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PRE-COLLEGE MATRICULATION RISK PROFILES AND
FRESHMAN DRINKING TRAJECTORIES

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by

Jerod Stapleton

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The dissertation of Jerod Stapleton was reviewed and approved* by the following:

Robert Turrisi
Professor of Biobehavioral Health
Dissertation Advisor
Chair of Committee

John W. Graham
Professor of Biobehavioral Health

Bill Gerin
Professor of Biobehavioral Health

Michael L. Hecht
Distinguished Professor of Communication Arts and Sciences

Michael J. Cleveland
Research Associate
The Methodology Center

Byron C. Jones
Professor of Biobehavioral Health
Chair of Graduate Program of Biobehavioral Health

*Signatures are on file in the Graduate School.
ABSTRACT

One of the goals of the 2007 National Institute of Health Call to Action to Prevent and Reduce Underage Drinking is to promote an understanding of college student alcohol consumption in a developmental framework that accounts for individual student characteristics. Toward this end, etiological work in college alcohol prevention has identified several decision-making variables related to underage drinking including alcohol expectancies, perceived peer norms, and social influences (Borsari, Murphy, & Barnett, 2007; Sher & Rutledge, 2007). In addition, patterns of heavy alcohol use during the college experience have been established (Del Boca, Darkes, Greenbaum, & Goldman, 2004; Goudriaan, Grekin, & Sher, 2007). However, little is known about how complex, naturally occurring patterns of decision-making variables may influence students’ alcohol consumption during college.

There were 3 aims of the dissertation: (1) to examine naturally occurring patterns of drinking-related decision-making variables measured during the summer prior to college matriculation, (2) to examine trajectories of alcohol consumption in first year college students to identify points in time that students are at the greatest risk for alcohol harm, and (3) to integrate the models from Aims 1 and 2 into a comprehensive model that tested the association between each of the decision-making profiles from Aim 1 with the alcohol consumption trajectories determined from Aim 2.

There were several findings in the current study. First, four distinct decision-making profiles were identified. Individuals within each of these profiles reported decision-making variable patterns that varied in their amount of favorable beliefs about alcohol use. In addition, four distinct drinking trajectories were identified. These trajectories modeled weekly alcohol consumption and included drinking trajectories that described participants who drank alcohol at
low levels, moderately-low levels, moderately-high levels, and at high levels. Finally, these drinking trajectories were modeled within each of the decision-making profiles. These analyses provided insights into how pre-college variables are related to alcohol consumption in college. The findings suggested that there was a general increase in drinking upon college matriculation but the amount and consistency of this increase was highly variable within each of the decision-making profiles. The implications of these findings were discussed in terms of informing efforts to identify at-risk students prior to college matriculation and referring them to appropriate prevention programs. The findings suggest that screening students for inclusion into intervention efforts based on behavioral measures alone may be inadequate.
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CHAPTER ONE: INTRODUCTION

Excessive alcohol consumption and related problems represent significant concerns on U.S. college campuses (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson, Zha, & Weitzman, 2009; O’Malley & Johnson, 2002; NIAAA, 2006). The highest proportion of heavy drinkers and individuals with diagnosable alcohol substance disorders are 18-25 year olds, the age range of 92% of college students (Dawson, Grant, Stinson, & Chou, 2004; Hingson et al., 2005; Perkins, 2002). Among 18-20 year olds, 40.8% exceed daily drinking limit and 12.6% exceed weekly drinking limit recommendations set forth by the United States Department of Health and Human Services (Chen, Dufour, & Yi, 2004-2005). Drinking in college is associated with unplanned sexual activity, driving injuries, physical assaults, sexual assaults, criminal mischief, and injury (Abbey, 2002; Baer, Kivlahan, & Marlatt, 1995; Cooper, 2002; Hingson et al., 2005, 2009; Leibsohn, 1994; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994a; Wechsler, Issac, Grodstein, & Sellers, 1994b). Although alcohol consumption and negative consequences emerge after college matriculation for some students (Baer, 2002), research indicates that excessive consumption in college represents a continuation or escalation of drinking patterns established earlier for many (Baer, et al., 1995; O’Malley & Johnston, 2002; Schulenberg & Maggs, 2002).

A number of factors are implicated in the etiology of alcohol misuse among college students. These include demographic variables such as gender, ethnicity, and family history as well as personality variables (Baer, 2002; Braitman et al., 2009; Harford, Yi, & Hilton, 2006; Weschler et al., 2002). Drinking-related psychosocial decision-making variables, consistent with individual decision-making health theories such as the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975) and Behavioral Alternative Theory (Jaccard, 1981) (BAT), are also strong predictors of alcohol consumption. These variables include alcohol expectancies (Carey &
Correia, 1997; Goldman, Greenbaum, & Darkes, 1997; Johnson & Fromme, 1994; Stewart, Zeitlin, & Samoluk, 1996; Wood, Sher, & Strathman, 1996), attitudes toward drinking and non-drinking alternatives (Turrisi, 1999; Vuchinich & Tucker, 1988), perceptions of peer alcohol use, called descriptive norms, and perceptions of peer approval of alcohol, called injunctive norms (Carey, 1993, 1995; Graham, Marks, & Hanson, 1991; Larimer, Irvine, Kilmer, & Marlatt, 1997; Wood, Vinson, & Sher, 2001). Although alcohol-related decision-making variables are often formed and influenced by the drinking culture of the college environment, evidence suggests they may carry over from beliefs formed prior to college (i.e., in high school) (Larimer, Turner, Mallett, & Geisner, 2004).

**Purpose**

In response to these findings, researchers have argued for better detection and earlier prevention of risk, prior to college matriculation (e.g., Larimer & Cronce, 2007). The focus of the current study was to examine how pre-college matriculation risk variables were associated with alcohol use. Alcohol use was measured in the summer prior to college, at various points throughout the freshman year, and into the first semester of the sophomore year. These analyses can provide insights into the identification of high-risk students and appropriateness of various alcohol prevention programs prior to college. The examination of alcohol use across the first year of college also provides information about periods of risk, in terms of high rates of alcohol consumption. Decision-making variables, measured prior to college matriculation, were chosen as the alcohol use predictor variables in this study for two primary reasons. First, these variables are theoretically amenable to change in brief intervention efforts delivered during the transition to college. Other relevant alcohol risk variables are either non-changeable (e.g., gender, race) or difficult to change in a prevention framework (e.g., personality). Second, decision-making
theories, such as the TRA and BAT, have driven the development of many existing and efficacious college student drinking prevention programs (Larimer & Cronce, 2007). If these research findings are intended to inform the targeting of these programs, the most effective strategy may be to match students to interventions based on these variables.

**Innovation**

Previous studies of decision making in college students have used traditional variable-centered approaches, like regression, to examine the relationships among decision-making variables and their influence on alcohol consumption. This approach indicates students drink more when they expect positive things to happen, feel favorably about drinking, feel unfavorably about non-drinking alternatives, perceive their peers to be drinking, and perceive approval of alcohol use from their peers. A strength of these approaches is the ability to test these associations between decision-making variables and alcohol use. Thus, the relationships predicted in TRA (i.e., decision-making risk variables predict drinking) hold true when examining average relationships across individuals (e.g., alcohol expectancies do predict behavioral tendencies, etc.). However, information about intraindividual differences may be masked when examining data at the mean variable level (Bates, 2000). For example, a student may have unfavorable alcohol expectancies and low perceived peer norms, which would indicate a low tendency to drink, but feel unfavorably about non-drinking alternatives, which might suggest a high tendency to drink. Another student might have favorable alcohol expectancies and perceive most students as drinking, suggesting a high tendency to drink, but might think close friends do not approve of drinking, which would suggest a low tendency to drink. In both cases, these complex patterns of decision-making variables suggest that changing drinking tendencies would require altering different decision-making variables for each individual.
The first aim of the study was to utilize an alternative analytic approach, latent profile analysis (LPA), to examine such complex patterns of decision-making variables. LPA is a person-centered technique that is used to examine how variables cluster together to form distinct patterns of decision making (Muthén & Muthén, 2000a). LPA allows for the analysis of such variable clusters by fitting latent subgroups of individuals, called profiles, based on common response patterns. Individuals in each profile have similar decision-making patterns as others within their profile and are distinctly different in their decision making compared to those in the other profiles. The appeal of LPA is the ability to examine decision-making variables simultaneously in a way that is difficult in variable-centered approach. For example, to examine the pattern of five decision-making variables using a variable-centered approach, the interpretation of a complex model, with up to a five-way interaction, would be necessary as would a very large sample size, atypical to most prevention studies. This study will be the first to examine TRA and BAT decision-making variables in a LPA framework.

In addition to modeling these decision-making patterns, or profiles, rates of alcohol consumption across the first year of college were modeled. These analyses provide information about periods of risk, in terms of alcohol consumption, for college students. While several studies have examined trajectories of drinking in adolescents (Colder, Campbell, Ruel, Richardson, & Flay, 2002; Jackson & Sher, 2005; Wiesner, Weichold, & Silbereisen, 2007), only a few studies have examined drinking in college (Del Boca et al., 2004; Goudriaan et al., 2007; Greenbaum, Del Boca, Darkes, Wang, & Goldman, 2005). The current study used growth mixture modeling (GMM) to examine distinct latent drinking trajectories throughout the first year of college. Each of these latent drinking trajectories have distinct growth curve shapes based on a single outcome variable measured at multiple time points (Muthén & Muthén, 2000a). The strength of the GMM
approach is that it does not assume a single trajectory of drinking for the entire sample (Abroms, Simons-Morton, Haynie, & Chen, 2005). Thus, GMM allows for the examination of latent subgroups of individuals with similar trajectories of drinking. Mean growth curves are reported for each latent trajectory and individual variation around these means is estimated by growth variance factors for each trajectory. The differential drinking patterns of these distinct trajectories may provide insight to periods of high-risk drinking and the best time to administer prevention efforts within each trajectory.

GMM and related techniques have previously been used to model trajectories of alcohol use in adolescents (Colder et al., 2002; Li, Barrera, Hops, & Fisher, 2002; Wiesner et al., 2007) and emerging adults (Casswell, Pledger, & Pratap, 2002; Jackson & Sher, 2005; Muthén & Muthén, 2000b; Schulenberg, O'Malley, Bachman, Wadsworth, & Johnston, 1996; Tucker, Orlando, & Ellickson, 2003; Tucker, Ellickson, Orlando, Martino, & Klein, 2005; Warner, White, & Johnson, 2007; White, Johnson, & Buyske, 2000). While these studies all vary in several ways including age range measured, timing of measurement, and outcome used, the trajectories observed often follow similar patterns. Common trajectories include non-users, drinkers who steadily increase consumption, drinkers who rapidly increase use over a short time, and drinkers who begin drinking prior to college and continue to use heavily throughout. College student studies have revealed similar results with the addition of a steady, moderate drinking group (Del Boca et al., 2004; Goudriaan et al., 2007; Greenbaum et al., 2005). Researchers have also used a variety of methods to link these trajectories with variables related to alcohol use. Studies have shown that demographic variables such as gender and family socioeconomic status (Greenbaum et al., 2005; Hill, White, Chung, Hawkins, & Catalano, 2000; Tucker et al., 2003; Warner et al., 2007; Wiesner et al., 2007) are related to alcohol use trajectories. In addition, alcohol use trajectories are related
to personality variables such as impulsivity, risk taking, and emotional distress (Colder et al., 2002; Goudriaan et al., 2007), parental behaviors (White et al., 2000), and environment factors (Casswell et al., 2002). Finally, select cognitive decision-making variables, such as alcohol expectancies (Greenbaum et al., 2005) and perceived peer and parent approval of alcohol use (Tucker et al., 2003) have been related to these trajectories. However, a comprehensive examination of decision-making variables and college drinking trajectories has not been conducted.

Thus, a final aim of the project was to examine the relationship between the observed pre-college decision-making profiles and the latent drinking trajectories using a multiple group growth mixture model. In this analysis, individuals will be assigned to their appropriate decision-making profile, based on the results of the LPA, and alcohol use trajectories will be modeled within each profile. The approach is summarized in the conceptual model (Figure 1.1). These analyses can provide insights into identifying subgroups of students who may be at elevated risk of alcohol related harm based on pre-college variables and specific time points of risky alcohol consumption during the first year of college. Early identification of at-risk students is an integral part of a targeted intervention approach where matching appropriate interventions to participants is viewed as a way to greatly increase efficacy and reduce costs associated with indiscriminate intervention distribution (King, Ahn, Atienza, & Kraemer, 2008).

Implications

The results of the analyses have implications for future intervention efforts. In a recent review of individually delivered college alcohol interventions, Larimer and Cronce (2007) highlight the need for studies that provide insight into both identifying students for interventions and referring them to the appropriate interventions. While screening procedures exist for students, most are designed to identify alcohol abuse disorders (Larimer & Cronce, 2007). The current
research may provide some insight into screening students on decision-making variables prior to college matriculation and predicting their likelihood to engage in risky alcohol consumption.

Person-centered approaches may provide insights into screening that are unique from those gained from variable-centered approaches. For example, an analysis using a variable-centered approach might lead to the conclusion that, on average, expectancies, attitudes, and normative beliefs are related to drinking. Based upon these findings, those who score high on those measures should be given the most intensive prevention efforts. Intervention efforts may not be as critical for those who score low on the variables and some efforts may be needed for those with moderate scores. However, this approach may mask how these variables influence behavior on an individual level as this becomes an attempt to predict an individual's behavior based upon relationships that are averaged across individuals. This is akin to the ecological fallacy. Person-centered approaches allow for a better approximation of an individually-focused understanding of health behavior which is important when considering screening.

Although the current analyses are by nature model-driven and exploratory approaches, I hypothesized about three likely findings. I expected the analyses to identify individuals who would report unfavorable alcohol-related decision-making profiles prior to college and who, as a result, would not engage in risky drinking during college. I also expected to find individuals who would report favorable alcohol-related decision-making patterns and would drink in a risky manner. However, the greatest potential strength of this approach is in the identification of those individuals with mixed levels of risk. I expected to find individuals with patterns of decision-making variables that were both favorable and unfavorable toward drinking. Given these students' ambiguity in their decision making, the alcohol consumption of these individuals is difficult to predict. These are the students that may not be in obvious need of intervention when first arriving
to campus but may begin risky drinking during their first year of college.

Research Aims

The specific aims of the research were to:

1. Identify subgroups of students based on alcohol-related decision-making patterns measured prior to college matriculation using LPA (Figure 1.1, Part A).
2. Explore alcohol consumption trajectories across the first year of college using GMM (Part B).
3. Examine the relationship between the observed decision-making profiles and the alcohol consumption trajectories (Part C).

Figure 1.1. Conceptual model of latent pre-college decision-making profiles related to weekly drinking trajectories.
CHAPTER TWO: REVIEW OF THE LITERATURE

Alcohol Use in College

Alcohol consumption among college students has been associated with a variety of consequences including unplanned sexual activity, driving injuries, physical assaults, sexual assaults, criminal mischief, and injury (Abbey, 2002; Baer et al., 1995; Cooper, 2002; Leibsohn, 1994; Wechsler et al. 1994a, 1995; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998). Epidemiological research suggests that a large portion of the college student population is affected by these alcohol-related consequences. In 2001, approximately 5,700,000 adults aged 18-24 were full time college students (Hingson et al., 2005). Of these students, 12% (696,000 students) reported being assaulted by another drinking student and 10.5% (599,000) were injured as a result of drinking. Sexual consequences were also common as 8% of students (474,000) reported not using protection during a sexual encounter because of drinking. Nearly 100,000 students reported alcohol-related sexual assaults or rape. A follow-up study found similar rates of assault, injury, and sexual consequences in 2005 (Hingson et al., 2009). Hingson et al. (2009) estimated that 1,825 college students died from alcohol-related unintentional injuries in 2005 and suggested that these types of estimates are likely conservative (Hingson et al., 2005).

The United States Department of Health and Human Services has highlighted the need to reduce alcohol use in an attempt to decrease alcohol-related problems in young people aged 18-24, the age range that represents approximately 92% of college students (Dawson et al., 2004; Hingson et al., 2005; Perkins et al., 2002). An important target of the Healthy People 2010 public health campaign (U.S. Department of Health and Human Services, 2000) is to reduce the amount of total alcohol consumed by young adults as number of drinks consumed per week is
related to alcohol-problems. Specifically, males who consume more than 14 drinks per week and females who drink more than 7 drinks per week are at an elevated risk for problems.

Despite these recommendations, national surveys show that reports of alcohol use are common in young adults. Johnson, O’Malley, Bachman, & Schulenberg (2008) found that 72% of 12th graders and 85% of college students have tried alcohol. Another study reported past-year drinking rates of 64% among 18-20 year olds (Chen et al., 2004-2005). High rates of consumption are also common. Among 18-20 year olds, 40.8% exceed daily drinking limits and 12.6% exceed weekly drinking limits set forth by Health People 2010 (Chen et al., 2004-2005). The highest proportion of heavy drinkers and individuals with diagnosable alcohol substance disorders are 18-25 year olds (Dawson et al., 2004).

There is an abundance of evidence that the college environment facilitates alcohol usage. Trends over the past 3 decades show a general decrease in alcohol usage among non-college samples while college sample drinking rates tend to be stable or increasing (Johnson et al., 2008). College bound students are less likely to drink in high school compared to their non-college bound peers but drinking rates upon college matriculation increase quickly and surpass those of non-college peers (Johnson et al., 2008). College students are significantly more likely that non-college peers to exceed the daily and weekly drinking recommendations (Chen et al., 2004-2005). Nearly 45% of college student report high-risk binge drinking, defined as consuming at least 5 or more drinks in one occasion, in the previous month, a rate that is significantly higher that non-college attending peers (Hingson et al., 2005, 2009).

**Alcohol Risk Factors**

A number of biopsychosocial factors are implicated in the etiology of alcohol use among college students. Biological variables include demographic characteristics such as gender,
ethnicity, and family history. A large scale, multi-campus college alcohol use study found that while past year drinking did not differ between males and females, males were more likely to engage in heavy drinking (Weschler et al., 2002). Other studies have found similar high rates of heavy drinking in males relative to females (Harford et al., 2006). Alcohol consumption is most common among Caucasian students relative to other ethnicities (Weschler et al., 2002). Research relating family history variables, for example whether or not a student has a family history of alcoholism, to alcohol use have provided mixed results (Baer, 2002; Braitman et al., 2009).

Personality variables have also been related to alcohol usage in college students. Students who report impulsive tendencies and sensation seeking tendencies are overrepresented among frequent alcohol users (Arnett, 1996; Baer, 2002; Lindgren, Mullins, Neighbors, & Blayney, 2007). Raynor and Levine (2009) found that conscientiousness was related to alcohol harm reduction behavioral strategies in students. In the same study, high scores on measures of extraversion were related to heavy alcohol consumption.

Several factors related to social aspects of the college environment are predictive of alcohol use. Peers have been shown to influence student drinking through the effects of modeling, perceptions of normative drinking behaviors, and providing access to alcohol (Baer 2002; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Perkins, 2002; Read, Wood, & Capone, 2005). Students who join Greek organizations typically report heavier alcohol use than their non-Greek counterparts (Baer, 1994; Cashin, Presley, Meilman, 1998; Weschler, et al., 2002) and research has explored the strong normative processes with respect to alcohol in these contexts (Sher, Bartholow, & Nanda, 2001). Participation in athletics while in college has also been show to be related to alcohol usage (Ham & Hope, 2003; Hildebrand, Johnson, & Bogle, 2001; Turrisi, Mastroleo, Mallett, Larimer, & Kilmer, 2007) with athletes consuming more alcohol compared to non-
athletes. Alcohol consumption is also related to parenting factors. Parental monitoring of students and positive parent-student relationship have been shown to reduce alcohol related use and negative outcomes (Turrisi, Wiersma, & Hughes, 2000; Wood, Read, Mitchell, & Brand, 2004).

Additional factors that are influential in college student alcohol use are psychosocial decision-making variables, consistent with individual-focused health theories such as the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975) and Behavioral Alternative Theory (Jaccard, 1981) (BAT). These factors include variables such as alcohol expectancies (Baer, 2002; Carey & Correia, 1997; Goldman et al., 1997; Johnson & Fromme, 1994; Stewart, Zeitlin, & Samoluk, 1996; Wood et al., 1996), attitudes toward alcohol use (Collins & Carey, 2007; Turrisi, 1999; Vuchinich & Tucker, 1988), and alcohol-related normative perceptions (Carey, 1993; 1995; Graham et al., 1991; Larimer et al., 1997; Neighbors et al., 2007; Wood et al., 2001). The following sections describe these decision-making theories and review the college alcohol prevention literature on these variables.

**Theory of Reasoned Action**

The TRA was designed to model the cognitive processes that influence the decision to engage in a variety of behaviors. A conceptual model of TRA theory is presented in Figure 2.1. A primary tenet of TRA theory is that behaviors are best predicted by one's intention to perform a behavior (Fishbein & Ajzen, 1975). Thus, when attempting to understand whether an individual will engage in a behavior, like drinking alcohol, the best cognitive predictor is one’s intention to drink. Intentions to engage in a behavior are influenced by one's attitude toward the behavior and one's subjective norm. The formation of attitudes and normative beliefs reflects individuals' inherent psychological tendency to evaluate entities (e.g., behaviors) with a degree of favor or disfavor (Eagly & Chaiken, 2005). These favorable or unfavorable views are formed through
cognitive, affective, and behavioral processes and are expressed through cognitive, affective, and behavioral responses (Eagly & Chaiken, 2005).

![Conceptual model of the Theory of Reasoned Action (Ajzen & Fishbein, 2005).](image)

As shown in Figure 2.1, attitudes and subjective norms are influenced by beliefs. Beliefs are defined as the subjective probability between the belief object and attributes of that object (Fishbein & Azjen, 1975). For example, a college student might believe that drinking frequently may cause certain consequences or that drinking frequently is a desirable behavior among peers. Put another way, beliefs are the considerations of the likely outcomes of a behavior (Ajzen & Fishbein, 2005). These beliefs arise spontaneously and without effort when an individual experiences contact with a behavior or an object (Ajzen, 2001). According to TRA, the sum of one's total beliefs forms an overall positive or negative evaluation, or attitude, toward an object or behavior. If the total perceived advantages of a behavior produced by positive beliefs outweigh the total perceived disadvantages of a behavior, the resulting attitude is likely to be positive toward engaging in the behavior. This situation would likely lead to positive intentions to engage in the behavior and ultimately the performance of the behavior (Ajzen & Fishbein, 2005). Conversely, a greater number of negative beliefs than positive beliefs would not lead to behavioral intention.
Normative beliefs are a special type of beliefs that correspond with one's beliefs about how others in the social environment (e.g., friends, other students, family) view the behavior. In the current study, normative beliefs are further decomposed into descriptive and injunctive norms. Descriptive norms describe an individual's perception of drinking behaviors in friends and in other college students (Fishbein & Ajzen, 1975). Injunctive norms describe individuals' perceptions of friends' approval or disapproval of their engagement in the behavior. The summation of these normative beliefs forms one's subjective norm toward engaging in a behavior. To the extent that one views peers as engaging in a behavior and approving of the behavior, the individual will be more likely to intend to engage in the behavior. If the individual does not view the behavior as something peers would typically do or as something that peers disapprove of, the intention to perform the behavior will likely be low.

Figure 2.1 also shows the influence of background variables on one's beliefs. The inclusion of these variables in the model reflects the idea that behavioral and normative beliefs are influenced by several personal and social factors (Ajzen & Fishbein, 2005). These influences are manifested in the difference in drinking found for the various biopsychosocial variables described in the previous section. However, according to the TRA these background variables do not directly influence behavior but instead act indirectly through affecting one's beliefs and attitudes. The broken lines in Figure 2.1 indicate that any influence of the background variables on behavior is thought to be produced primarily through the way beliefs are formed.

**Behavioral Alternative Theory**

Some researchers have questioned the utility of the TRA. Although a body of literature exists that has demonstrated the usefulness of TRA in predicting behavior, some research has demonstrated a discrepancy between attitudes and norms and actual behavior. According to the
TRA, individuals who generally feel favorable about a behavior and who generally think their friends/peer approve of the behavior would be expected to engage in the behavior. However, it is not uncommon for individuals to not behave in a manner that is consistent with these decision-making variables. Jaccard (1981) argued that this discrepancy can be explained in some instances due to individuals choosing another behavioral option that they felt equally favorable or more favorable about. For example, a student may choose to not drink on a Friday night even though she feels favorably about drinking and knows that her friends would approve of her drinking. She may instead go to an alcohol-free campus event to watch a band perform. The fact that the drinking attitudes and normative beliefs did not predict her behavior is not necessarily a failure of the TRA but simply a reflection of the fact that her attitude toward listening to the band was more favorable that her attitude toward drinking with her friends.

According to BAT it is important to measure not only attitudes toward the behavior but also attitudes toward non-drinking alternative behaviors when attempting to predict behavior (Jaccard, 1981). This was accomplished in the current study by presenting a variety of behaviors to participants (school-sponsored sporting event, going to a party, going to a campus special event, and "hanging out" with friends) and asking them to report how favorable they would feel about not drinking, having a few drinks, or getting drunk while engaging in these behaviors.

**TRA and BAT in College Alcohol Literature**

The TRA and BAT have generated a great deal of research in the etiology of alcohol use in college students. Specifically, researchers have highlighted the importance of alcohol-related expectancies (e.g., alcohol-related beliefs), attitudes toward drinking, attitudes toward non-drinking alternatives, descriptive normative beliefs, and injunctive normative beliefs in an attempt to predict and prevent alcohol usage in college students.
Alcohol expectancies describe beliefs about the effects or the outcomes of alcohol use. The earliest studies of expectancies found several distinct beliefs about alcohol in college students. These expectancies include beliefs that alcohol transforms experiences in a positive way, increases social behavior, enhances social and physical pleasure, enhances sexual experiences, and reduces feelings of tension (Brown, Goldman, Inn & Anderson, 1980). Several studies have shown alcohol expectancies to be uniquely predictive of alcohol consumption when modeled with other biopsychosocial risk factors (e.g., Baer 2002; Brown, 1985). Expectancies have been shown to be predictive of future drinking behaviors in college students (Sher, Wood, Wood, & Raskin, 1996) and of transitioning from non-problematic to problematic drinking (Christiansen, Smith, Roehling, & Goldman, 1989, c.f. Baer, 2002). In non-drinkers, positive alcohol expectancies are predictive of future use (Smith, Goldman, Greenbaum, & Christiansen, 1995). Turrisi et al. (2000) found that expectancies related to the belief that alcohol can positively transform experiences and the belief that alcohol can enhance social behaviors were related to several drinking-related consequences.

Several studies have demonstrated that favorable attitudes toward alcohol are related to consumption (Baer, Stacy, & Larimier, 1991; Collins & Carey, 2007). Burden and Maisto (2000) found drinking attitudes to be the most consistent of several predictors across a variety of drinking-related outcome variables. Using the BAT theoretical framework, Turrisi (1999) assessed attitudes toward engaging in certain behaviors while drinking and while not drinking. The study findings indicated that favorable binge drinking attitudes were associated with increased drinking. Attitudes toward non-binge drinking alternatives were negatively associated with attitudes toward binge drinking and drinking behavior.
Social normative beliefs have been shown to be uniquely predictive of drinking behaviors when controlling for the effects of expectancies (Neighbors et al., 2007; Wood, Nagoshi, & Dennis, 1992). Subjective norms are also predictive of heavy episodic drinking (Johnston & White, 2003). Larimer et al. (2004) found fraternity and sorority students’ perceptions of acceptance of alcohol use within their fraternity or sorority (injunctive norms) to predict individual alcohol use and related problems. In this study, injunctive norms were more predictive than descriptive norms on several outcomes. Perkins and Wescheler (1996) found perceived norms were stronger predictors of alcohol misuse in students with favorable attitudes compared to those with less favorable attitudes. These findings suggest that normative beliefs may be influential in drinking in an interactive fashion through intensifying the effects of attitudes.

Although it is often assumed that the collegiate social environment is responsible for facilitating drinking, research suggests that favorable alcohol-related decision-making variables often form prior to college matriculation. Normative perceptions in college often reflect those beliefs carried from high school into college (Read, Wood, Davidoff, McLacken, & Campbell, 2002). Baer (1994) also found evidence of pro-drinking normative perceptions prior to college matriculation. In addition, students routinely overestimate how liberal other students' normative beliefs are (Perkins & Berkowitz, 1986; Prentice & Miller, 1996) and overestimate the amount of drinking of other college students (Baer et al, 1991; 1993; 2002). Thus, risky perceptions of peer norms may not be an accurate reflection of the amount of drinking that is actually occurring on and around college campuses.

Alcohol Prevention Programs for College Students

A variety of individually-oriented behavioral alcohol prevention and intervention programs have been developed with the goal of reducing alcohol consumption and alcohol-related problems
in college students. Larimer and Cronce (2002; 2007) have reviewed the literature on such programs published from 1984 through 2006. In order to be considered in these reviews, the interventions had to meet certain scientific criteria: studies must have had a comparison or control condition and must have measured at least one behavioral outcome, in the form of alcohol consumption or alcohol-related problems. Based on these inclusion criteria, 42 prevention programs reported from 1984-2000 were included in their reviews.

Larimer and Cronce classified these prevention and intervention programs into three main types. The first type were educational-awareness programs. These programs are typically designed to be informative in nature with the assumption that students typically engage in risky alcohol use because they are ill informed about the health risks and consequences of alcohol use. Thus, providing students with this information would reduce use. The majority of these types of interventions have demonstrated little empirical evidence of efficacy in reducing alcohol use with the exception of one program type: normative re-education programs. These programs are designed to highlight discrepancies in students own normative perceptions and the actual drinking tendencies of other students. These normative re-education programs seem to be consistently efficacious in producing desired changes in alcohol-related decision-making variables but evidence of their efficacy in influencing drinking behaviors and related consequences have been mixed.

A second type of prevention program identified by Larimer and Cronce were cognitive-behavioral skills-based approaches. These interventions generally provide information that is similar in nature to education and awareness programs. However, these programs are unique in teaching alcohol-focused skills. The alcohol skills taught in these programs include teaching alcohol consumption self-monitoring skills and increasing assertive drinking refusal skills. These programs also frequently challenge participants’ existing alcohol expectancies regarding the
positive effects of alcohol use on enhancing social and other behaviors. Evidence for efficacy of these skills interventions are mixed but show some promise in reducing use. An additional type of cognitive-behavioral interventions are multi-component skills training interventions which incorporate several components of alcohol skill training as well as general life skills training. Among the cognitive-behavioral approaches, these interventions provide the most consistent evidence of intervention efficacy.

The third type of programs identified by Larimer and Cronce were called motivational/feedback-based approaches. These programs are designed to increase students' motivations to reduce alcohol use with interventions that typically incorporate components designed to provide information to participants, skills training, and personalized feedback about an individual’s drinking relative to others. Interventions of this variety are often delivered in-person in either a one-on-one format or in groups. These interventions have provided the most consistent evidence of efficacy. As these types of interventions tend to be resource intensive compared to other approaches, researchers have begun to evaluate the efficacy of providing mail or printed personalized feedback to college students. Studies of this approach have generally found mailed feedback to be efficacious in reducing drinking behaviors (Larimer et al., 2007).

**Prevention Program Identification and Screening Efforts in College Students**

In their review of the college alcohol prevention literature, Larimer and Cronce (2007) highlighted the need for research that improves methods of identifying and referring drinkers into appropriate prevention programs. Traditional work in this area has typically sought to identify high-risk drinkers for interventions. For example, screening surveys used for identifying students for interventions include the CAGE (Heck, 1991) and the Michigan Alcoholism screening test (Martin et al., 1990) which have been developed to measure alcohol-related problems in adult
populations with an emphasis on identifying chronic alcohol abuse (Larimer & Cronce, 2002). Such screening tools are inadequate to measure the type of decision-making or drinking behaviors that high school students are likely to engage in prior to college matriculation. Other screening strategies include using measures designed to assess alcohol-related consequences that are specific to college students including the Rutgers Alcohol Problem Index (White and Labouvie, 1989) and the Young Adult Alcohol Problem Severity Test (Hurlbut and Sher, 1992). Once again, these measures are not specifically designed to measure risky drinking prior to college. Thus, this way of screening may miss students who are not yet at-risk but may be at risk for drinking heavily in college as a function of their alcohol-related cognitions.

Use of Mixture Models in College Alcohol Literature

Latent profile analysis. Over the past decade, the utilization of person-centered approaches, such as LPA, has increased greatly in the field of adolescent and young adult alcohol prevention. The appeal of LPA and latent class analysis (LCA) (the former uses continuous data and the latter uses categorical data) is the ability to examine a large number of predictor variables simultaneously in a way that is difficult in variable-centered approaches. LPA allows for the analysis of such complex patterns by fitting latent subgroups of individuals based on common response patterns. These techniques have been used to examine a variety of alcohol related behaviors (Auerbach & Collins, 2006; Chung & Martin, 2001; Coffman, Patrick, Palen, Rhoads, & Ventura, 2007; Lanza & Collins, 2006; O’Connor & Colder, 2005; Park, Sher, & Krull, 2008).

As an example of these techniques, Coffman et al., (2007) used LCA to examine patterns of drinking motivations in 12th grade students. Drinking motivations were measured by asking students to indicate the most important reasons for their personal use of alcohol. Students were provided with the following motivations for drinking: experimenting, having a good time, getting
high, getting away from problems, relaxation, boredom, the good taste of alcohol, and to release anger/frustration. LCA was used to test for subgroups of individuals who shared similar response patterns to these motivational variables. The LCA revealed 4 subgroups of students with similar within-group responses. The first subgroup of students was the most likely to report experimenting as their primary motivation for drinking. These students did not report high levels of the other motivations and thus were considered by the authors to be "experimenters". The second subgroup of students was the most likely to report drinking to have a good time and to get high. These students were considered “thrill-seekers”. A third subgroup of students was likely to endorse all of the motivations and they were considered to be "multiple purpose drinkers". The final subgroup was likely to report drinking to relax and was unlikely to report other drinking motivations. This study demonstrates the utility of an LPA approach in detecting distinct patterns of psychological predictors of alcohol use. Although a variable-centered approach, like regression, would likely have demonstrated that several of these motivations were significantly related to alcohol use, this analysis shows that each subgroup of students had distinct motivations that would be masked in a variable-centered analysis.

*Growth mixture modeling.* GMM techniques, another form of person-centered analysis, can be used to model latent subgroups of individual trajectories based on a single outcome variable measured at multiple time points (Muthén & Muthén, 2000a). GMM produces mean growth curves for each subgroup and estimates individual variation around these means by growth variance factors for each class. GMM and other related techniques have been used to model patterns, or trajectories, of alcohol use in adolescents (Colder at el., 2002; Li et al., 2002; Wiesner et al., 2007) and emerging adults (Casswell et al., 2002; Del Boca et al., 2004; Goudriaan et al.,
As an example of a GMM, Greenbaum et al. (2005) modeled drinking patterns of college students using weekly drinking data over one school year. The authors observed 5 distinct latent subgroups of drinkers who shared drinking patterns. The first subgroup was considered “light-stable” and these individuals on average reported very low levels of drinking throughout the year. The second subgroup of students was considered “light-stable, high holiday” and drank at low levels throughout the year with small, pronounced spikes in their drinking rates during holiday breaks. The third subgroup was considered medium-increasing. These students typically began the year drinking at moderately high levels and slowly increased their consumption throughout the year. A fourth subgroup, “high-decreasing” reported high rates of drinking in the beginning of the year but their consumption slowly declined throughout the semester. A final subgroup, “heavy-stable”, described students who drank heavily throughout the year without fluctuation. This study demonstrated that although modeling drinking during the freshman year by averaging across individuals revealed a general increase in drinking, using GMM showed distinct patterns in drinking with some students increasing, decreasing, and remaining stable in their drinking.
CHAPTER THREE: METHODOLOGY

The current project is a secondary data analysis using data from Project ACT (R01AA015737). Project ACT is designed to reduce the onset and extent of college student drinking through the implementation of a parent-based intervention during students’ first year of college.

Sample

The sample consists of the non-intervention control group participants in cohorts 1 and 2 of Project ACT. Participants were 285 undergraduate students (mean age = 17.88, SD = 0.40) invited from a student database at a Northeastern U.S. university. Approximately half of the participants were female (n = 150 (52%)). Racial characteristics were as follows: 87% White/Caucasian, 4% Asian, 2% Black or African American, 0.5% American India/Alaskan Native, 2% Multiracial, and 5% other. Seven percent of the sample (n = 20) identified as Hispanic or Latino. Other demographic characteristics of participants are presented below (Table 3.1). The distributions of the sample demographic variables were similar to those of the campus population as a whole. Thus, there was little evidence of sample bias.

Recruitment

Eligible participants were incoming, first-time freshman students drawn from the university’s student database. Study invitation emails were sent out to 1,750 students in two cohorts. Students were randomly assigned into one of four conditions prior to participation: (1) a parent-based intervention administered prior to college matriculation, (2) a parent-based intervention administered prior to college matriculation with intervention boosters, (3) a parent-based intervention after college matriculation, and (4) a non-intervention control group.
Table 3.1

*Baseline Demographic and Drinking Variables*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family socioeconomic status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Much lower than most families</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Moderately lower</td>
<td>14</td>
<td>4.9%</td>
</tr>
<tr>
<td>About average</td>
<td>133</td>
<td>46.7%</td>
</tr>
<tr>
<td>Moderately higher</td>
<td>127</td>
<td>44.6%</td>
</tr>
<tr>
<td>Much higher than most families</td>
<td>11</td>
<td>3.9%</td>
</tr>
<tr>
<td>Intention to join a fraternity or sorority</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>65</td>
<td>22.8%</td>
</tr>
<tr>
<td>Yes</td>
<td>220</td>
<td>77.2%</td>
</tr>
<tr>
<td>Intention to participate in sports in college</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>226</td>
<td>79.3%</td>
</tr>
<tr>
<td>Yes</td>
<td>59</td>
<td>20.7%</td>
</tr>
<tr>
<td>Alcohol usage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never tried alcohol.</td>
<td>45</td>
<td>15.8%</td>
</tr>
<tr>
<td>I have tried alcohol, but currently don't drink.</td>
<td>91</td>
<td>31.9%</td>
</tr>
<tr>
<td>I am a light, social, non-problem drinker.</td>
<td>87</td>
<td>30.5%</td>
</tr>
<tr>
<td>I am a moderate, social, non-problem drinker.</td>
<td>61</td>
<td>21.4%</td>
</tr>
<tr>
<td>I am a heavy, non-problem drinker.</td>
<td>1</td>
<td>0.4%</td>
</tr>
<tr>
<td>I am a heavy, problem drinker.</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Alcohol usage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never drank alcohol.</td>
<td>55</td>
<td>19.3%</td>
</tr>
<tr>
<td>Age 13 or younger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>21</td>
<td>7.4%</td>
</tr>
<tr>
<td>15</td>
<td>46</td>
<td>13.7%</td>
</tr>
<tr>
<td>16</td>
<td>50</td>
<td>13.7%</td>
</tr>
<tr>
<td>17</td>
<td>57</td>
<td>20.0%</td>
</tr>
<tr>
<td>18</td>
<td>23</td>
<td>8.1%</td>
</tr>
</tbody>
</table>
Of the 1,750 recruited students, 1,153 consented to participate in the study and completed the baseline survey (66%). The response rate is consistent with other online health promotion studies in college populations (Hillhouse, Turrisi, Stapleton, & Robinson, 2008; Larimer et al., 2007; Turrisi et al., 2009). Approximately 25% of these participants were randomized into the control condition, yielding a control group sample size of 285 participants. All participants gave informed consent and the procedures were approved by the university’s Institutional Review Board.

Procedures

Recruited students were invited to participate in the survey with a mailed invitation letter, followed by an invitation email. The letter/email provided information about the study, information about compensation for participation, and a URL along with a personal identification number to access the online baseline survey. After completing the baseline survey, participants were asked to complete 4 additional follow-up surveys at various points during their freshman and sophomore years. Data was collected at the following 5 time points: (1) the summer prior to college matriculation (June, baseline), (2) the beginning of the first semester, first year (October, 3 month follow-up), (3) the end of the first semester, first year (December, 5 month follow-up), (4) the end of the second semester, first year (April, 8 month follow-up), and (5) the beginning of the first semester, second year (October, 15 month follow-up). These data collection periods allow for the measurement of changes or stability in alcohol consumption from high school levels upon arriving in college, at the end of the first semester after students have had some time to acclimate to the college environment, and at the end of the freshman year. The final measure served as a long-term follow-up to assess intervention effects in the three intervention conditions.

All participants completed the baseline survey and response rates for the follow-up surveys were as follows: 88% (3 month), 87% (5 month), 84% (8 month), and 79% (15 month follow-up).
Participants were paid upon completion of each survey and received $25 for completing the baseline survey, $20 for the 3 and 8 month surveys, and $30 for the 5 and 15 month surveys. The survey assessments and procedures were identical for participants in the control condition and the intervention conditions with the exception that parents of students in the control group did not receive the parent intervention until after the final follow-up survey.

**Measures**

The decision-making variables were measured at baseline and the alcohol consumption items were included in all surveys. All items have been tested in previous work (Turrisi, Jaccard, Taki, Dunman, & Grimes, 2001) and have demonstrated good psychometric properties: alphas for item scales have been shown to be at or above 0.7, non-significant correlations have been demonstrated between the measures and indices of social desirable responding, and reasonably high test-retest reliability estimates have been observed (e.g., Jaccard & Turrisi, 1987; Turrisi & Jaccard, 1991).

**Alcohol-Related Decision-Making Variables**

*Alcohol expectancies.* Five expectancies were measured: alcohol can lead to positive transformations (“drinking makes me feel good”), alcohol can facilitate social behavior (“a few drinks makes it easier to talk to people”), alcohol can increase negative affect (“drinking alcohol can result in negative changes in my personality and make me irritable”) (reverse coded), normative approval of alcohol (“everybody goes through the drinking phase”), and health orientation (“I am committed to a healthy lifestyle”) (reverse coded). Expectancy items were measured with 5-point Likert-type scales anchored with -2 (*strongly disagree*) and 2 (*strongly agree*). These five items were averaged to create a single index of alcohol expectancies (Table 3.2).
Attitudes toward drinking. To assess attitudes towards drinking activities, individuals were presented with the following list of activities: (1) going to a school-sponsored sporting event on a weekend, (2) going to a party on a weekend night, (3) going to a campus special event on a weekend night, and (4) "hanging out" with friends on a weekend night. Participants were asked to indicate whether they felt favorable toward “having a few drinks” and “getting drunk” while engaging in these activities. Items were measured with 5-point Likert-type scales anchored with -2 (strongly disagree) and 2 (strongly agree). These eight items (4 activities X 2 drinking options) were averaged to create a single attitude toward drinking index.

Attitudes toward non-drinking alternatives. To assess attitudes toward non-drinking alternatives, individuals were presented with the previous list of activities and asked to indicate how favorable or unfavorable they would feel toward “not drinking” while engaging in the activities. Items were measured with 5-point Likert-type scales anchored with -2 (strongly disagree) and 2 (strongly agree).

Descriptive peer norms. Perceived descriptive norms of typical college students and close friends’ alcohol use were measured with the Drinking Norms Rating Form (DNRF; Baer et al., 1991). The DNRF asks participants to write how many drinks they think are typically consumed on each day of the week for their close friends and for their college peers. To create a composite measure of descriptive peer norms, the responses to these 14 items (7 days a week for both close friend and peers) were averaged to create a single score.

Injunctive peer norms. Injunctive norm items measured participants’ perceptions of their friends’ approval or disapproval of their personal drinking (Baer, 1994) (e.g., “How would your friends respond if they knew: (1) you drank alcohol every weekend, (2) you drank alcohol daily, (3) you drove a car after drinking, and (4) you drank enough alcohol to pass out?”). Response
options are on a 7-point scale anchored with -3 (strong disapproval) and 3 (strong approval).

Creating composite variables. Items within each of the five categories of decision-making variables were averaged to create a single composite score within each category. Cronbach's coefficient alpha values, means, and standard deviations for each scale are presented below.

Table 3.2

<table>
<thead>
<tr>
<th>Composite Decision-Making Variables</th>
<th>Alpha</th>
<th>Mean</th>
<th>Stan. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectancies</td>
<td>0.69</td>
<td>-0.30</td>
<td>0.81</td>
<td>-2.00</td>
<td>1.40</td>
</tr>
<tr>
<td>Drinking Attitude</td>
<td>0.92</td>
<td>-0.36</td>
<td>0.94</td>
<td>-2.00</td>
<td>1.75</td>
</tr>
<tr>
<td>Non-Drinking Attitude</td>
<td>0.86</td>
<td>0.89</td>
<td>0.90</td>
<td>-2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Descriptive Norm</td>
<td>0.83</td>
<td>1.77</td>
<td>1.15</td>
<td>0.00</td>
<td>6.79</td>
</tr>
<tr>
<td>Injunctive Norm</td>
<td>0.74</td>
<td>-1.82</td>
<td>0.89</td>
<td>-3.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Drinking Outcome Measure

Weekly alcohol use. Weekly alcohol use was measured using the Daily Drinking Questionnaire (Collins, Parks, & Marlett, 1985) which asked respondents to indicate how much they typically drink on each night of the week. The items read "Given that it is a typical week, please write the number of drinks you probably would have each day (if none, then write in 0; If you are not exactly sure then write in your best estimate)." A response scale is provided for each day of the week (e.g., Monday_____, etc.). The number of drinks for each day of the week were summed to create the composite weekly drinking variable. These items were measured in each survey and were used to model typical drinking trajectories across the freshman year and into the beginning of the sophomore year.

In order to reduce the influence of outliers in the open-ended items, extreme outliers (less than 4% of responses) were recoded based on the recommendations of Tabachnick and Fidell
Specifically, outliers were recoded to a unit greater than the largest non-outlying value (two standard deviations above the mean). The recoded means are presented below (Table 3.3).

Table 3.3

*Composite Weekly Drinking Variables*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Stan. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1 (Prior to College)</td>
<td>2.96</td>
<td>4.54</td>
<td>0.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Time 2 (Beginning Freshman Year)</td>
<td>6.68</td>
<td>7.09</td>
<td>0.00</td>
<td>23.00</td>
</tr>
<tr>
<td>Time 3 (End First Fresh. Semester)</td>
<td>7.41</td>
<td>7.79</td>
<td>0.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Time 4 (End Freshman Year)</td>
<td>8.00</td>
<td>7.92</td>
<td>0.00</td>
<td>26.00</td>
</tr>
<tr>
<td>Time 5 (Beginning Sophomore Year)</td>
<td>9.32</td>
<td>9.23</td>
<td>0.00</td>
<td>30.00</td>
</tr>
</tbody>
</table>

**Statistical Analyses**

Throughout the statistical analyses and results section, the term "profile" will refer to the results of the LPA analysis of the patterns of decision-making (Aim 1), the term "trajectory" will refer to the results of the GMM analysis of the modeling of the alcohol consumption across the measurement period (Aim 2), and the term "drinking process" will refer to the multiple group GMM analysis that will link the decision-making profiles with the drinking trajectories (Aim 3).

**Aim 1: To identify profiles of students based on response patterns to decision-making variables measured prior to college matriculation (Part A of the Conceptual Model (Figure 1.1)).**

Latent profile analysis was used to identify latent, categorical alcohol-related decision-making profiles based on participants' mean response patterns to the decision-making variables. The decision-making variables were measured at the pre-matriculation baseline summer survey and included alcohol expectancies, attitudes toward drinking, attitudes toward non-drinking alternatives, descriptive norms, and injunctive norms. The goal of LPA is to identify latent
profiles, or subgroups, of participants who have decision-making patterns that are similar to others within their profile and distinct from participants in other profiles (Figure 3.1).  

**Figure 3.1.** The latent profile model of the alcohol-related decision-making variables.

In Figure 3.1, c represents a categorical latent variable that corresponds to the unique subpopulations that are modeled as the distinct latent profiles (Muthén & Muthén, 2006). The five indicator variables are continuous resulting in profiles that are distinguished based upon between-profile differences in mean response patterns. The arrows in the model from c to the indicator variables represent regressions of the continuous indicator variables on dummy variables that represent the latent profiles of c. These regressions imply that the mean values for the indicator variables vary across the latent profiles (c). LPA models provide information about the proportion of participants in the sample who fit each latent profile, the pattern of means of the decision-
making variables within each profile, and the probabilities of each individual belonging to each of
the observed profiles (called a posterior probability). The default LPA model used assumes equal
indicator-item variances across the latent profiles.

LPA model testing was conducted using Mplus Version 5.21 (Muthén & Muthén, 2006) and
testing procedures followed those recommended in the mixture modeling literature (Jung &
Wickrama, 2008; Lanza, Collins, Lemmon, & Schafer, 2007, Muthén, 2004; Muthén & Muthén,
2006). The first step in determining the best fitting LPA model was to test a model with a one-
profile solution to the data. Upon fitting the one-profile model, the fit indices are recorded to be
compared with a less restricted model that allowed for a two-profile solution to the data. The fit
indices of the two-profile model were then compared to the fit indices of the one-profile model to
determine which model had better fit to the data. Thus, a \( k+1 \)-profile model was estimated and
model fit was compared to a \( k \)-profile model. The fit indices that have been shown to perform the
best in simulation models (cf. Duncan, Duncan, Strycker, Okut, & Li, 2006), are recommended in
technical treatment of mixture models (Lanza & Collins, 2006; Muthén, 2001a, 2001b), and are
most commonly used in the application of mixture models (Boscardin, Muthén, Francis, & Baker,
2008; Connell, Dishion, & Deater-Deckard, 2006; Jung & Wickrama, 2008) are the Bayesian
Information Criteria (BIC), and the sample adjusted Bayesian Information Criteria (SABIC).
When interpreting these fit indices, a decrease in absolute size is indicative of better model fit.

While these fit indices were considered when determining the best fitting LPA model (i.e.,
the one with the appropriate number of profiles), other model aspects were also considered.
An appropriate model must contain profiles that are practically interpretable, theoretically sound,
and adequately sized. Also, the model must properly converge on the proper global solution (Jung
& Wickrama, 2008). Mplus has built-in program features to aid in proper convergence including
the ability to increase the amount of random start values and model iterations to avoid local solutions (Muthén & Muthén, 2006). The latent profiles must also be well separated and distinct which is related to accuracy in classifying individuals into the appropriate latent profiles (Ram & Grimm, 2009). The entropy value statistic reflects this classification confidence and can hold values between 0.00 and 1.00. An entropy value above 0.80 suggests adequate confidence in classifying individuals, separate and distinct latent profiles, and good predictive value of the decision-making profiles by the indicator variables (Celeux & Soromenho, 1996).

**Aim 2: Explore common drinking trajectories across the freshman and sophomore years of college (Part B of the Conceptual Model (Figure 1.1)).** Growth Mixture Modeling (GMM) was used to identify latent, categorical drinking trajectories that correspond to distinct growth patterns based on drinking measures across the freshman year and into the first semester of the sophomore year of college. The drinking measure will consist of a composite weekly drinking variable created by averaging the typical number of drinks that a participant consumes across each day of the week. The goal of GMM was to identify latent growth patterns of participants whose drinking is similar to others within their growth trajectory and distinct from participants in other growth trajectories (Figure 3.2). Thus, heterogeneity in growth patterns of individuals is captured in the latent growth trajectories.
Figure 3.2. Growth mixture model of weekly drinking trajectories.

The Drinking 1-5 variables represent weekly drinking measured at five time points and c represents the latent, distinct growth trajectories (Muthén & Muthén, 2006). The arrows from the intercept, slope, and quadratic latent variables to the Drinking 1-5 variables represent longitudinal growth factors. The coefficients of the intercept factors for each time point are fixed at 1. The slope growth factor coefficients are fixed at 0, 1, 1.5, 2.5, and 4, which models linear growth at non-equivalent time periods. This parameterization reflects the uneven measurement intervals of the follow-up surveys. The latent means of these growth terms represent the patterns of alcohol use within a latent class. A significant mean intercept term indicates non-zero levels of drinking at
time 1 (baseline) within a profile. A significant mean latent slope value indicates linear increases in drinking over the follow-up period and a significant quadratic term indicates a curvature in the growth rate of drinking (Duncan et al., 2006). The variance for the growth terms can also be estimated. Significant variances in these growth components indicate within class differences among individuals. For example, although each latent trajectory identified by GMM has a distinct average growth pattern, individuals within the trajectory are likely to vary in terms of how alike their trajectory is in respect to the average trajectory.

The lines from the c variable to the growth latent variables represent a regression of the growth variables on a set of dummy variables that represent the latent growth trajectories. These regressions imply that the mean of the latent growth factors vary across the latent trajectories. The GMM model provides information about the proportion of participants who fit each growth trajectory, the growth factors within each trajectory, and the probabilities of each individual belonging to each of the observed trajectories. The default GMM model assumes equal growth factor variances across latent trajectories. Allowing only the growth factor means to vary across trajectory classes achieves the goal of the proposed research of identifying latent trajectories based on shared patterns of mean change rather than on trajectory variability.

The procedures for determining the best fitting model in GMM are similar to those for LPA and follow the recommendations in the mixture model literature (Duncan et al., 2006; Jung & Wickrama, 2008; Muthén, 2001a, 2001b, 2004). The goal of the analysis in Aim 2 is to fit the unconditional model, which represents the latent growth trajectories without the decision-making profiles in the model. This analysis will determine the number of trajectories to include in the multiple group GMM that is described in Aim 3. First, a one-trajectory model with class-invariant mean and covariance growth factors (analogous to a conventional growth curve model) is fit. The
first model will provide insight into the extent of variation in drinking trajectories by modeling the average drinking trajectories for the entire sample and testing for random variation around the line. Assuming evidence for differing trajectories is found, the next step will be to determine the optimal number of latent trajectories using latent class growth analysis (LCGA), a special case of GMM. In LCGA, the variances of the growth factors (Figure 3.2) are fixed at zero. This adjustment leads to a model that allows for estimating mean intercept, growth (slope), and fluctuation (quadratic) patterns for each trajectory but assumes that all individuals within each trajectory follow the same growth pattern. A series of models will be tested, starting with a model with a one-trajectory ($k$) solution to the data. The number of latent trajectories will be increased by one trajectory ($k + 1$) while evaluating the model fit indices for each model. The BIC and the sample size adjusted BIC will be the primary fit indices and smaller values represent a better model fit.

In the case that the fit indices do not provide a clear, best-fitting model, Muthèn (2004) has provided suggestions for determining the best-fitting model. First, the BIC values can be presented graphically in an attempt to identify the point at which the decrease in model BIC ceases to be substantial. Second, Muthèn (2004) recommends examining the growth curves for each of the trajectories in the model with the largest number of trajectories to determine trajectories with meaningful numbers of participants. Similar to the LPA analyses, the best model must be practical, include trajectories that appear to be distinct, include trajectories with a reasonable number of individuals in each class, be parsimonious, and theoretically sound. In addition, the best fitting model is one where each identified latent class has a high probability of being fitting into a specific trajectory and a low probability of fitting other trajectories. Thus, the best model must have an entropy value above 0.80.
After the appropriate number of latent classes has been determined, within-class variability in growth trajectories will be tested by allowing various growth factor variances to be estimated. The GMM model will allow for within class variation in means and variances for the intercepts, slopes, and quadratic terms.

**Aim 3: Examine the relationship between the decision-making profiles and drinking trajectories (Part C of the Conceptual Model (Figure 1.1)).** In the final analysis, the relationship between the pre-college decision-making profiles and the drinking trajectories will be examined. A multiple group GMM analysis will be conducted to determine the likelihood of following each drinking trajectory for individuals assigned to each of the decision-making profiles (Figure 3.3). The results of the multiple group GMM will be referred to as drinking processes.

*Figure 3.3. Multiple group growth mixture model.*
The latent growth aspect of the model is the same as the model presented in Aim 2 as this analysis is a form of GMM analysis. The drinking outcome measures are the same and the growth factors are specified in a similar manner. The variable labeled cg in Figure 3.3 represents a categorical latent variable for known classes (Muthèn & Muthèn, 2006). In the current analysis, the known classes represent the decision-making profiles as identified in Aim 1. The arrow from cg to the c latent variable represents a multinomial logistic regression of c on cg, the known decision-making classes. This allows the class probabilities of the latent growth trajectory classes to vary across the known classes. Thus, 16 possible growth processes are modeled (4 decision-making profiles X 4 drinking trajectories). Mplus provides the probabilities of participants belonging to each distinct growth process. The arrows from cg to the latent growth terms (intercept, slope, and quadratic) imply the mean and variances of the growth trajectories are allowed to vary across the decision-making profiles.

When fitting the model, the number of estimated growth trajectories will reflect the optimal number determined in the unconditional GMM analysis from Aim 2. The cg variable will represent a decision-making profile variable, in which each participant is assigned to her/his most likely decision-making profile based on the LPA results from Aim 1. Specifically, each participant will be assigned based upon their highest individual posterior probability from the LPA results (Clark & Muthèn, 2010). The model will first be fit with the latent growth factor variances fixed to zero. Subsequent models will be tested with growth factor variances freed within classes. The trajectories that result from this model will not perfectly correspond to those found in aim 2 because the output of this model will be conditioned on the decision-making profiles.
Data Considerations

Missing data in all of the analyses will be handled in Mplus via the full information maximum likelihood utility. The amount of missing data on the decision-making variables is less than 0.01%. The percentage of missing data on the weekly drinking outcome at each survey measurement was as follows: 0.4% (survey 1), 13.3% (survey 2), 11.2% (survey 3), 16.1% (survey 4), 17.9% (survey 5).
CHAPTER FOUR: RESULTS

Latent Profile Analysis

The first step in the LPA analysis was to fit a one-profile solution to the data. The fit indices for this model were then compared to the fit indices of models with additional profiles (Table 4.1).

Table 4.1

Fit Indices for Latent Profile Analysis Models

<table>
<thead>
<tr>
<th>Number of profiles</th>
<th>BIC</th>
<th>SABIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3893.83</td>
<td>3862.12</td>
</tr>
<tr>
<td>2</td>
<td>3538.33</td>
<td>3487.59</td>
</tr>
<tr>
<td>3</td>
<td>3425.62</td>
<td>3355.86</td>
</tr>
<tr>
<td>4</td>
<td>3367.95</td>
<td>3279.16</td>
</tr>
<tr>
<td>5</td>
<td>3357.81</td>
<td>3250.00</td>
</tr>
</tbody>
</table>

Note. BIC = Bayesian Information Criteria, SABIC = sample-size adjusted BIC. Smaller values on these indices indicate better model fit.

Fit indices for the two-profile solution indicated an improvement in model fit over the one-profile model: a decrease in the BIC and SABIC indices. Given the better fit of the 2-profile solution, the 2-profile model became the baseline comparison model for testing a 3-profile solution. This process of testing models by adding profiles and comparing to the previous best fitting model was continued until the model fit indices indicated that the tested model did not have better fit than the preceding model.

Although the fit indices for the 5-profile solution did show a small improvement over the 4-profile solution, the 5-profile solution was not retained as the final model as it did not converge properly. In an attempt to aid model convergence, the amount of random starting values was
increased from 250 to 1000. A properly converged model in LPA is a model that converges on the global maximum solution, the parameter estimate with the largest loglikelihood (Jung & Wickrama, 2008). The purpose of increasing the number of random starting values is to reduce the likelihood of a model converging on a local solution. However, convergence for the 5-profile solution was still unsuccessful. Given the non-convergence of the 5-profile solution, the 4-profile model was retained as the best-fitting model. The model fit indices indicated the 4-profile solution fit better than the 3-profile solution. The 4-profile model converged properly using 250 random start values and the best log likelihood value replicated.

The next step of the LPA was to determine if the profiles were well separated, with mean patterns of the indicator variables that are distinct between profiles. The entropy value provides an estimate of the model separation. The entropy value for the four-profile solution was 0.85, above the 0.80 value that indicates well defined profiles (Celeux & Soromenho, 1996). The LPA analysis provided posterior probabilities which represent the probability that each participant would be assigned to the observed profile. Table 4.2 provides the average posterior probabilities for each of the four profiles. Posterior probabilities that approach a value of 1.0 for one profile and 0.0 for others are also suggestive of well defined profiles as participants are highly likely to be described by only one profile (Muthén, 2000a).

The average posterior probabilities were at least 0.90 for each of the four profiles which suggest that individuals are highly likely to be assigned to only one profile. Given the high entropy values and average posterior probabilities, individuals were assigned to their profile with the highest posterior probability (Clark & Muthén, 2010) in order to be used in the multiple group analysis in Part C of the analysis.
Table 4.2

Average Latent Profile Probabilities for Most Likely Latent Profile Membership

<table>
<thead>
<tr>
<th>Latent Profile</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.96</td>
<td>0.00</td>
<td>0.04</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>0.00</td>
<td>0.90</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>3</td>
<td>0.03</td>
<td>0.06</td>
<td>0.91</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>0.00</td>
<td>0.05</td>
<td>0.00</td>
<td>0.95</td>
</tr>
</tbody>
</table>

The means for each of the decision-making indicator items within each of the profiles are presented below (Table 4.3). Decision-making variable means were compared between profiles by assigning participants to the most likely profile and using Tukey's HSD Post Hoc Test to test for mean differences.
Table 4.3

*Standardized Means (and Variances) of the Drinking-related Decision-Making Variables Within Each Profile*

<table>
<thead>
<tr>
<th></th>
<th>Profile 1 (n = 60; 21%)</th>
<th>Profile 2 (n = 100; 35%)</th>
<th>Profile 3 (n = 108; 38%)</th>
<th>Profile 4 (n = 17; 6%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Expectancies</td>
<td>-1.42 (^{2,3,4})</td>
<td>0.31 (^{1,3})</td>
<td>-0.34 (^{1,2,4})</td>
<td>0.43 (^{1,3})</td>
</tr>
<tr>
<td>(σ² = .23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude toward Drinking</td>
<td>-1.71 (^{2,3,4})</td>
<td>0.47 (^{1,3})</td>
<td>-0.49 (^{1,2,4})</td>
<td>0.58 (^{1,3})</td>
</tr>
<tr>
<td>(σ² = .20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude toward Non-drinking Alternatives</td>
<td>1.79 (^{2,3,4})</td>
<td>0.30 (^{1,3})</td>
<td>1.01 (^{1,2,4})</td>
<td>0.27 (^{1,3})</td>
</tr>
<tr>
<td>(σ² = .49)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descriptive Peer Norms</td>
<td>1.21 (^{2,4})</td>
<td>2.10 (^{1,3,4})</td>
<td>1.31 (^{2,4})</td>
<td>4.85 (^{1,2,3})</td>
</tr>
<tr>
<td>(σ² = .54)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injunctive Peer Norms</td>
<td>-2.40 (^{2,3,4})</td>
<td>-1.49 (^{1,3,4})</td>
<td>-2.00 (^{1,2,4})</td>
<td>-0.55 (^{1,2,3})</td>
</tr>
<tr>
<td>(σ² = .57)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Superscripts (e.g., \(^{1}\)) indicate a significant mean difference with the numbered profile, \(p < .05\). For example, the mean score on the alcohol expectancy variable for individuals in profile 1 was -1.42 which was significantly different from the mean score on the alcohol expectancies variable for profiles 2 (0.31), 3 (-0.34), and 4 (0.43). The subscripts \(^{2,3,4}\) represent these significant differences.

Each column represents one of the four profiles and contains both the number of individuals who are well described by the profiles and the mean value for each of the indicator decision-making variable within each profile. The response pattern of 60 participants, 21% of the sample, was well described by profile 1. On average, these participants reported strongly unfavorable alcohol expectancies (-1.42), strongly unfavorable attitudes toward drinking (-1.71), strongly favorable attitudes toward non-drinking alternatives (1.79), low levels of descriptive peer norms (1.21), and perceived their friends as strongly disapproving of their drinking (-2.40). When compared to the mean scores of participants in profiles 2, 3, and 4, participants in profile 1 reported the significantly lowest scores on the alcohol expectancy and attitude toward drinking.
measures, the significantly highest scores on the attitudes toward non-drinking alternatives variable, and the significantly lowest perceptions of friends’ approval of alcohol use. For the descriptive norm measure, those assigned to profile 1 perceived significantly less drinking by their friends and peers (1.21) compared to those in profiles 2 (2.10) and 4 (4.85). Based on the unfavorable alcohol expectancies and attitudes toward drinking, the positive attitudes toward non-drinking alternatives, the low normative perceptions of this profile, and the strong disapproval from referents, the profile was labeled "Anti-Drinking".

Profile 2 described 35% of the participants. On average, these participants reported slightly favorable alcohol expectancies (0.31) and attitudes toward drinking (0.47). These participants also held slightly favorable attitudes toward non-drinking alternatives (0.30), perceived their friends and peers as drinking an average of approximately 2 drinks per night (2.10), and perceived disapproval of drinking from their friends (-1.49). When compared to the mean scores of participants in profiles 1 and 3, those in profile 2 reported significantly more favorable alcohol expectancies, significantly more favorable drinking attitudes, and significantly less favorable attitudes toward non-drinking alternatives. Those assigned to profile 2 also perceived significantly more friend and peer drinking and significantly less disapproval of drinking from peers compared to those in profiles 1 and 3. However, their descriptive and injunctive drinking norms were significantly less than participants in profile 4. Given that participants in profile 2 had, on average, among the most favorable levels of alcohol expectancies and attitudes toward drinking, the lowest levels of attitudes toward non-drinking alternatives, and levels of normative perceptions that were higher than 2 profiles and lower than profile 4, profile 2 was labeled "Mixed". This label reflects their generally drinking-favorable
alcohol expectancies and attitudes and their alcohol-unfavorable descriptive and injunctive peer norms.

The third profile (38% of the sample) described participants who reported slightly unfavorable expectancies (-0.34) and attitudes toward drinking (-0.49), reported favorable attitudes toward non-drinking alternatives (1.01), perceived their friends and peers as drinking at low levels (1.31), and reported strong disapproval of their personal drinking from their friends (-2.00). Participants assigned to profile 3 reported alcohol expectancies, attitudes toward drinking, descriptive peer norms, and injunctive peer norms that were significantly less drinking-favorable when compared to those reported by profiles 2 and 4. However, the means for the alcohol expectancies, attitudes toward drinking, and injunctive norms measures were significantly less negative when compared to the Anti-drinkers (profile 1). Given the mild disapproval on most of the drinking variables, this profile was labeled "Unfavorable".

The fourth profile (6% of the sample) described participants who reported slightly favorable alcohol expectancies (0.43) as well as slightly favorable attitudes toward drinking (0.58) and attitudes toward non-drinking alternatives (0.27). Participants in profile 4 also reported high rates of drinking in their friends and peers (4.85) and slight disapproval of drinking from their friends (-0.55). When compared to those in the Anti-Drinking (profile 1) and Unfavorable (profile 3) profiles, participants in profile 4 reported significantly more favorable alcohol expectancies and attitudes toward drinking and significantly less favorable attitudes toward non-drinking alternatives. Profile 4 participants also reported descriptive norms that were significantly higher and injunctive norms that were significantly less anti-drinking compared to the other 3 profiles. They were labeled "Risky".
Growth Mixture Model

Prior to fitting the GMM model, I examined the general patterns of alcohol use by plotting observed drinking scores on each measure for each individual (Figure 4.1).

Figure 4.1. Individual trajectories of weekly drinking and a single average growth parameter.

In this graph, the lines represent the observed drinking scores for each of the 280 participants. The Y-axis represents the number of drinks consumed in the average week and the X-axis represents the time of measurement (0 = baseline (prior to college matriculation), 1 = 4-month follow-up, 1.5 = 6-month follow-up, 2.5 = 10-month follow-up (end of the freshman year), & 4 = 16-month follow-up (sophomore year)). Modeling these individual drinking patterns shows considerable variability in the participants’ drinking patterns. The dark line represents a single average growth estimate obtained by a traditional latent growth curve model. In this model, the average growth estimate is represented by significant growth factors of the mean (3.04), slope (3.89), and quadratic terms (-0.59) (all p’s < .001). These growth factors are
reflected in the graph as non-zero drinking at baseline, an increase in drinking across time (positive slope), and a non-constant rate of drinking increases across time (negative quadratic term). In the growth curve model, the variances of the growth factors were also estimated to test for significant individual variation around the growth line. Significant variances were observed for the intercept (17.19), the slope (15.50), and quadratic (-0.59) terms (all p's < .001). These significant variances suggest individual variation around the mean line in drinking at baseline, individual differences in the rate of growth, and individual differences in the amount of drinking fluctuation. These findings suggest that the growth in college drinking may not be adequately modeled with a single average growth line and individual variation exists that may reflect a variety of growth trajectories.

In the next step, a series of models were tested to determine the optimal number of latent trajectories. In these models, the means of the growth factors are estimated but the variances of these factors are set to zero. The BIC and sample-size adjusted BIC are presented in Table 4.4.

Table 4.4

Fit Indices for Latent Class Growth Mixture Models

<table>
<thead>
<tr>
<th>Number of trajectories</th>
<th>BIC</th>
<th>SABIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8507.57</td>
<td>8482.20</td>
</tr>
<tr>
<td>2</td>
<td>7745.47</td>
<td>7707.41</td>
</tr>
<tr>
<td>3</td>
<td>7532.93</td>
<td>7482.20</td>
</tr>
<tr>
<td>4</td>
<td>7463.35</td>
<td>7399.93</td>
</tr>
<tr>
<td>5</td>
<td>7385.57</td>
<td>7309.46</td>
</tr>
<tr>
<td>6</td>
<td>7321.31</td>
<td>7232.52</td>
</tr>
<tr>
<td>7</td>
<td>7279.35</td>
<td>7177.88</td>
</tr>
</tbody>
</table>
The value of both fit indices continues to decrease for each of the 7 models. This is indicative of better model fit for each subsequent model. Given that the BIC and SABIC did not fail to improve in any of the models, it was unclear at this point in the analyses as to which model was the best-fitting model. Muthén (2004) has provided suggestions for determining the best fitting model in such ambiguous situations. First, the BIC values can be presented graphically in an attempt to identify the point at which the decrease in model BIC ceases to be substantial (Figure 4.2).

The curve of the plotted BIC values gradually levels off and does not provide a definitive point where the BIC for a model with $k$ latent trajectories fails to improve over the BIC of the $k-1$ trajectory model. This is consistent with Table 4.4. However, the curve begins to level near trajectories 3 and 4 which suggests one of these solutions may be the best model to retain as the fit does not seem to improve substantially for the subsequent models.

![Figure 4.2. BIC values for the growth mixture models.](image-url)
In addition to plotting the BIC values, Muthén (2004) recommends examining the growth curves for each of the trajectories in the model with the most trajectories (e.g., 7 in this case). This plot provides information regarding whether the 7 trajectories seem to be large and well defined (e.g., more than 10% of the sample) or if the trajectories contain small groups of participants. Trajectories that represent a very small portion of the sample may reflect random variation around other trajectories and thus may be artifacts of the analysis. The mean trajectory curves for the 7-trajectory model are presented in Figure 4.3.

Figure 4.3. Growth curves for seven trajectory model.

In general, the mean growth curves show an increase in weekly alcohol consumption from the pre-college baseline (labeled 0 on the X-axis) upon college matriculation (labeled 1 on the X-axis). For most trajectories, the consumption continues to increase until the end of the freshman year (2.5) and growth levels off between the end of the freshman year and the last measurement. Each of the bolded lines represent trajectories that contained more than 10% of
participants. A fourth trajectory, represented by the dotted lines with the X markers, contained nearly 8% of participants in the sample. The remaining three trajectories contained less than 6% of the total sample. Given the small number of participants in these three classes, it is possible that these trajectories represent variations of the larger trajectories and are not distinct growth patterns. Based on the plot of the BIC values that suggests a leveling off in substantial improvement in model fit indices beginning near the 3-trajectory and 4-trajectory solutions (Figure 4.2) and the three large trajectories with a fourth approaching 10% in Figure 4.3, I further examined the trajectories in the 3- and 4-trajectory models to determine which model seemed to have the appropriate number of growth trajectories (Figures 4.4 and 4.5).

Figure 4.4. Mean growth trajectories for the 3-trajectory solution.
Figure 4.5. Mean growth trajectories for the 4-trajectory solution.

The trajectories in both these figures share common shapes. Both the 3- trajectory and 4- trajectory solution contained trajectories with a large number of students (Trajectory 2 in Figure 4.4 (50.4%), Trajectory 4 in Figure 4.5 (46.1%)) who reported low levels of consumption. In these trajectories, participants reported, on average, very low drinking at baseline and a small linear increase in weekly consumption throughout the project assessment period. However, weekly consumption did not seem to exceed 2 drinks per week at the final survey for the trajectories in either Figure. The 3- trajectory and 4- trajectory solutions also shared a high consumption trajectory (Trajectory 3 in Figure 4.4 (18.4%), Trajectory 1 in Figure 4.5 (11.3%)). Participants described by these trajectories reported the highest consumption prior to college at
baseline and rapidly increased their drinking throughout their freshman year. The differences between the two graphs are in the trajectories that describe the midlevel drinkers. In the 3-trajecory solution, Trajectory 1 participants reported drinking at a moderate rate prior to college and increased drinking during the freshman year, with a leveling off between the last two measures. In the 4- trajectory solution, a similar shaped trajectory seemed to split into two lines (Trajectory 2 & Trajectory 3), with each line representing different baseline consumption levels.

In Figure 4.5, Trajectory 2 participants consumed approximately 6 drinks a week at the pre-college baseline while Trajectory 3 participants consumed approximately 2 drinks per week. It is not clear from these two figures if the middle trajectories should be distinct as in the 4- trajectory solution or are better described as a single trajectory with individual variance in the growth parameters.

In order to determine if the middle consumption pattern is better modeled as a single trajectory or as two distinct curves, the 3- trajectory and 4- trajectory models were tested while allowing the growth factor variances to be freely estimated. In the previous models, these growth factor variances were not estimated (i.e., set to 0 in the analyses). The growth factor variances were estimated as random effects in a step-wise fashion: the first model freely estimated the intercept variance, the second model freely estimated the intercept and slope variance, and the third model freely estimated the intercept, slope, and quadratic growth factor variances. This process was conducted for both the 3- trajectory and 4- trajectory solution. In all the models, the growth factor variances were constrained to be equal across trajectories.

When attempting to run the models, the results did not converge because of a non-positive definite residual item variance matrix. The residual variance of the first weekly drinking
measure was nearly zero and negative. This parameter was fixed to zero in order to estimate the models. Results are presented in Table 4.5.

Table 4.5

*Fit Indices for the 3-trajectory and 4-trajectory GMM with Random Growth Factors*

<table>
<thead>
<tr>
<th>Number of Trajectories</th>
<th>Random Effects</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>I</td>
<td>7480.92</td>
</tr>
<tr>
<td>3</td>
<td>I,S</td>
<td>7368.75</td>
</tr>
<tr>
<td>3</td>
<td>I,S,Q</td>
<td>7312.12</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
<td>7402.51</td>
</tr>
<tr>
<td>4</td>
<td>I,S</td>
<td>7313.33</td>
</tr>
<tr>
<td>4</td>
<td>I,S,Q</td>
<td>7165.64</td>
</tr>
</tbody>
</table>

The model with best fit indices was the 4-trajectory model with freely estimated latent growth factor intercept, slope, and quadratic variances. The BIC for this model was much lower than the BICs for any of the random growth estimated models in Table 4.5. The model entropy value was 0.99 and the average probabilities of individuals being assigned to the appropriate observed trajectory was close to 1 (Table 4.6), suggestive of well-separated trajectories.

Table 4.6

*Average Latent Trajectory Probabilities for Most Likely Latent Trajectory Membership*

<table>
<thead>
<tr>
<th>Latent Trajectory</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.99</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>0.00</td>
<td>0.99</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>0.00</td>
<td>0.00</td>
<td>0.99</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.99</td>
</tr>
</tbody>
</table>
Based on the BIC values presented in Table 4.5 and the high entropy values, the 4-trajectory GMM with random intercept, slope, and quadratic growth factors was retained as the best fitting model (Figure 4.6). The significant random effects suggest that within each of the trajectories, individuals vary in their drinking at baseline, differ in the amount of increase in drinking, and differ in drinking fluctuation patterns.

![Graph showing weekly number of drinks across different measurement periods for each trajectory.]

**Figure 4.6.** Final 4-trajectory GMM model.

The trajectory that represented the largest amount of participants, labeled trajectory 1 in the figure, represents 65% of the sample. This trajectory was labeled "low consumption" (subsequently referred to as LC). This trajectory had significant means for the intercept (0.14
(0.03), $p < .001$), the slope (3.16 (0.35), $p < .001$), and the quadratic (-0.46 (0.08), $p < .001$) terms. This trajectory was characterized by low levels of alcohol consumption at baseline and an increase in drinking throughout the freshman year. Weekly consumption levels off from the end of the freshman year to the sophomore year measure.

Trajectory 2 represents 16% of the sample. This trajectory was labeled “moderately-low consumption, freshman increase” (MLI). This trajectory had significant means for the intercept (4.26 (0.17), $p < .001$), the slope (6.48 (0.85), $p < .001$), and the quadratic (-1.05 (0.19), $p < .001$) terms. This trajectory was characterized by moderately-low weekly levels of alcohol consumption at baseline and an increase in drinking at all the follow-up measures. The significant quadratic terms suggests the growth in drinking is not constant across the follow-up measures. This trajectory was also characterized by a slight reduction in drinking at the final follow-up.

Trajectory 3 represents 11% of the sample. This trajectory was labeled “moderately-high consumption, freshman increase” (MHI). The trajectory had significant means for the intercept (8.84 (0.20), $p < .001$), the slope (5.42 (1.17), $p < .001$), and the quadratic (-0.92 (0.31), $p < .001$) terms. This trajectory was characterized by moderately-high weekly levels of alcohol consumption at baseline and an increase in drinking at all the follow-up measures. The significant quadratic terms suggests the growth in drinking is not constant across the follow-up measures. This trajectory was also characterized by a slight reduction in drinking at the final follow-up.

Trajectory 4 represents 9% of the sample. This trajectory was labeled "high consumption, steady increase" (HCSI). This trajectory had significant means for the intercept (14.12 (0.26), $p < .001$) and the slope (2.89 (0.99), $p < .001$) terms. This trajectory was
characterized by the highest weekly levels of alcohol consumption at baseline and an increase in drinking at all the follow-up measures. A non-significant quadratic (-0.29 (0.23), p = 0.21) suggests the increase in drinking was constant across the measurement period.

**Multiple Group Growth Mixture Model**

For the final analysis, the results from the LPA model from Aim 1 and the GMM model from Aim 2 were combined to determine the relationship between the pre-college decision-making profiles and the drinking trajectories. This analysis answers the primary question of “Within each decision-making profile, what are participants’ likely drinking trajectories”. In this analysis, individuals were assigned to their most likely decision-making profiles (i.e., Unfavorable, Anti-Drinking, Mixed, or Risky) and four drinking trajectories were estimated within each profile. Four growth trajectories were estimated based on the best-fitting 4-trajectory model of the GMM from Aim 2. Difference in growth trajectories in the current model and Figure 4.6 are expected as the model presented in Figure 4.6 is an unconditional model and in the current model, the growth trajectories are conditional on the decision-making profiles. Thus, the trajectories in the current model are only considered in terms of growth within each decision-making pattern.

In the multiple group GMM, there are 16 possible results in terms of drinking trajectories within each profile (4 decision-making profiles X 4 drinking trajectories). These combinations of drinking trajectories within each profile are called drinking processes. The Aim 3 analysis provides two primary results: (1) how many individuals within each decision-making profile follow each drinking process and (2) the drinking growth curves for each of the trajectories within each profile.
The first model fit a 4-trajectory solution to the data with freed variances of the growth trajectories, based on the best-fitting model from Aim 2. However, when adding the decision-making groups to the analysis, the model did not properly converge as several of the estimated parameters in the PSI matrix, which represent the growth factor latent variances, were not positive definite. Thus, in the subsequent model, the latent growth factor variances were constrained to zero. This constraint produced a model with variation in the growth parameters for participants within each observed class held to be zero. The fit indices of this model were: \( \text{BIC} = 8062.95 \) and \( \text{SABIC} = 7847.32 \) (see footnote 1). The entropy value for this model was 0.95 which suggests that individuals were highly likely to be correctly assigned to their most likely profile.

Table 4.7 presents the number of participants who fit each of the drinking processes. For example, latent class pattern 1-3 represents individuals who were assigned to Anti-Drinking profile and follow trajectory 3. It is important to note that given that the drinking trajectories are conditioned on the decision-making profiles in this model and, as a result, trajectory 3 does not necessarily correspond to the drinking trajectory 3 presented in Aim 2. Thus, it is difficult to interpret these findings without presenting them graphically, which are shown below (Figure 4.6). The drinking processes with the highest numbers of participants (above 10% of the sample) have been bolded and italicized in Table 4.7.

Footnote 1: When fitting the model, results indicated that zero participants were assigned to drinking processes 1-1 and 1-2. This means that only two distinct drinking processes were observed for decision-making profile 1. Because of this, the means for the growth factors for these processes were zero which resulted in a non-positive definite matrix. Mplus automatically fixed these parameters to zero in order to fit the model.
Table 4.7

Classification of Individuals Based on their Most Likely Decision-Making Profile

<table>
<thead>
<tr>
<th>Decision-Making Profile</th>
<th>Drinking Process</th>
<th>Number of Participants</th>
<th>Percentage of Total Sample</th>
<th>Percentage of Within Decision-Making Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Drinkers</td>
<td>1-1</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-2</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-3</td>
<td>57</td>
<td>20%</td>
<td>94%</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-4</td>
<td>3</td>
<td>1%</td>
<td>6%</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-1</td>
<td>13</td>
<td>5%</td>
<td>14%</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-2</td>
<td>28</td>
<td>10%</td>
<td>28%</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-3</td>
<td>29</td>
<td>10%</td>
<td>28%</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-4</td>
<td>30</td>
<td>11%</td>
<td>31%</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-1</td>
<td>64</td>
<td>22%</td>
<td>59%</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-2</td>
<td>9</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-3</td>
<td>33</td>
<td>12%</td>
<td>31%</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-4</td>
<td>2</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Risky</td>
<td>4-1</td>
<td>4</td>
<td>1%</td>
<td>24%</td>
</tr>
<tr>
<td>Risky</td>
<td>4-2</td>
<td>2</td>
<td>1%</td>
<td>12%</td>
</tr>
<tr>
<td>Risky</td>
<td>4-3</td>
<td>10</td>
<td>4%</td>
<td>60%</td>
</tr>
<tr>
<td>Risky</td>
<td>4-4</td>
<td>1</td>
<td>0.5%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 4.7 also shows the most likely drinking processes for individuals in each decision-making profile. Those individuals assigned to decision-making profile 1, the Anti-Drinkers, were highly likely to follow only one drinking pattern, trajectory 3 (0.94). Those in decision-
making profile 2, Mixed, were not highly likely to follow one certain trajectory. The probability of following trajectories 2 (0.28), 3 (0.28), and 4 (0.31) were nearly equal. Those in decision-making profile 3, Unfavorable, were highly likely to either follow trajectory 1 (0.59) or to have drinking patterns consistent with trajectory 3 (0.31). Finally, those in decision-making profile 4, Risky, were highly likely to follow trajectory 3 (0.59), followed by trajectory 1 (0.24).

In order to examine alcohol consumption for each of the drinking processes from Table 4.7, the results of the multiple group GMM are presented graphically (Figures 4.7-4.10). Each figure represents the drinking processes for each of the decision-making profiles. In these figures, the Y-axis represents the number of weekly drinks and the X-axis represents the various survey measurement points. Each line represents the drinking trajectories for the drinking processes with each decision-making profile. The thickness of each line represents the proportion of individuals within the decision-making profile that fit the drinking trajectory, with thicker lines representing more participants. Four trajectories were estimated for each decision-making profile. Thus, four processes were observed for most of the decision-making profiles. The only exception, in terms of number of drinking processes, were the Anti-drinkers shown below in Figure 4.7. Only two processes were observed for the Anti-drinkers which suggest that the participants were only likely to follow two distinct drinking trajectories.
As shown in Table 4.7, zero participants were assigned to the 1-1 and 1-2 drinking processes. However, 57 participants were likely to be classified into drinking process 1-3 (94% of Anti-Drinkers) and 3 participants (6% of Anti-Drinkers) were classified into drinking process 1-4. Figure 4.7 shows that those in drinking process 1-3 drank very little at baseline and continued this very low consumption pattern throughout the measurement period. Those in process 1-4 also drank at very low levels prior to college matriculation but increased their drinking throughout their freshman year to a peak of approximately 7 weekly drinks at the end of their freshman year. Thus, those assigned to the Anti-Drinker profile were highly likely to drink at very low levels through the project period. A small group of the Anti-Drinkers increased their drinking but were still drinking at low weekly levels.
The drinking processes for those assigned to decision-making profile 2, the Mixed profile, are presented below (Figure 4.8).

As shown in Table 4.7, 13 participants were assigned to drinking process 2-1, 28 to process 2-2, 29 to process 2-3, and 30 to process 2-4. Within the Mixed profile (decision-making profile 2), process 2-1 represents 14% of those assigned to the profile, process 2-2 represents 28%, process 2-3 represents 28% and process 2-4 represents 31%. Figure 4.8 shows those described by drinking process 2-1 drank at moderately-high levels prior to college matriculation and dramatically increased their drinking throughout the freshman year with some leveling off at the last assessment period. Those described by process 2-2 drank at low levels prior to college and increased their drinking slightly. Process 2-3 represents individuals who drank at moderately-high levels prior to college and gradually increased their drinking.
throughout the assessment period. Those described by process 2-4 drank at low levels prior to college but quickly increased to moderately-high drinking levels during the freshman year.

The drinking processes for decision-making profile 3, the Unfavorable profile, are presented below (Figure 4.9).

![Processes for Unfavorable](image)

**Figure 4.9.** Drinking processes for decision-making profile 3, "Unfavorable".

As shown in Table 4.7, 64 participants were assigned to drinking process 3-1, 9 to process 3-2, 33 to process 3-3, and 2 to process 3-4. Within the Unfavorable profile (decision-making profile 3), process 3-1 represents 59% of those assigned to the profile, process 3-2 represents 9%, process 3-3 represents 31% and process 3-4 represents 2%. Those classified into process 3-1 reported low levels of consumption prior to college and slightly increased their use during college. Process 3-2 describes participants who drank at moderate levels prior to college and increased their drinking to high levels during the freshman year. Process 3-3 describes
participants who drink at low levels prior to college and increased to moderate drinking levels at the end of the measurement period. Finally, process 3-4 describes individuals who drank at very low levels prior to college and dramatically increased their drinking throughout the freshman year. Between the last two measures, there was a dramatic increase in drinking for those described by process 3-4.

The drinking processes for decision-making profile 4, the Risky profile, are presented below (Figure 4.10).

![Processes for Risky](image)

*Figure 4.10.* Drinking processes for decision-making profile 4, "Risky".

As shown in Table 4.7, 4 participants were assigned to drinking process 4-1, 2 to process 4-2, 10 to process 4-3, and 1 to process 4.4. Within decision-making profile 4, process 4-1 represents 24% of those assigned to the profile, process 4-2 represents 12%, process 4-3 represents 59% and process 4-4 represents 6%. Process 4-3 described the majority of the Risky
profile and represents participants who drank frequently at baseline and gradually increased their drinking throughout the follow-up periods. Risky participants who followed process 4-1 reported high levels of consumption prior to college and steadily increased weekly consumption throughout the measurement period. Those classified into process 4-2 drank at moderate levels prior to college and steadily increased to heavy drinking. Finally, Process 4-4 described participants who drank at very low levels prior to college and increased their drinking to high levels at the end of the freshman year.

Fitting a Constrained Model

In the previous model, the multiple group growth mixture model, the means and variances of the drinking trajectories were allowed to vary within each of the 4 decision-making profiles. This model was informed by the results of Aim 2 by allowing four trajectories. However, this model does not directly compare the results of Aims 1 and 2 as the means and variances of the drinking trajectories are not the same as in Aim 2. In order to directly compare the findings of Aim 1 and Aim 2, I computed a constrained model. In the constrained model, the growth factors means and variances for the participants within each decision-making profile were constrained to be equal to those found in the four growth trajectories observed in Aim 2. This analysis is less exploratory than the previous multiple group growth mixture model and answers the question “How many participants in each decision-making profile follow the drinking trajectories observed in Aim 2”. This analysis is analogous to a multiple group structural equation model in which the factor loading and beta values in the model vary from the whole sample SEM model to the models that are fit for each group.

To test the constrained model, the values intercept, slope, and quadratic means and variances were constrained to be equal to those found in final Aim 2 GMM model. Thus, the
alcohol growth factors for Processes 1-1 through 1-4 were equal to the four trajectories from Aim 2. This was repeated for all of the decision-making profiles. The fit indices for this model were: BIC = 7864.26 and SABIC = 7800.84. The entropy value was 0.99. These indices indicate that the model fit is better than the unconstrained model. However, four regression parameters had to be fixed to zero by Mplus to fit the model. It is unclear from the Mplus output as to why this was required. The unconstrained and constrained models were compared on differences in number of participants assigned to processes, the drinking trajectories within the processes, and the multinomial logistic regression results.

Table 4.8 compares the number of participants who fit each of the unconstrained drinking processes from Aim 3 and the drinking processes from the constrained model. The results of the unconstrained and constrained models are very similar in terms of the number of participants assigned to processes within each decision-making profile. For the Anti-drinkers, the majority of participants are assigned to one process in both the unconstrained (Process 1-1, n = 57) and constrained model (Anti-LC, n = 60). For the Mixed decision-making profile, approximately 30% of participants were distributed across three drinking process and 13-14% of participants were assigned to a fourth process in both the unconditional and conditional model. The Risky drinkers were highly likely to follow one process for both the unconstrained (Process 4-3, n = 10) and constrained model (Risky-HCSI, n = 11). However, there were differences in the distribution of drinking processes within the Unfavorable profile. In the unconstrained model, the largest process for the Unfavorable profile (Process 3-1) described 64 participants and the second largest process (Process 3-3) described 33 participants, whereas in the constrained model the largest process (Unfavorable- LC) described 91 participants and the second largest (Unfavorable- MLI) described 13 participants.
### Table 4.8

*Comparison of the Unconstrained and Constrained Models on the Classification of Individuals Based on their Most Likely Decision-Making Profile*

<table>
<thead>
<tr>
<th>Decision-Making Profile</th>
<th>Unconstrained Model</th>
<th>Constrained Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drinking Process</td>
<td>Number of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participants</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-1</td>
<td>0</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-2</td>
<td>0</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-3</td>
<td>57</td>
</tr>
<tr>
<td>Anti-Drinkers</td>
<td>1-4</td>
<td>3</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-1</td>
<td>13</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-2</td>
<td>28</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-3</td>
<td>29</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-4</td>
<td>30</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-1</td>
<td>64</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-2</td>
<td>9</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-3</td>
<td>33</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-4</td>
<td>2</td>
</tr>
<tr>
<td>Risky</td>
<td>4-1</td>
<td>4</td>
</tr>
<tr>
<td>Risky</td>
<td>4-2</td>
<td>2</td>
</tr>
<tr>
<td>Risky</td>
<td>4-3</td>
<td>10</td>
</tr>
<tr>
<td>Risky</td>
<td>4-4</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note.* The processes from the unconstrained and constrained model are not directly comparable as presented in the table. Thus, the process labeled "1-1" in the unconstrained model is not directly comparable in terms of alcohol consumption to the process labeled "1-1" in the constrained model. LC - low consumption, MLI - moderately-low consumption, freshman increase, MHI - moderately-high consumption, freshman increase, HCSI - high consumption, steady increase.
In order to compare the drinking trajectories for each of the processes, the results of the constrained model are presented below for each of the decision-making profiles. As in the figures from the previous section, the Y-axis represents the number of weekly number of drinks and the X-axis represents the various survey measurement points. Each line represents the drinking trajectories and the thickness represents the proportion of individuals within the decision-making profile that fit the drinking trajectory.

![Anti-Drinkers Conditional Model](image)

*Figure 4.11.* Anti-Drinkers conditional model. Only one drinking process is presented for the Anti-Drinkers because zero participants were found to follow the MLI, MHI, or HCSI trajectories.

As shown in Table 4.8, zero participants in the Anti-Drinker profile were assigned to the MLI, MHI, or HCSI trajectory. All 60 Anti-Drinker participants were assigned to the LC process (Figure 4.11). These findings are similar to those in the unconstrained model (Figure...
4.7) in that these participants drink at low levels throughout the measurement period. However, the overall amount of consumption is higher in the constrained model.

As shown in Table 4.8, 30 participants were assigned to the Mixed-LC process, 32 participants were assigned to the Mixed-MLI process, 24 participants were assigned to the Mixed-MHI process, and 14 participants were assigned to the Mixed-HCSI process (Figure 4.12). These findings are similar to those in the unconstrained model (Figure 4.8): a process with participants who drank at a relatively low level (Process 2-2/Mixed-LC), a process with low pre-college consumption that increased throughout the measurement period (Process 2-4/Mixed-MLI), a process with high pre-college consumption with an increase throughout the measurement period (Process 2-3/Mixed-MHI), and a process with heavy drinking participants who reported increases in drinking throughout the measurement period (Process 2-1/Mixed-HCSI). There were two primary differences in the models: a more dramatic drinking increase for the highest consumption processes (Process 2-1/Mixed-HCSI) in the unconstrained model and a marked decrease in consumption over the final two measurements for the Process 2-4/Mixed-MLI process in the unconstrained model.
As shown in Table 4.8, 91 participants were assigned to the Unfavorable-LC process, 13 participants were assigned to the Unfavorable-MLI process, 4 participants were assigned to the Unfavorable-MHI process, and 0 participants were assigned to the Unfavorable-HCSI process (Figure 4.13). When comparing these processes to the drinking processes observed in the unconstrained model (Figure 4.9), notable differences are apparent. First, although the majority of participants follow the lowest consumption process in each model (Process 3-1/ Unfavorable-LC) the percentages of participants are different. In the unconstrained model, 59% of Unfavorable participants follow process 3-1 whereas 84% of participants in the constrained model follow the Unfavorable-LC process. Second, the middle drinking trajectory in each model (Process 3-3/ Unfavorable-MLI) represents 31% of participants in the unconstrained model (Processs 3-3) but only 12% of participants in the constrained model. The heaviest drinking
process (Process 3-2/ Unfavorable-MHI) represents a small number of participants in the Unfavorable profile in both the unconstrained model (9%) and the constrained model (4%). A fourth small process found in the unconstrained model (Process 3-4, 2%) is not represented in the constrained model.

Figure 4.13. Unfavorable conditional model. Only three drinking process are presented for the Unfavorable profile because zero participants were found to follow the HCSI trajectory.

As shown in Table 4.8, 1 participant was assigned to the Risky-LC process, 3 participants were assigned to the Risky-MLI process, 2 participants were assigned to the Risky-MHI process, and 11 participants were assigned to the Risky-HCSI process. These findings share some similarities to those in the unconstrained model (Figure 4.10), most notably a process with participants who drank at a high levels prior to and throughout the measurement period (Process
However, there are noticeable differences in the other processes, primarily related to the large increases seen in the unconstrained model.

Figure 4.14. Risky conditional model.

Mplus relates the decision-making profiles to the latent drinking trajectories through the use of multinomial logistic regression. Multinomial logistic regression results from the constrained model are presented below, in Table 4.9. Data were coded so that the reference variables were the Anti-Drinker profile and the LC drinking trajectory.

These findings suggest that Anti-Drinkers, when compared to participants in the Risky profile, were significantly more likely to be in the LC trajectory compared to the MLI trajectory \( (b = 28.76, t = 24.10, p < .001) \), the HCSI trajectory \( (b = 40.02, t = 36.59, p < .001) \), or the MHI trajectory \( (b = 28.54, t = 21.50, p < .001) \). Also, Anti-drinkers, when compared to Mixed profile
participants were significantly more likely to be in the LC trajectory compared to the MLI trajectory \( (b = 27.73, t = 69.50, p < .001) \) and the MHI trajectory \( (b = 27.62, t = 47.54, p < .001) \).

Table 4.9

**Multinomial Logistic Regression**

<table>
<thead>
<tr>
<th>MLI on Risky</th>
<th>HCSI on Risky</th>
<th>MHI on Risky</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risky</td>
<td>Anti</td>
<td>Risky</td>
</tr>
<tr>
<td>MLI</td>
<td>3.0</td>
<td>HCSI</td>
</tr>
<tr>
<td>LC</td>
<td>1.0</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>28.76 (1.19) ***</td>
<td>40.02 (1.09) ***</td>
<td>28.54 (1.33) ***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MLI on Mixed</th>
<th>HCSI on Mixed</th>
<th>MHI on Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed</td>
<td>Anti</td>
<td>Mixed</td>
</tr>
<tr>
<td>MLI</td>
<td>32.0</td>
<td>HCSI</td>
</tr>
<tr>
<td>LC</td>
<td>30.0</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>27.73 (0.40) ***</td>
<td>36.86 (0.00) n/a</td>
<td>27.62 (0.58) ***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MLI on Unfav.</th>
<th>HCSI on Unfav.</th>
<th>MHI on Unfav.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfav.</td>
<td>Anti</td>
<td>Unfav.</td>
</tr>
<tr>
<td>MLI</td>
<td>13.3</td>
<td>HCSI</td>
</tr>
<tr>
<td>LC</td>
<td>90.7</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>60.0</td>
</tr>
<tr>
<td>25.74 (0.00) n/a</td>
<td>9.79 (0.00) n/a</td>
<td>24.73 (0.00) n/a</td>
</tr>
</tbody>
</table>

*Note.* The referent variables were the Anti-drinker decision-making profiles and low consumption drinking trajectory. *** = \( p < .001 \), n/a represents beta parameters that were fixed to zero by the Mplus program.
CHAPTER FIVE: DISCUSSION

This study is the first to examine decision-making variables from the TRA and BAT in a person-centered framework, which allows for the identification of distinct types of decision-making profiles. Weekly alcohol consumption was also measured across five time periods throughout the freshman and sophomore semesters and modeled as distinct drinking trajectories. These drinking trajectories were examined within each decision-making profile to determine the relationship between decision-making patterns and college alcohol consumption. The discussion of these results is organized as follows. First, a summary of the results is presented. Second, the advantages of the person-centered analyses are discussed in terms of insights gained from the findings. Next, I discuss the possible application of the results into prevention identification and screening efforts. These sections describe the implications of the findings in terms of general and specific intervention strategies and timing of efforts. The discussion concludes with future directions and study limitations.

Summary of Results

*Decision-making profiles.* The first aim of the analysis was to model decision-making profiles based on variables measured prior to college matriculation. The latent profile analysis (LPA) revealed 4 distinct decision-making profiles. The largest profile represented 38% of participants and was labeled “Unfavorable”. The Unfavorable profile reported, on average, slightly unfavorable alcohol expectancies and drinking attitudes and held moderately favorable attitudes toward non-drinking alternatives. In addition, the Unfavorable profile did not seem to perceive strong pro-drinking social influences as these individuals reported low amounts of perceived alcohol consumption in their friends/peers and strong perceptions of disapproval of drinking from their friends.
A similarly large-sized profile represented 35% of participants and was labeled “Mixed”. Individuals in the mixed profile reported alcohol expectancies and attitudes toward drinking that were moderately positive. This profile also held moderately positive attitudes toward non-drinking alternatives. Finally, this profile perceived low amounts of alcohol consumption among their friends/peers and moderate disapproval of alcohol use from their friends. This profile was similar to the Risky profile described below in regards to alcohol expectancies and attitudes toward drinking but differed on their normative perceptions as individuals in the Risky profile reported more pro-drinking normative beliefs.

The “Anti-Drinkers” profile described 21% of the sample. The Anti-Drinkers reported strongly negative alcohol expectancies and strongly unfavorable attitudes toward drinking while reporting highly favorable attitudes toward non-drinking alternatives. These individuals also perceived very little alcohol consumption and strong disapproval of drinking among their friends.

The smallest profile, 6% of participants, was labeled “Risky”. This profile held moderately positive alcohol expectancies and attitudes toward drinking and their attitudes toward non-drinking alternatives were only slightly favorable. This profile was unique as perceptions of favorable drinking social influences seemed to be the highest of any profile. This profile perceived the highest amount of drinking among their friends and disapproval of drinking that was only slightly unfavorable.

The combination of the Anti-Drinkers (21% of the sample) with the Unfavorable profile (38%) suggests that 59% of the participants held decision-making patterns that are generally unfavorable toward drinking and did not perceive a substantial amount of drinking approval among their friends and peers. This finding is encouraging and suggests that the majority of
college-bound students in this sample do not report pro-drinking decision-making variables prior to college matriculation. However, this optimism is short-lived as the examination of alcohol consumption upon college matriculation reveals increases in some of the participants. Also encouraging is that the riskiest profile in terms of decision-making variables represented the smallest profile.

*Drinking trajectories.* Growth mixture modeling (GMM) was used to model the drinking trajectories of the participants throughout their freshman year of college and into the beginning of their sophomore year. The alcohol outcome used was a measure of number of weekly drinks. Several GMM models were fit and model diagnostic criteria were used to determine the optimal number of drinking trajectories needed to accurately model alcohol consumption. The best-fitting model consisted of four distinct drinking trajectories. In this final model, variances of the growth factors were freely estimated which indicates that within each drinking trajectory, individuals significantly varied in their initial, pre-college matriculation drinking rates, amount of change in drinking during the first year of college, and the rate of change across the measurement period.

The drinking trajectory with the largest amount of participants described 65% of the sample. This trajectory was labeled “low consumption” (LC) and described individuals who drank at very low levels prior to college matriculation and slowly increased their consumption throughout the measurement period. However, LC participants still drank at relatively low levels even at the point of highest consumption. This finding is encouraging as LC represents the best-case scenario in terms of weekly alcohol consumption in the data and also described the largest number of participants.
The trajectory with the smallest number of participants (9%) and highest levels of drinking was labeled “high consumption, steady increase” (HCSI). HCSI participants reported drinking at very high levels prior to college matriculation. In fact, these individuals, on average, drank only slightly less at end of high school than the highest average amount consumed by any other of the trajectories during college. HCSI participants steadily increased their weekly drinking throughout the measurement period.

The remaining two trajectories had similar shapes in terms of the amount and rate of increase in drinking consumption throughout the measurement period. The primary difference in the trajectories was the amount of drinking at the pre-college baseline. Trajectory 2 and trajectory 3 in Figure 4.6 represent these two trajectories. Trajectory 2 described 16% of the sample and was labeled “moderately-low consumption, increase” (MLI). MLI participants reported moderately low levels of drinking prior to college matriculation and increased their drinking considerably during the freshman year. For MLI, alcohol consumption leveled off/decreased slightly from the end of the freshman year to the beginning of the sophomore year. MLI seems to describe the typical view of the college experience: participants drink at low levels prior to college and, once on campus and away from their parents, begin experimenting with alcohol. It is possible those who follow the MLI could be at a high risk for alcohol-related consequences given their dramatically high increase and relatively little experience with drinking.

The trajectory labeled “moderately-high consumption, increase” (MHI) described 11% of the sample. MHI participants reported moderately high levels of drinking prior to college matriculation and increased their drinking considerably during the freshman year. MHI participants also leveled off/decreased their consumption levels from the period after the
freshman year to the beginning of the sophomore year. The increase from moderately high to high consumption levels suggests MHI participants do not merely continue their high-school consumption patterns but increase after college matriculation.

The current findings are consistent with other literature that has examined trajectories of alcohol use. Using similar methods, Greenbaum et al. (2005) measured weekly alcohol use throughout the freshman semester. However, they collected information about drinking every week throughout the freshman year. They also found a drinking trajectory that reported low levels of weekly consumption that was similar in size (53%) of participants to the LC trajectory in the current analysis (65%). In addition they found a heavy drinking trajectory that described 10% of their sample. The HCSI trajectory in the current study was a similar size (9%). Greenbaum et al. (2005) also found two trajectories with moderate consumption. However, whereas in the current analysis both of the moderate level trajectories increased their drinking throughout the freshman year, the moderate trajectories in Greenbaum both increased and decreased their drinking in college. In addition, the trajectories in Greenbaum tended to represent more stable drinking with small spike in consumption around holidays whereas the current trajectories all showed at least small increases in drinking across the freshman year. This lack of consistency is likely due to the lack of pre-college assessment in the Greenbaum study which would have missed the increase in drinking upon entering college and the difference in measurement intervals of the studies.

*Multiple group analysis- drinking processes, unconstrained model.* After determining the drinking-related decision-making profiles in Aim 1 and the optimal number of drinking trajectories in Aim 2, the final step in the analyses was to examine typical drinking trajectories within each decision-making profile. These trajectories were conditioned within each of the
decision-making profiles and were referred to as drinking processes. The drinking processes were modeled by assigning individuals into their most likely decision-making profile, based on the results of the LPA, and fitting four weekly consumption growth trajectories within each profile, based on the GMM results. Thus, the analyses yielded four different drinking trajectories within each of the four decision-making profiles for a possible 16 distinct drinking processes. The four trajectories within each profile were not entirely consistent with the four trajectories from Aim 2 because, as previously described (page 56), they were conditioned to reflect the influence of the decision-making profiles. In the following paragraphs, only the drinking processes that represented either a sizable percentage of the total number of participants (10% or more) or a sizable portion of participants within each of the decision-making profiles are discussed.

The weekly drinking processes observed within the Anti-drinker profile were unique in that only two processes were found. This means that the individuals assigned to the Anti-drinker decision-making profile followed only one of two unique drinking trajectories. The two processes observed (1-1 and 1-3 in Figure 4.7) showed that as a group, the Anti-drinkers drank very little throughout college. Process 1-3 described nearly all Anti-Drinkers (94%) and these participants, on average, did not consume more than 1-2 drinks per week throughout the measurement period. Process 1-1 describes the remaining, small percentage of Anti-Drinkers. Although these participants reported moderately-low weekly consumption trajectories, they seemed to be drinking at a relatively non-risky rate (Chen et al., 2004-2005). As a whole, these two drinking processes suggest that the interpretation of Anti-drinkers’ general decision-making pattern as low risk for drinking is accurate based on actual consumption trajectories of those assigned to the Anti-drinker profile.
Figure 4.8 represents the drinking processes for those assigned to the Mixed decision-making profile. These individuals tended to report decision-making variables that were favorable toward drinking but unfavorable drinking normative beliefs. These drinking processes were unique in that those assigned to the Mixed profile were equally likely to follow one of three drinking processes (each with approximately 30% of Mixed participants). One of these processes, process 2-2, described participants with relatively low levels of use, who reported on average drinking at most approximately 7 drinks per week. The other two larger processes consumed relatively high amounts of alcohol although the pattern of drinking was slightly different. Process 2-3 was consistent with heavy drinking prior to college and a steady increase in consumption throughout the measurement period. The other process (Process 2-4) described a drinking trajectory of low levels of drinking prior to college, a large increase at the second survey measure, upon college matriculation, a steady increase throughout the freshman year, and a decrease in consumption following the freshman year. Finally, Process 2-1 described 14% of those in the Mixed profile who reported heavy drinking prior to college with a dramatic increase in consumption during the freshman year.

For those participants assigned to the Unfavorable decision-making profile (Figure 4.9), most followed process 3-1 (59%) which represents low levels of consumption prior to college with a small increase in consumption throughout the measurement period. This finding was consistent with the decision-making variable means of the Unfavorables: unfavorable alcohol expectancies, unfavorable attitudes toward drinking, favorable attitudes toward non-drinking alternatives, and social normative beliefs that are unfavorable toward drinking. Process 3-3 described the drinking of another sizeable portion of those assigned to the Unfavorable profile (31%). These individuals consumed alcohol at very low levels prior to college but increased to
moderate levels of drinking throughout the study period. Nearly 90% of those assigned to the Unfavorable profile were described by either process 3-1 or process 3-3, which both showed low drinking prior to college that increased to either low or moderate levels of consumption. This suggests that holding pre-college matriculation decision-making variables that are only slightly unfavorable toward drinking is related to less risky drinking levels.

The smallest decision-making profile was the Risky drinking profile, which described 17 participants. Unfortunately, the small number of participant in this profile made it difficult to examine large-sized, within-profile drinking processes (Figure 4.10). The majority of individuals in the Risky profile were assigned to Process 4-3 (59%), which described participants who drank very heavily in high school and continued an approximately steady increase throughout the measurement period. This is not a surprising finding given their risky decision-making patterns. For these individuals, the collegiate drinking environment seems to reinforce their high school drinking and the lack of drinking controls, in the form of parents, may lead to an increase in an already established pattern.

The two largest processes were processes 3-1 for the Unfavorable decision-making profile (22% of the total sample) and 1-3 for the Anti-drinkers (20% of the total sample). This finding is encouraging as these two processes represent the lowest weekly consumption processes, with very low drinking prior to college and very small increases throughout the measurement period. Also encouraging is the finding that with the exception of the Risky decision-making profile (process 4-3), the riskiest drinking processes within each profile did not tend to contain one of the larger proportions of participants.

*Multiple group analysis- drinking processes, constrained model.* In the final analysis, the factor growth variances for the four drinking trajectories were modeled within each decision-
making profiles and constrained to be equal to the growth factors observed in Aim 2 of the model. This allowed for a more direction comparison of the results of Aim 1 and Aim 2. When compared to the unconstrained model, the results of the constrained model were similar in terms of number of participants assigned to drinking processes and the drinking trajectories of the processes. The primary difference was in the unfavorable profile with a greater number of participants following a low alcohol consumption process in the constrained model. Given the conceptually negligible differences found in the unconstrained and constrained model and the model identification issues of the constrained model, I chose to discuss the findings in terms of the unconstrained model.

**Insights from the Person-Centered Approach**

The current study is unique in examining distinct decision-making profiles in a person-centered framework and linking these profiles to drinking behaviors prior to and throughout the first year of college. The person-centered techniques used to examine patterns of decision-making variables provided insights about complex relationships that are difficult to study using a variable-centered approach. In this section, I briefly discuss previous findings related to decision-making in the college alcohol literature and highlight the insights gained from the current study.

Several studies have examined the influence of the various decision-making variables on drinking behaviors using variable-centered approaches (Carey & Correia, 1997; Johnson & Fromme, 1994; Larimer et al., 2004; Turrisi, 1999; Wood et al., 1996, 2001). These studies typically have used regression or structural equation modeling techniques to examine the relationship of expectancies, attitudes, or norms to alcohol consumption across all participants. However, these studies tend to examine these variables in isolation (i.e., studies tend to focus
only on alcohol expectancies or alcohol related norms). Only a few studies have examined these variables simultaneously or in the same model as a test of TRA constructs in college student alcohol use (e.g., Burden & Maisto, 2000; Collins & Carey, 2007; Connor, Warner, Close, & Sparks, 1999; O'Callaghan, Chant, Callan, & Bigliani, 1997; Turrisi, 1999). These studies have not found consistent results in regards to the TRA and BAT constructs. For example, Collins and Carey (2007) found that attitudes indirectly predicted heavy drinking tendencies (mediated through intentions) while subjective norms were not significantly predictive. O'Callaghan et al. (1997) found that norms were predictive of behavior but attitudes were not. Connor et al. (1999) tested TRA models in three independent samples, but did not find consistent results in terms of the predictive value of attitudes and norms.

These studies that have used variable-centered approaches seem to indicate that the decision-making constructs are not consistent predictors of drinking behavior. It is possible that this lack of consistency is due in part to the masking of the TRA variable-behavioral relationship when these relationships are viewed as averaged across individuals. The approach of this study was to examine distinct and person-specific patterns of decision-making variables. Each of the decision-making profiles were labeled according to how theoretically risky they were in terms of participants' tendency to drink according the TRA and BAT. These labels mapped on well to the drinking processes. That is, those in the Risky profile were likely to drink heavily and those in the Anti-drinker profile were likely to drink at low levels. This indicates that the TRA and BAT constructs may be better predictors of drinking when considered in a person-centered framework. The results, in terms of decision-making variable patterns and subsequent drinking, are summarized below for each of the decision-making profiles.
Both drinking processes for the Anti-Drinkers described very low rates of drinking. Thus, the Anti-drinkers seem to be the safest drinking profile when compared to the others in terms of actual consumption. This is not surprising given their unfavorable alcohol decision-making variable means and their favorable attitudes toward non-drinking alternatives. Also, when compared to the other decision-making profiles and the processes within each profile, the Anti-drinkers demonstrated the least amount of variability in drinking trajectories (i.e., both trajectories described low consumption). In contrast, the processes for the Mixed profile (Figure 4.8) were quite varied in their consumption patterns. This finding suggests that holding unfavorable toward drinking decision-making variables were more predictive of low alcohol consumption than favorable decision-making patterns were predictive of risky drinking.

An examination of the drinking processes for the Mixed decision-making profile suggests a lot of variability in drinking trajectories exists for this profile. Some of the individuals in the Mixed profile clearly do not progress to heavy drinking (process 2-2) despite holding, on average, some of the riskiest alcohol expectancies and attitudes toward drinking. It is possible that the low social normative beliefs of this profile may explain this differential drinking. The Mixed profile individuals in process 2-2 may not have made friends with other students who were frequent drinkers during their first year of college. As a result, their normative beliefs about others drinking and acceptability remained low and this may have influenced their decision not to drink. However, individuals in process 2-4, who drank at similarly low levels prior to college as process 2-2 but progressed into moderately-high levels of consumption, may have made friends with drinkers. This could shift their social normative beliefs in college toward more drinking favorable and this, combined with their favorable alcohol expectancies and attitudes toward drinking, would have made them more likely to make the decision to drink.
It is also interesting to compare the drinking processes for profiles with similar scores on decision-making variables. The Mixed and Risky decision-making profiles are similar in their means of several of the decision-making variables. Both have similar levels of alcohol expectancies and attitudes toward drinking that tended to be favorable toward engaging in drinking. The primary difference between the profiles seemed to be in the social normative beliefs: participants in the Risky profile perceived significantly more drinking from their friends and perceived their friends as being significantly more approving of their drinking compared to participants assigned to the Mixed profile. When comparing the drinking processes within these profiles, the primary difference in alcohol consumption is that the drinking processes within the Mixed profile described less risky drinking than the processes within the Risky profile. There is also more variability in the alcohol consumption and size of the processes, in terms of proportions of participants, in the Mixed decision-making profile compared to the Risky drinkers. These findings reinforce the idea that pro-drinking social normative beliefs combined with moderately favorable alcohol expectancies and attitudes toward drinking are related to increased alcohol use (Collins & Carey, 2007; Larimer et al., 2004). Thus, while favorable expectancies and attitudes are important in predicting alcohol consumption, the presence of pro-drinking social normative beliefs in conjunction with these variables is related to the heaviest drinking patterns.

The Unfavorable and Anti-Drinking profiles are also similar to each other in their decision-making patterns. The primary difference between the profiles is that although both profiles hold unfavorable alcohol expectancies and unfavorable attitudes toward drinking, the Anti-Drinkers are significantly less favorable on these variables. Within each profile, the largest drinking processes, in terms of number of participants, followed the trajectory with the lowest
levels of alcohol use. However, individuals within the Unfavorable profile were more likely to follow moderate or heavy drinking processes when compared the processes within the Anti-drinker profile. This suggests that the differences in magnitude of the decision-making variables were meaningful. Both are unfavorable toward drinking but the more extreme unfavorable views of the Anti-drinkers seem to be more protective against alcohol use.

**Implications for a Targeted Intervention Approach**

Although a great deal of research in the alcohol prevention literature has examined the efficacy of alcohol prevention programs, little research has been conducted to study the most effective methods for either screening participants into these programs or identifying college students who may be at risk for drinking based on their pre-matriculation behavioral tendencies (Larimer & Cronce, 2002, 2007). The screening techniques that are commonly used measure aspects of alcohol dependency or measure specific alcohol problems. The findings show a marked increase in consumption for many individuals during the period prior to college matriculation to the beginning of the freshman year. This suggests that efforts to screen participants into appropriate and cost-effective prevention programs after they have become acclimated to campus life may be too late to prevent this increase in consumption.

Screening surveys that include decision-making measures may be predictive of nuanced drinking tendencies more than those that measure drinking alone. In other words, screening tools that only measure drinking prior to college may not have as strong of a predictive value of college drinking. This is illustrated by an examination of the drinking processes. For example several of the processes are described by very low levels of drinking prior to college, including Process 1-1, 1-3, 2-2, 2-4, 3-1, 3-3, and 3-4. Of these 7 processes, approximately 3 continued to drink at low levels while the others increased to moderate or moderately/high drinking. In
comparison, the drinking processes that describe individuals who were drinking at moderate or high levels prior to college are generally accompanied by an increase in drinking during the study period. These findings seem to indicate that screening primarily on consumption may be effective at identifying those at the highest risk for drinking but could miss those who aren’t consuming a lot of alcohol in high-school but increase consumption in college. However, if a student's decision-making pattern was known, prevention scientists would be better able to determine which students are at risk for increased consumption.

Jaccard et al. (1990) suggested that two factors are critical when attempting to identify individuals for appropriate targeted prevention programs. The first of these considerations is the screening method must allow for the identification of individuals early, before problems begin. Screening solely on drinking tendencies prior to college is not adequate for identifying all students who are likely to progress to heavier drinking trajectories. However, knowledge of high school drinking and decision-making variables allows for more accurate assumptions about an individual’s likely drinking processes. Second, the data used for screening must be easily obtained. The survey items used in the current study could easily be assessed in a short survey and may be easily included in standard contacts with incoming freshman (e.g., as a part of orientation). Larimer and Cronce (2002) have suggested that incorporating screening measures in this way minimizes reactivity to such screening attempts.

It is important to note that in the current findings the most risky group of students, in terms of decision-making profiles (Risky profile), reported only slightly favorable alcohol expectancies and attitudes toward drinking on average. In addition, although the Risky profile participants perceived a high amount of drinking in their friends, overall they reported perceiving disapproval of drinking in their friends and peers. These findings suggest that students do not
necessarily have to be extremely favorable toward drinking in their decision-making to be considered at risk to drink heavily in college. Screening measures designed to identify only those students who are strongly favorable toward drinking would likely miss many at-risk individuals.

**General Intervention Approaches**

Prevention efforts can be classified into one of three categories: universal, selected, and indicated (Gordon, 1983). Universal prevention is the most general kind of prevention and is typically used for those individuals who have not yet begun to engage in a certain risk behavior (e.g., they are not currently drinking alcohol). These types of prevention programs are typically delivered without active and ongoing professional advice or assistance. Thus, universal prevention programs are designed to be very general and generic to students and to be less resource intensive options. Examples of universal approaches are parent-delivered interventions, electronically-delivered prevention programs, and social marketing campaigns. Selected interventions are by nature more resource intensive than universal programs and are typically designed for individuals who may not be at risk for a problem but, as a function of their some other characteristics (e.g., risky drinking beliefs), are putting themselves at risk. In the current example, this would correspond to students who aren’t drinking at excessively high levels but are drinking at moderate levels. An example of selected prevention programs are cognitive-behavioral skills-based approaches that can be delivered either in a one-on-one setting or in a group based format. Finally, indicated prevention efforts are designed for those who are already engaging in the risk behavior of interest. In this example, these would be students who are drinking at high levels. Prevention programs designed for this group are often resource intensive and may involve the use of professionals or trained persons for program administration. An
example of an indicated prevention programs is BASICS, a motivational enhancement interview that is typically delivered by a professional or trained peer counselor (Larimer et al., 2001).

I previously suggested that screening students based on their decision-making and drinking behavior may be a useful method for identifying students for intervention efforts. These screening tools may also provide information about types of interventions that may be appropriate for various drinking processes. In Table 5.1, select drinking processes are presented along with information about their decision-making profile and levels of pre-college drinking. While it would not be possible to identify freshman drinking processes for incoming students, information regarding decision-making profiles and pre-college drinking levels could be obtained for any incoming college student.

Table 5.1

*Intervention Types based on Drinking Processes*

<table>
<thead>
<tr>
<th>Drinking Process</th>
<th>Decision-Making Profile</th>
<th>Pre-College Drinking</th>
<th>Intervention Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>Anti-Drinkers</td>
<td>Low</td>
<td>Universal</td>
</tr>
<tr>
<td>2-1</td>
<td>Mixed</td>
<td>Moderate</td>
<td>Indicated</td>
</tr>
<tr>
<td>2-2</td>
<td>Mixed</td>
<td>Low</td>
<td>Selected</td>
</tr>
<tr>
<td>2-3</td>
<td>Mixed</td>
<td>Moderate</td>
<td>Indicated</td>
</tr>
<tr>
<td>2-4</td>
<td>Mixed</td>
<td>Low</td>
<td>Selected</td>
</tr>
<tr>
<td>3-1</td>
<td>Unfavorable</td>
<td>Low</td>
<td>Selected</td>
</tr>
<tr>
<td>3-3</td>
<td>Unfavorable</td>
<td>Low</td>
<td>Selected</td>
</tr>
<tr>
<td>4-3</td>
<td>Risky</td>
<td>High</td>
<td>Indicated</td>
</tr>
</tbody>
</table>
This table shows possible intervention strategies for each of the listed drinking processes. For example, individuals who continue onto drinking process 1-3, defined by very low consumption throughout the first year of college, had an Anti-drinking decision-making profile prior to college and drank at low levels prior to college. These individuals could be identified as Anti-Drinkers and low alcohol consumers prior to college. Given these results indicate that these individuals are at a low risk of heavy consumption, as a function of being in drinking process 1-3, these individuals may benefit from a universal type approach that reinforces their existing non-drinking orientation. In contrast, knowing that an individual has a Risky decision-making profile and drinks at a high rate prior to college, suggests that an indicated prevention program may be the most appropriate approach as they are likely to follow drinking process 4-3 (the heaviest drinking process).

This table also demonstrates how the type of recommended prevention approach might be different if only examining drinking behavior and not behavior and decision making together. For example, individual in drinking processes 1-3, 2-2, 2-4, 3-1, and 3-3 all drank at very low levels prior to college matriculation. If this was all the information available for screening then an assumption might be made that they are all at low risk and universal interventions are appropriate as more intensive interventions are not necessary. However, as can be seen in Figures 4.7 - 4.10, they all follow quite different trajectories. Those in processes 1-3, 2-4, 3-1 continue their low consumption while those in 2-2 and 3-3 progress to heavier drinking. This suggests if an individual drinks at a low level prior to college and is an Anti-drinker, one can be more confident the individual will not progress to heavy drinking. However, if the individual is drinking at a low level but is in either the Mixed or Unfavorable profile, drinking in college is more difficult to predict. This suggests the need for more intensive prevention efforts.
Specific Intervention Approaches

In the following section, I discuss potential intervention content strategies for each of the observed profiles.

For the Anti-Drinker profile, intervention efforts that reinforce their existing expectancies and attitudes toward non-drinking may be the most effective given that these individuals would theoretically tend to choose not to drink or engage in non-drinking alternatives. Some researchers have suggested that for abstainers or other light drinkers, not drinking or drinking very little relative to others represents a goal state (Gerrard, Gibbons, et al., 2002). These individuals view restricting their drinking as an achievement and it is possible these cognitive processes are reinforcing the Anti-drinking decision-making and behavior. These individuals may also benefit from the teaching of resistance skills as being confident in one’s ability to not drink or to turn down drinking offers could be helpful in carrying out non-drinking intentions that are likely to result from their patterns of decision-making.

The Unfavorable profile seems to represent decision making of individuals who would be unlikely to drink given their beliefs. Alcohol prevention strategies that may be effective in this group include those that reinforce their unfavorable drinking beliefs as opposed to those that teach alcohol self-monitoring skills or increase motivation not to drink. Providing normative education to this profile may also not be the most effective option as they already hold unfavorable normative beliefs. It may be important to reinforce their existing unfavorable drinking views. This could be accomplished through parent initiated conversations (Turrisi et al., 2009) or through a personalized feedback approach (Larimer et al., 2007; Walters, Bennett, & Miller, 2002). The goal of such a message would be to reinforce the existing unfavorable toward drinking decision-making while delivering the message that the majority of students think
similarly about alcohol usage. The message would essentially be "You don't believe that alcohol use is such a great thing and a lot of your college-bound peers would agree with you".

The Mixed profile reported slightly favorable alcohol expectancies and attitudes toward alcohol, moderately favorable attitudes toward non-drinking alternatives, and low perceptions of normative drinking in their friends. This suggests that those in the Mixed profile may experience some ambivalence when making alcohol-related decisions as these individuals hold both favorable and unfavorable drinking cognitions. The most effective prevention efforts for individuals in this profile may be those that seek to slightly shift students' beliefs/expectancies about alcohol to become more negative (e.g., Jones, Silvia, & Richman, 1995). Alternatively, making attitudes toward non-drinking alternatives more favorable may lead to reduction in drinking for this group (Turrisi et al., 1999). Given that the decision-making of this group is theoretically likely to lead to alcohol consumption, these individuals may benefit from more intensive prevention programs. These include programs designed to increase motivation for reduced alcohol use while incorporating information about alcohol through techniques such as brief motivational interviewing (Murphy et al., 2001; Turrisi et al., 2009; White, Morgan, Pugh, Celinska, Labouvie, & Pandin, 2006) and multi-component alcohol skills training (Bosari & Carey, 2005; Fromme & Corbin, 2004).

**Intervention Timing**

When examining the general features of the trajectories from Aim 2, similarities emerge. Increases in alcohol consumption during the freshman year are seen in all four trajectories. However, consumption patterns from the end of the freshman year to the beginning of the sophomore year tend to vary across trajectories. It also seems that the highest amount of weekly alcohol consumption for each trajectory is strongly related to pre-college drinking levels. That
is, those students who drink the most prior to college tend to drink the most during the first year of college and those who drink the least prior to college tend to consume smaller amounts.

A consideration of the drinking processes as a whole (Aim 3, Figures 4.7-4.10), across the decision-making profiles, reveals some consistent patterns. In general, in those profiles where drinking increased, the most dramatic increases were seen between the pre-college survey and the fall freshman survey. Increases were generally observed between the beginning and end of the freshman year although the increases were typically not as dramatic. These findings suggest that the beginning of the freshman year is a risky time for moderate and heavy high-school drinkers to increase consumption. Intervention efforts may be the most successful when administered prior to college matriculation. However, with some notable exceptions (Turrisi et al., 2001, 2009), many established drinking interventions are administered either after students arrive on campus or have been cited for underage drinking. These findings also suggest that students are quick to get acclimated to the college drinking culture, in the form of increasing their pre-college alcohol consumption. It is also possible that a focus on strict enforcement of underage alcohol policies and an increased focus on freshman drinking may help prevent this large increase. In contrast to the early increase pattern, there is little consistency among the drinking processes in changes in drinking during the time between the end of the freshman year and the beginning of the sophomore year, the final two measurements. Intervention efforts that are administered later in the freshman year are likely to miss an opportunity to reduce the heaviest drinking.

An examination of the drinking processes also has implications for timing of prevention programs targeted toward certain drinking processes. In Table 5.2, select drinking processes are
presented along with information about periods of risk, which describe periods of heavy or increased drinking for each process.

Table 5.2

*Periods of Increased Risk for Select Drinking Processes*

<table>
<thead>
<tr>
<th>Decision-Making Profile</th>
<th>Drinking Process</th>
<th>End of High School Prior to College</th>
<th>Summer Prior to College</th>
<th>During Freshman Year</th>
<th>After Freshman Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Drinkers</td>
<td>1-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>2-1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>2-3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mixed</td>
<td>2-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-1</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3-3</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Risky</td>
<td>4-3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

This table shows that for the Anti-drinkers, there is no distinct period of increased risk in drinking as their drinking is very low throughout the measurement period. In contrast, those in the Risky profile and drinking process 4-3 were drinking at heavy levels in high school, increased their drinking upon entering college, increased their drinking during the freshman year, and were drinking at high levels at the final measurement point. Any or all of these times seem to represent good time points for administering prevention efforts. For the mixed profile, the periods of increased risk varied greatly depending on the drinking process. This table shows that while the periods of risk differ for each of the drinking processes presented, entrance to college was a period marked by a general increase in consumption levels. It also suggests that the
drinking in the heaviest drinking processes (2-1, 2-3, and 4-3) begins early as members of these processes tend to report alcohol consumption in high school. Thus, intervention efforts for the heaviest drinkers need to be administered prior to arriving to campus.

**Future Directions**

Future work should seek to replicate these findings in diverse samples to determine the construct validity of the observed decision-making profiles and the drinking processes. If similar results are found, it increases the confident in these decision-making profiles and the drinking processes associated with them. If these findings are not able to be replicated, it is important to consider where differences exist. It is likely that the decision-making profile findings will replicate to other samples as the attitudinal and belief measures underlying the decision-making processes are not situation specific. However, what may be different are the drinking trajectories and, as a result, the typical drinking processes that are associated with the decision-making profiles.

There are a variety of alcohol prevention programs that have been developed for college students. The programs largely vary in the amount of time and financial resources needed to implement them. The current research suggests that knowing about students' pre-college drinking and decision-making can provide insight into their risk for alcohol consumption throughout the first year of college. The research also suggests that not all students need resource intensive prevention programs as they are unlikely to progress into alcohol use even when they are not provided with such programs. Thus, the targeting of certain prevention programs to certain students may be the best approach. In order to utilize the current findings to accomplish this goal, future work is needed to develop screening tools based on the decision-making variables. A screening survey should be developed and tested. This requires the
development of an algorithm that allows for the assigning of individuals into decision-making profiles based on their patterns of responses to the variables. The accuracy of such algorithms should be tested by assigning individuals into the appropriate decision-making profile and tracking their drinking trajectories. If the drinking processes of individuals within each of these algorithm assigned decision-making profiles approximates the current findings, then confidence is increased in the ability to use these measures as screening tools.

Limitations

A primary limitation of the current analysis is the sample size. While the sample size is adequately powered to assess variable-level associations between drinking and decision-making variables, the person-centered analyses used divided the participants into smaller subgroups. For example, the Risky decision-making profile described 6% of the sample which corresponded to 17 participants. This small sized profile limited the size of the drinking processes that were modeled for this profile.

This research focuses primarily on individual-level variables related to alcohol use. However, it is important to remember that the college context is also related to increased risk of alcohol misuse in students. Individuals are not passive participants in the college experience and campus culture factors interact with these individual-level variables to influence the use of alcohol (Presley, Meilman, & Leichliter, 2002). Campus contextual variables that have been related to increased alcohol use include the presence of a Greek system, a focus on athletics, and the physical and behavioral properties of campuses (Presley et al., 2002). While the current findings are designed to inform the use of individual-level interventions in prevention alcohol misuse, future work needs to consider the interactive role of the college context on the relationships found in the current study. Further, future work should seek to consider the generalizability of the current
findings to other colleges with diverse contexts. The sample was drawn from a traditional, 4-year college with a large Greek system, a heavy focus on athletics, and a strong drinking culture. While it may be reasonable to assume that the current findings would replicate on a similar campus, different drinking processes may be observed on other college campuses with different cultural contexts.

This study utilized self-reported drinking measures. Self-reported measures have been the cornerstone of the vast majority of alcohol prevention research (e.g., Larimer et al., 2004; Spoth, Redmond, & Shin, 2001; Turrisi et al., 2001; White et al., 2006) and the reliability and validity of such reports have been repeatedly affirmed in diverse populations (e.g., Babor, Stephens, & Marlatt, 1987; Babor, Steinberg, Anton, & Del Boca, 2000; O'Farrell & Maisto, 1987; Smith, McCarthy, & Goldman, 1995; Sobell, Sobell, Klainer, & Pavan, 1986). Steps were taken to reduce the small potential for self-report bias. First, instructional sets were used that encouraged honest responding on the part of individuals, including assurances of confidentiality. Second, I I used objective measures of alcohol use and consequences that have been shown to be reliable and valid. Third, data collection was structured so that the respondent provided confidential answers on web questionnaires to encourage honest responding.

I made several conjectures as to why individuals who shared decision-making patterns differed in their drinking processes. While some of this within-profile variability is likely due to fact that decision-making variables are not perfect predictors of behavior and due to individual variability, many alternative reasons were hypothesized to explain these differences. For example, with the Mixed profile, three drinking processes described high rates of weekly consumption while one process describes low consumption levels. I hypothesized that this could be due to the fact that the individuals who followed the low consumption profile did not make
friend with drinkers in college. Thus, these individuals were not fully exposed to the drinking culture on campus. It would be theoretically possible to examine variables such as friends drinking or perceptions of culture as covariates to assess the influence on drinking processes.

To fully examine differences in variables underlying drinking processes, it would be necessary to examine each drinking process for differences in these variables. However, the small sample sizes of the various drinking trajectories do not allow such an analysis. In addition, decision-making variables are not measured at all measurement periods and the data did not provide variables related to the drinking and cultural social environment.

**Conclusion**

The current study identified distinct decision-making profiles and modeled alcohol usage across the first year of college in each of the profiles. The analyses provided insights into how pre-college decision-making risk variables were related to alcohol consumption in college. Given the wide availability of alcohol prevention programs in college students, there is a need for research that helps to identify at-risk students prior to college matriculation and refer them to appropriate prevention programs. The current findings suggest that screening participants on decision-making and drinking prior to college can provide insights into appropriate types and timing of prevention efforts.
REFERENCES


*Journal of Studies on Alcohol. Special Issue: College Drinking, what it is, and what do to about it: Review of the State of the Science, Supplement 14*, 118-128.


*Personality and Individual Differences, 20*(6), 693-702.


*Journal of Studies on Alcohol. Special Issue: College Drinking, what it is, and what do to about it: Review of the State of the Science, Supplement 14*, 40-53.


Connor, M., Warren, R., Close, S., & Sparks, P. Alcohol consumption and the theory of planned
behaviour: An examination of the cognitive mediation of past behavior. *Journal of Applied

Cooper, M. L. (2002). Alcohol use and risky sexual behavior among college students and youth:
evaluating the evidence. *Journal of Studies on Alcohol. Special Issue: College Drinking,
what it is, and what do to about it: Review of the State of the Science, Supplement 14*,
101-117.

drinking and alcohol use disorders among college and non-college youth. *Journal of
Studies on Alcohol, 65*, 477-488.

Del Boca, F. K., Darkes, J., Greenbaum, P. E., & Goldman, M. S. (2004). Up close and personal:
Temporal variability in the drinking of individual college students during their first year.
*Journal of Consulting and Clinical Psychology, 72*(2), 155-159.

modeling of adolescent alcohol use data. Retrieved from Oregon Research Institute Web
Site: http://www.ori.org/methodology.

knowledge. In D. Albraracín, B. T. Johnson & M. P. Zanna (Eds.), *The handbook of

theory and research*. Addison Wesley Publishing Company. Reading, MA


CURRICULUM VITAE

JEROD STAPLETON

EDUCATION

2010  Ph.D., Biobehavioral Health, The Pennsylvania State University
2004  B.S., Psychology, East Tennessee State University

PROFESSIONAL EXPERIENCE

2005-2010  Graduate Research Assistant, The Pennsylvania State University
2008-2010  Course Instructor, Department of Biobehavioral Health, Penn State

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