
M_2	457.48**	202.33**	688.98**	304.54**	913.39**	380.42**
RMSEA	0.07	0.10	0.10	0.13	0.12	0.14
AIC	4552.75	2698.46	4651.48	2702.85	4680.73	2715.79
BIC	4650.38	2757.043	4749.11	2761.43	4778.36	2774.37

Note: θ = Theta, Discrimination Parameter; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; **p < 0.01

Table 10

Item Response Theory discrimination parameters and fit indices for Conformity Subscale

Item	Baseline		6-month Follow-up		12-month Follow-up	
	5-items	3-items	5-items	3-items	5-items	3-items
θ – Because your friends pressure you to drink	1.28		1.69		1.97	
θ – So that others won't kid you about not drinking	2.03		3.16		3.46	
θ – To fit in with a group you like	2.62	2.45	2.96	3.01	2.92	2.75
θ – To be liked	4.14	5.32	4.29	4.38	4.01	4.31
θ – So you won't feel left out	4.04	4.03	5.83	7.01	4.26	4.94
M_2	176.80**	38.31**	319.82**	103.78**	475.21**	193.32**
RMSEA	0.02	0.00	0.05	0.06	0.08	0.09
AIC	2337.04	1454.79	2407.46	1472.40	2605.03	1701.06
BIC	2434.67	1513.37	2505.09	1530.98	2702.66	1759.64

Note: θ = Theta, Discrimination Parameter; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; **p < 0.01

Table 11

Fit indices for Latent Profile Analysis

	Model	AIC	BIC	ADJ BIC	Entropy	BLRT	LMR
Baseline	2-class	11937.92	12082.42	11965.03	0.93	$p < 0.001$	$p < 0.001$
	3-class	**11284.37**	**11479.64**	**11321.01**	**0.94**	**$p < 0.001$**	**$p = 0.113$**
	4-class	11036.90	11282.93	11083.06	0.95	$p < 0.001$	$p = 0.34$
	5-class	10800.29	11097.10	10855.98	0.94	$p < 0.001$	$p = 0.648$
6 Months	2-class	11972.95	12217.45	12000.07	0.99	$p < 0.001$	$p < 0.01$
	3-class	**11055.88**	**11251.15**	**11092.52**	**0.94**	**$p < 0.001$**	**$p < 0.00$**
	4-class	10736.44	10982.47	10782.60	0.96	$p < 0.001$	$p = 0.513$
	5-class	10541.54	10838.35	10597.23	0.96	$p < 0.001$	$p = 0.209$
12 Months	2-class	11854.02	11998.52	11881.13	0.94	$p < 0.001$	$p < 0.001$
	3-class	**10961.10**	**11156.37**	**10997.73**	**0.95**	**$p < 0.001$**	**$p < 0.01$**
	4-class	10708.78	10954.82	10754.95	0.93	$p < 0.001$	$p = 0.112$
	5-class	10498.48	10795.28	10554.16	0.94	$p < 0.001$	$p < 0.03$

Note: AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; ADJ BIC = Adjusted Bayesian Information Criteria;

BLRT = Bootstrapped Likelihood Ratio Test; LMR=Lo-Mendell-Rubin

Table 12

Endorsement percentages for 3-class solution across time points

Time Point	Profile	Cross-sectional LPA % Endorsement ($n = 367$)	LTA % Endorsement ($n = 345$)
Baseline	Low Motive	38.7% ($n = 142$)	39.5% ($n = 136$)
	High Motive	10.9% ($n = 40$)	11.3% ($n = 39$)
	Positive Reinforcing Motive	52.3% ($n = 185$)	49.2% ($n = 170$)
6 Months	Low Motive	34.4% ($n = 127$)	36.9% ($n = 127$)
	High Motive	10.9% ($n = 40$)	9.8% ($n = 34$)
	Positive Reinforcing Motive	55.6% ($n = 200$)	53.3% ($n = 184$)
12 Months	Low Motive	39.4% ($n = 145$)	37.6% ($n = 130$)
	High Motive	13.6% ($n = 50$)	13.8% ($n = 47$)
	Positive Reinforcing Motive	47% ($n = 172$)	48.6% ($n = 168$)

Table 13

Estimated latent transition probabilities across drinking motives at each time point

Baseline	6-month follow-up		
	High Motive	Positive Reinforcing Motive	Low Motive
High Motive	0.31 (OR = 3.71, 95% CI, 1.26, 6.17, p < .05)	0.57 (OR = 1.84, 95% CI, 0.20, 3.47, p = .06)	0.12
Positive Reinforcing Motive	0.08 (OR = 2.67, 95% CI, 0.71, 4.62, p < .05)	0.78 (OR = 2.57, 95% CI, 1.76, 3.38, p < .01)	0.14
Low Motive	0.05	0.21	0.74

6-month follow-up	12-month follow-up		
	High Motive	Positive Reinforcing Motive	Low Motive
High Motive	0.68 (OR = 5.99, 95% CI, 2.45, 9.53, p < .01)	0.24 (OR =1.68, 95% CI, 0.06, 3.31, p = .09)	0.08
Positive Reinforcing Motive	0.07 (OR = 3.98, 95% CI 0.22, 7.74, p = .08)	0.75 (OR = 3.06, 95% CI 1.91, 4.21, p < .01)	0.18
Low Motive	0.09	0.18	0.73
Entropy	0.96		

Note: OR = Odds Ratio; CI = Confidence Interval; p = p-value; Row headings represent Baseline and 6-month follow-up stages; column headings represent stages at 6-month and 12-month follow-up

Table 14

Logistic regression coefficients for 3-class model with DPW and RAPI predicting latent classification at each time point

	Predictor	Coefficient	SE	*p*-value	Odds ratio (95% CI)
Baseline					
High Motive	**DPW**	**0.05**	**0.02**	**<0.05**	**1.05 (0.01, 0.91)**
	RAPI	**0.14**	**0.04**	**<0.001**	**1.14 (1.08, 1.21)**
Positive Reinforcing Motive	**DPW**	**0.07**	**0.02**	**<0.001**	**1.08 (0.05, 0.10)**
	RAPI	**0.11**	**0.03**	**<0.001**	**1.12 (1.06, 1.18)**
6-month Follow-up					
High Motive	**DPW**	**0.07**	**0.03**	**<0.05**	**1.07 (0.02, 0.11)**
	RAPI	0.06	0.04	=0.194	1.06 (0.99, 1.13)
Positive Reinforcing Motive	**DPW**	**0.04**	**0.02**	**<0.05**	**1.04 (0.01, 0.08)**
	RAPI	0.02	0.03	=0.484	1.02 (0.97, 1.07)
12-month Follow-up					
High Motive	DPW	0.03	0.02	=0.255	1.03 (-0.01, 0.07)
	RAPI	**0.06**	**0.02**	**<0.001**	**1.06 (1.03, 1.09)**
Positive Reinforcing Motive	DPW	0.03	0.02	=0.090	1.03 (0.00, 0.06)
	RAPI	0.02	0.02	=0.123	1.02 (1.00, 1.05)

Note: Low Motive class is reference; CI=Confidence Interval; SE = Standard Error; DPW = Drinks Per Week; RAPI = Rutgers Alcohol Problem Index; Bold = statistically significant.

Table 15

Estimated transition probabilities based on model with only DPW (mean versus 1 standard deviation above the mean) as a covariate

DPW = Mean (16.80) — 6-month follow-up

Baseline	High Motive	Positive Reinforcing Motive	Low Motive
High Motive	0.18	0.59	0.23
Positive Reinforcing Motive	0.05	0.71	0.25
Low Motive	0.02	0.11	0.87

DPW = Mean (17.41) — 12-month follow-up

6-month follow-up	High Motive	Positive Reinforcing Motive	Low Motive
High Motive	0.62	0.27	0.11
Positive Reinforcing Motive	0.04	0.65	0.32
Low Motive	0.03	0.12	0.85

DPW = Standard Deviation (32.46) — 6-month follow-up

Baseline	High Motive	Positive Reinforcing Motive	Low Motive
High Motive	0.13	0.57	0.31
Positive Reinforcing Motive	0.04	0.69	0.27
Low Motive	0.01	0.07	0.92

DPW = Standard Deviation (32.90) — 12-month follow-up

6-month follow-up	High Motive	Positive Reinforcing Motive	Low Motive
High Motive	0.47	0.28	0.25
Positive Reinforcing Motive	0.02	0.61	0.37
Low Motive	0.03	0.13	0.84

Note: DPW=Drinks per week; Standard Deviation = 1 standard deviation above the mean; Row headings represent Baseline and 6-month follow-up stages; column headings represent stages at 6-month and 12-month follow-up

Table 16

Odds ratio transition probabilities for DPW mean versus 1 standard deviation above the mean

Baseline	6-month follow-up								
	High Motive			Positive Reinforcing Motive			Low Motive		
	OR	p	95% CI	OR	p	95% CI	OR	p	95% CI
High Motive	0.53	0.452	(-0.51-1.56)	0.73	0.740	(-0.62-2.08)	1.90	0.692	(-1.32-2.598)
Positive Reinforcing Motive	0.75	0.350	(0.30-1.19)	0.89	0.422	(0.66-1.12)	1.13	0.477	(-0.14-0.38)
Low Motive	0.62	0.483	(-0.29-1.52)	0.55	0.097	(0.10-1.00)			ref

6-month follow-up	12-month follow-up								
	High Motive			Positive Reinforcing Motive			Low Motive		
	OR	p	95% CI	OR	p	95% CI	OR	p	95% CI
High Motive	0.32	0.000	(0.03-0.61)	0.43	0.036	(-0.01-0.88)	3.12	0.222	(0.22-2.06)
Positive Reinforcing Motive	0.44	0.021	(0.04-0.84)	0.80	0.449	(0.36-1.24)	1.26	0.547	(-0.33-0.78)
Low Motive	0.77	0.667	(-0.11-1.65)	1.12	0.819	(0.29-1.94)			ref

Note: DPW=Drinks per week; OR = Odds Ratio; *p* = p-value; CI = Confidence Interval; ref = Reference Class; Row headings represent Baseline and 6-month follow-up stages; column headings represent stages at 6-month and 12-month follow-up

Appendix C

Figures

Figure 1

Latent Transition Model for three time points with a covariate: covariate moderating C2 on C1 and C3 on C2
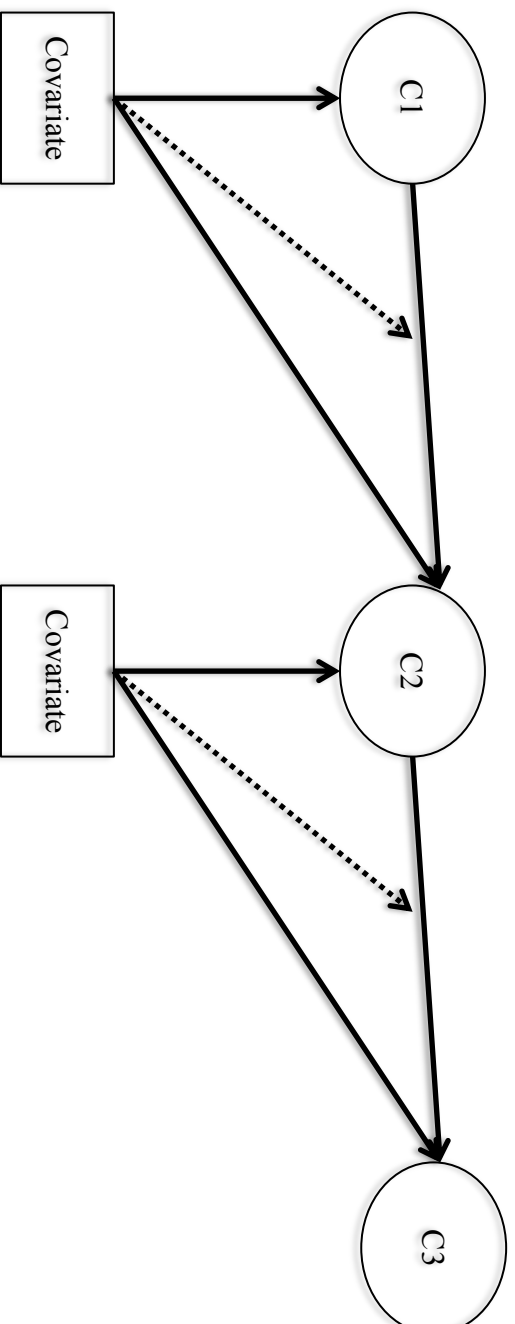
Note: C1 = latent class at time 1; C2 = latent class at time 2; C3 = latent class at time 3; Covariate = Drinks per week and Rutgers Alcohol Problem Index scores; Indicator variables and latent class categories at each time point were excluded from the figure
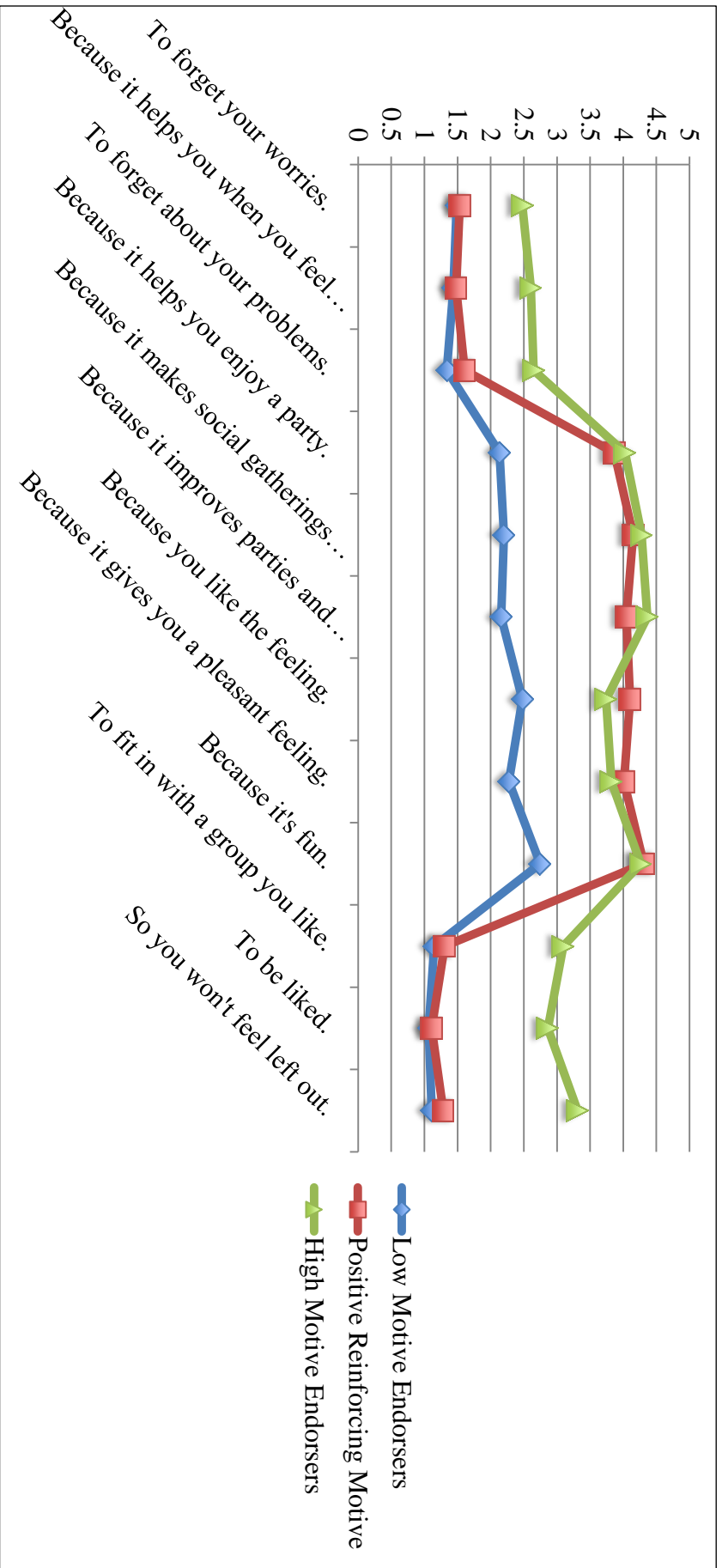
Figure 2
Standardized Means for Baseline Latent Profile Analysis with 3 classes

Figure 3
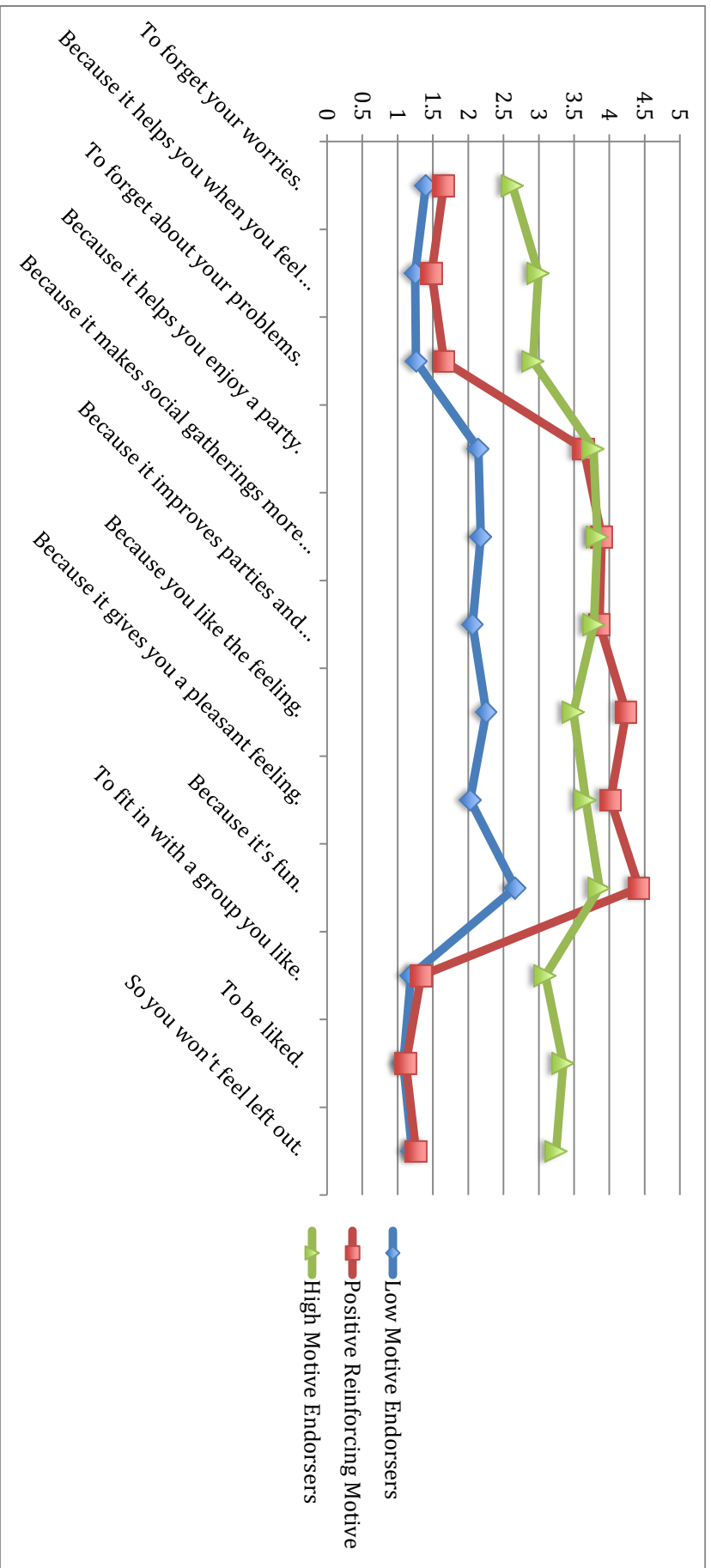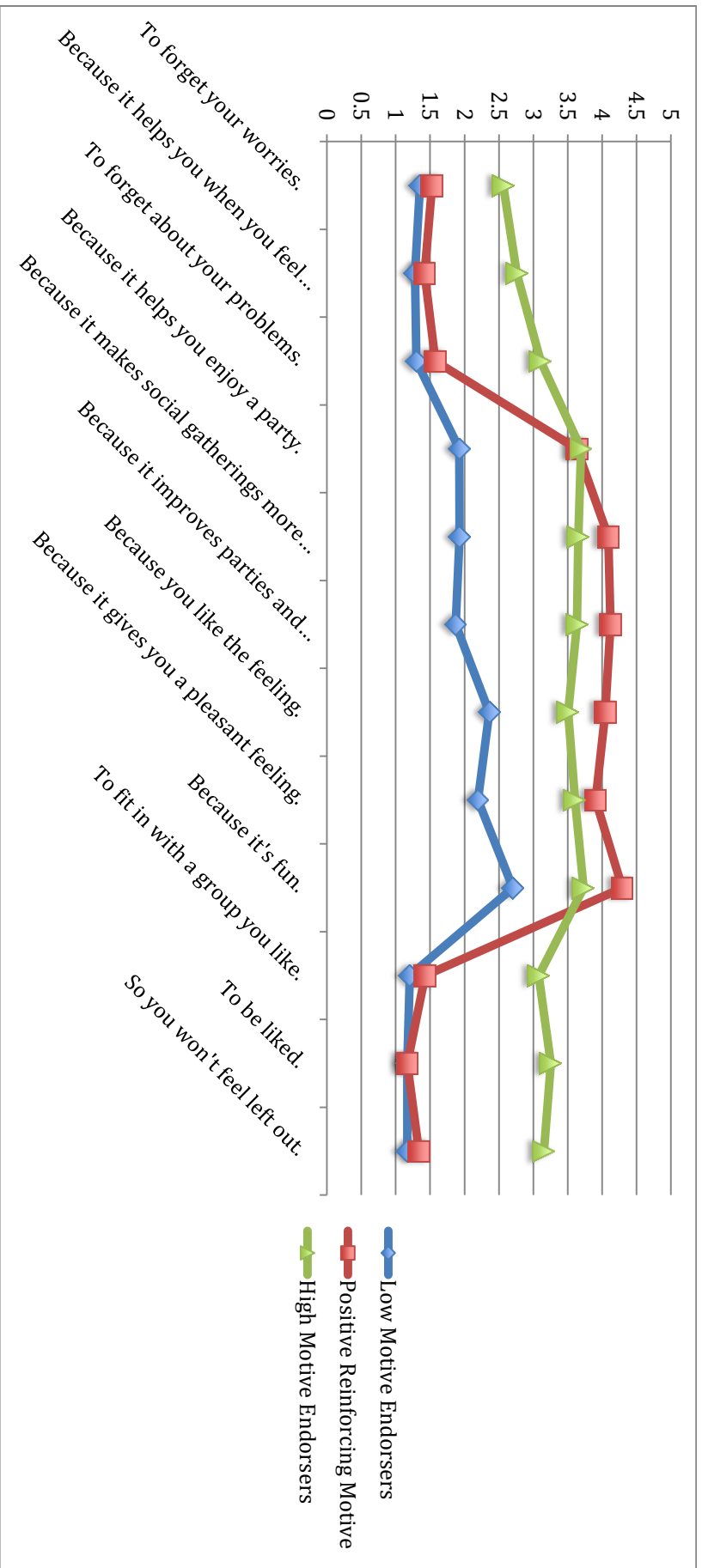Standardized Means for 6-months Latent Profile Analysis with 3 classes

Figure 4
Standardized Means for 12-months Latent Profile Analysis with 3 classes

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