ABSTRACT

Title of Dissertation: TRAJECTORIES OF FRESHMEN ALCOHOL CONSUMPTION: EXAMINING THE INFLUENCE OF DRINKING REFUSAL SELF-EFFICACY

Keisha Lynn Watson, Doctor of Philosophy, 2008

Dissertation directed by: Professor Bradley Boekeloo
School of Public Health

The misuse of alcohol is a major social and health issue for college students in the United States. Specifically, first-year students are at a higher risk of consuming alcohol than the rest of the college population.

Considerable data suggest heterogeneity in how alcohol use changes during adolescence. New statistical procedures, such as latent class growth analysis (LCGA), are now available that are better suited to study behavior change than earlier applied traditional methods such as regression analysis and structural equation modeling.

This study aimed to reveal alcohol consumption patterns of college freshmen using secondary data and LCGA. A second aim of this study was to examine the influence of drinking refusal self-efficacy (DRSE) on potential trajectories of alcohol use among college freshmen. Data used for this study was collected by a federally funded NIH grant entitled "*Peers as Family: Preventing Problem Drinking*" and includes longitudinal self-reported data of freshmen alcohol use and DRSE.

Results revealed four distinct types of drinking trajectories among college freshmen. Growth patterns identified had the following characteristics: 1) "Light-stable"

drinkers reported drinking very little or no alcohol use across time assessments; 2) "Escalating" drinkers gradually increased alcohol consumption across time assessments; 3) "Moderate increase-decrease" drinkers increased alcohol use between first and second time points and decreased consumption between second and third time assessments; and 4) "Heavy increase-decrease" drinkers shared an identical pattern of consumption as the moderate increase-decrease group only levels of alcohol use were significantly higher at each time assessment.

DRSE was found to significantly ($p < .0006$) predict membership in all trajectories described above. The light-stable trajectory reported higher levels of DRSE than all other growth patterns, while the heavy increase-decrease trajectory reported the lowest levels of DRSE when compared to all other growth patterns.

Study results illustrated that DRSE plays a significant role in explaining why some college freshmen abstain from alcohol use, while others escalate use or drink at high levels over time. Ultimately, this knowledge may facilitate the development of more tailored and consequently effective interventions designed to reduce alcohol consumption on college campuses.

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By

Keisha Lynn Watson

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Advisory Committee:

Professor Bradley Boekeloo (Chair)
Professor Kenneth Beck
Associate Professor Sharon M. Desmond
Associate Professor Donna Howard
Professor Kevin O'Grady

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CHAPTER 1: INTRODUCTION

1.1 Statement of the Problem

The misuse of alcohol is a major social and health issue for college students in the United States. The challenge of curbing college alcohol use is not new (Schulenberg et al., 2001). For most of the American population, the college years represent the period of life associated with the highest levels of alcohol consumption and, most likely, the highest prevalence of alcohol use disorders (Grant, 1997). First-year students are at a higher risk of excessive drinking than the rest of the college population. Research indicates during the transition to college, freshmen experience newly acquired freedoms, which may lead to experimentation with alcohol and escalation of drinking to dangerous levels (Hartzler & Fromme, 2003). Available data sets suggest that each year 1,400 students die, 600,000 are physically assaulted, 500,000 are injured, and 70,000 are sexually assaulted in conjunction with alcohol use (Greenbaum et. al., 2005). Drinking patterns associated with such a high level of negative consequences demand close research attention utilizing a wide range of methodological approaches.

Recent research has focused increasingly on college drinking; however, most of the prevalence estimates come from a few landmark studies conducted with national datasets (Greenbaum et. al., 2005). Specific datasets based solely on college students include the College Alcohol Study (CAS), The Core Institute and the National College Health Risk Behavior Survey. Other commonly cited datasets focusing on college-aged young adults include Monitoring the Future (MTF), the National Household Survey on Drug Abuse (NHSDA) and the National Longitudinal Study of Youth (NLSY). The

methodology used in these studies reveals macro-level trends in consumption over periods of years rather than detailed information about ongoing drinking. Most research on temporal changes in alcohol use comes from cross-sectional comparisons of successive respondent cohorts rather than repeated measurements of the same individuals. Cross-sectional studies do not explain or focus on behavior change and are less effective at predicting one person's future drinking patterns based on his or her past patterns of use (Maggs & Schulenberg, 2005). Thus, in order to examine patterns of alcohol use most effectively, longitudinal data analysis studies that follow college-aged adolescents over time are greatly needed.

One methodology used to address the issue of analyzing drinking patterns over time is the use of latent growth modeling which enables researchers to study growth trajectories of individuals. Over the past several years, there has been growing interest in identifying distinct developmental trajectories of substance use (Ellickson et al., 2005). Considerable data suggest heterogeneity in how alcohol use changes during adolescence. Specifically this research indicates that adolescent populations may be composed of subpopulations characterized by qualitatively different patterns of substance use over time (Colder et al., 2002). Traditional latent growth modeling allows for the identification of a single growth trajectory only; however, recent advances with this statistical application have yielded additional methods to manipulate longitudinal data and address the issue of heterogeneity in adolescent alcohol use populations. Latent class growth analysis (LCGA) is one of the more newly available approaches to studying trajectories of growth. It takes into account unobserved heterogeneity in the population and it allows for the simultaneous examination of the influences of risk factors on the

subpopulations and outcome variables. Its purpose is to reveal distinct clusters of individuals with homogeneous longitudinal trajectories within the population and to explain individual level differences at the group level (Nagin, 1999, 2005). This fairly new statistical development provides a more accurate representation of the data than any of the prior conventional modeling methods (Muthen & Muthen, 2000). Applications of latent growth modeling are still uncommon in the literature. More applications are sorely needed in adolescent substance abuse research to explain why different patterns of alcohol use exist.

A risk factor of interest in this study is drinking refusal self-efficacy (DRSE). To date, no identified studies have examined the possible influence of DRSE on trajectories of alcohol use among college freshmen. DRSE has proven to be a significant predictor of adolescent alcohol use in cross-sectional studies (Oei, et al., 1998; Baldwin et al., 1993; Young et al., 2005). This study aims to take knowledge of this construct a step further and determine if DRSE also predicts patterns of adolescent alcohol use over time. This will increase the understanding of how DRSE impacts adolescent alcohol use by specifically looking at its influence on subgroups of a heterogeneous college population.

1.2 Study Aims and Hypotheses

The overall goal of this study is to use LCGA to determine if multiple trajectories of alcohol use among college freshmen exist, and if so, the extent to which DRSE predicts potential differences in patterns of alcohol use.

The specific aims of this study are the following:

Aim #1: Use conventional latent modeling to determine the average pattern of alcohol use among college freshmen.

Aim #2: Use latent class growth analysis to estimate homogeneous clusters of college freshmen with similar patterns of alcohol use.

Aim #3: Use latent class growth analysis to estimate the influence of initial levels of drinking refusal self-efficacy on homogenous clusters of college freshmen with similar patterns of alcohol use.

Aim #4: Use latent class growth analysis to estimate the influence of initial drinking refusal self-efficacy and potential confounders on homogeneous clusters of college freshmen with similar patterns of alcohol use.

Aim #5: Use latent class growth analysis to reveal all significant influences (identified in study aim #4) on homogeneous clusters of college freshmen with similar patterns of alcohol use.

Hypotheses:

Prior longitudinal alcohol research conducted using college samples have found common growth patterns that guide the expected trajectories used in the first set of hypotheses in this study (Greenbaum et al., 2005; O'Connor & Colder, 2005).

Hypothesis 1: LCGA will reveal homogeneous clusters of college freshmen alcohol use.

In longitudinal adolescent alcohol research, the most common trajectories observed across studies contain abstainers or very light drinkers (Maggs & Schulenburg, 2005). Adolescents in this subgroup typically maintain very little or no alcohol use across time assessments. Conversely, other alcohol use studies involving adolescents have identified groups of chronic heavy drinkers (Bartholow et al., 2003; Ellickson et al., 2005). Those who are designated as chronic heavy drinkers typically begin drinking heavily at younger ages and tend not to decrease their alcohol use during college. Other trajectories identified in the literature are those which increase or decrease over time (Maggs & Schulenburg, 2005). Adolescents who gradually increase their alcohol consumption across time assessments are commonly called 'escalators,' whereas adolescents who indicate a decrease in alcohol consumption across time assessments are commonly characterized as 'decliners' in alcohol research (Maggs & Schulenberg, 2005). Based on previous research, the following trajectories of college freshmen alcohol use are hypothesized:

- Hypothesis 1a: LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as Light/Stable Drinkers who report no drinking or low levels of drinking across time assessments.

- Hypothesis 1b: LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as Escalating Drinkers who report no drinking or

light drinking at the first time assessment and gradually increase alcohol consumption over time.

- Hypothesis 1c: LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as Heavy Declining Drinkers who report high levels of drinking at the first time assessment and gradually decrease alcohol consumption over time.

- Hypothesis 1d: LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as Heavy Drinkers who report high levels of alcohol consumption across time assessments.

Hypothesis 2: DRSE will predict homogeneous clusters of college freshmen alcohol use.

DRSE has not been examined in trajectory analysis research; however, the construct has proven to be associated with frequency of alcohol consumption in university students (Baldwin et at., 1993) and the frequency and volume of consumption in other adolescent and adult populations (Connor et al., 2000; Hasking & Oei, 2002; Lee & Oei, 1993; Young & Oei, 2000). Research also indicates that DRSE adds unique variance to the prediction of drinking behavior (Baldwin et al., 1993). The second set of hypotheses below is guided by literature that is cross-sectional in nature but does show that higher DRSE levels are consistently associated with lower levels of alcohol

consumption (Baldwin et at., 1993; Connor et al., 2000; Hasking & Oei, 2002; Lee & Oei, 1993; Young & Oei, 2000).

- Hypothesis 2a: Light Stable drinkers will be more likely to report high levels of initial drinking refusal self-efficacy than all other growth patterns.

- Hypothesis 2b: Escalating and Heavy Declining drinkers will be more likely to report moderate levels of initial drinking refusal self-efficacy than all other growth patterns.

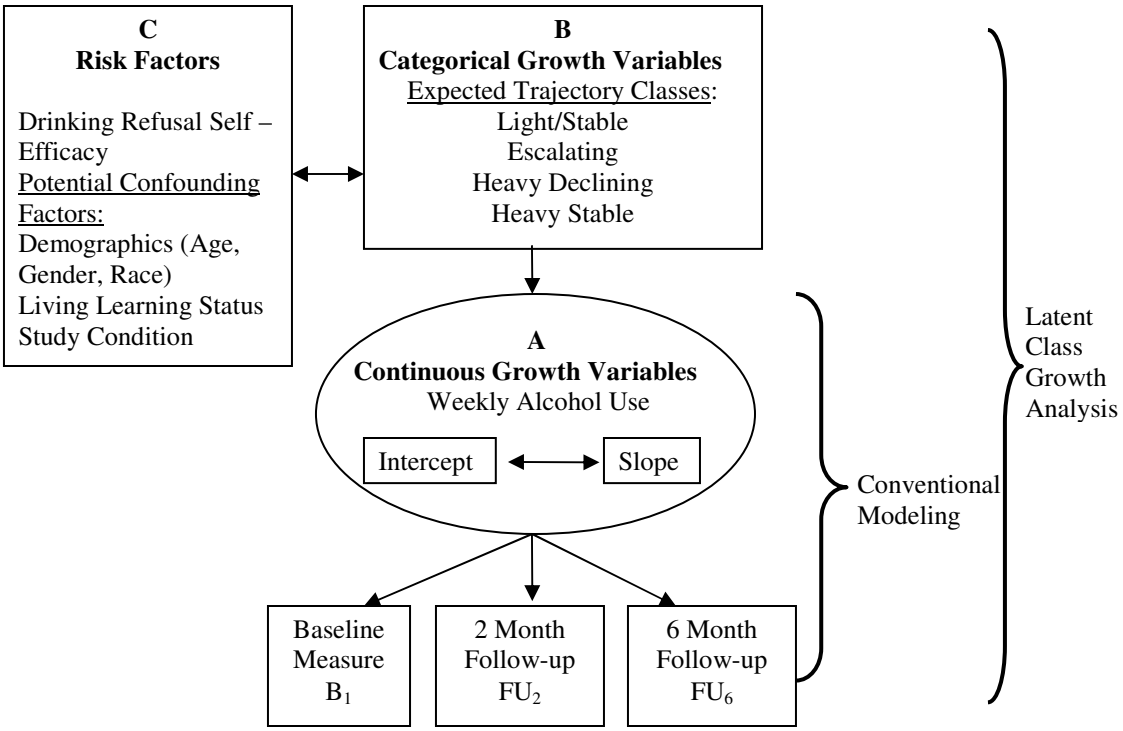
- Hypothesis 2c: Heavy drinkers will be more likely to report low levels of initial drinking refusal self-efficacy than all other growth patterns.

1.3 Conceptual Model

The conceptual model (Figure 1-1 on page 9) is adapted from a commonly used research design developed by Muthen and Muthen that illustrates growth modeling (Fuzhong et. al., 2001). The model contains both latent continuous growth variables (see letter A), and latent categorical growth variables (see letter B). In the context of this study, latent continuous growth variables represent the unobserved, average pattern of alcohol use among college freshmen. Latent categorical growth variables represent the unobserved subpopulations of college freshmen who share similar patterns of alcohol use over time. The bottom portion of the model containing the latent continuous growth variables represents conventional growth modeling. This portion of the model will

measure the dependent variable (alcohol use) over time. B_1 represents the baseline time assessment, while FU_2 and FU_6 represent the two and six month follow-up time assessments respectively. Conventional modeling will use intercept and slope measures over time to reveal a single trajectory estimating the average alcohol use of college freshmen. The arrow from B to A indicates a conditional growth model which is designed to capture subpopulations of college freshmen who share similar patterns of alcohol use. One advantage of growth modeling is that it allows explanatory variables to be incorporated in the model showing how growth trajectories can be predicted from a set of independent variables or risk factors. This relationship is shown with the arrow from C to B. The main risk factor of interest in this study is DRSE. This portion of the model will reveal the influence of initial levels of DRSE on potential subpopulations of college freshmen who share similar patterns of alcohol use. Potential confounding factors will also be examined in the model and include: age, gender, race, living learning status, and study condition.

Figure 1-1: Conceptual Model



1.4 Significance of the Study

Analyzing drinking patterns of college freshmen over time using growth modeling is an innovative strategy that could prove greatly valuable to the future development of longitudinal data analyses. Recent literature indicates only limited success in identifying determinants of different patterns of use. Colder and colleagues (2002) suggest expanding future growth modeling research to include a broader set of influences on adolescent alcohol use. By evaluating the impact of drinking refusal self-efficacy on the drinking trajectories of college freshmen, this study may provide a clearer picture of what determines patterns of alcohol use. As interest in this topic continues to increase, the

literature has raised multiple questions in an effort to better understand drinking trajectories. These questions include the following: 1) Why do some adolescents abstain from substance use, whereas some maintain their use at low levels; and 2) Why do some adolescents steadily escalate their use over time, while others decrease their use or quit altogether? Current research that has attempted to answer such questions has focused on environmental influences on trajectory membership, such as familial use, the impact of advertising and access to substances (Chassin et al., 2002; Del Boca et al., 2002; DeJong & Langford, 2002). However, other studies suggest it is also likely that intrapersonal factors are also relevant (Baer, 2002; Presely et al., 2002). Therefore, findings from this study that support the notion of DRSE significantly impacting different types of drinking patterns may provide useful and much needed strategies for curbing initiation and escalation of alcohol consumption during adolescence and emerging adulthood.

Understanding what influences one person to drink excessively during college and another to drink moderately will also facilitate the development of interventions that target these distinguishing characteristics. By differentiating types of drinking patterns that exist among college students, more effective steps can be taken to reduce alcohol consumption on college campuses. Trajectories identified will help to clarify whether the freshman year time frame is a critical period of change in alcohol use, and indicate which populations among all college freshmen are at greatest risk of heavy alcohol consumption. These subpopulations may become the target groups of tailored interventions, which in turn may provide the key to more effective alcohol risk reduction.

Definition of Terms

Conventional Growth Modeling—also termed Traditional Growth Modeling; statistical analysis that estimates a mean growth curve under the assumption that all individuals in the sample come from a single population. This form of modeling is used to analyze longitudinal data by relating an observed outcome variable to time or to a time-related variable such as age (Duncan & Duncan, 2004).

Drinking Refusal Self-efficacy—a person's belief that he or she is able to resist or refuse alcohol at will (Baldwin et. al., 1993).

Latent Class—term indicating subpopulations in the context of unobserved heterogeneity; the term 'latent class' is used when subpopulations are not known beforehand and must be inferred from the data (Lubke & Muthen, 2005).

Latent Class Growth Analysis—(LCGA), also termed Group Based Modeling; statistical analysis whose object is to estimate different growth curve shapes and class probabilities. LCGA uses a single outcome variable measured at multiple time points to define a latent class model in which the latent classes correspond to different growth curve shapes for the outcome variable (Muthen & Muthen, 2000).

Subpopulation—a generic term indicating a cluster within a heterogeneous population (Lubke & Muthen, 2005).

Trajectory-- a path, progression, or line of development; longitudinal continuities in the development of behavior (Toumbourou et. al., 2003); describes the developmental course of a behavior over time (Nagin & Tremblay, 2001).

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The following literature review begins with a discussion of adolescent alcohol use including the current scope of college alcohol consumption, alcohol use and the first year transition, and how alcohol use is commonly measured when applied to college populations. Following this discussion, this literature review will specifically address longitudinal studies of alcohol use. Topics such as the advantages and limitations of longitudinal studies and how to handle missing data are also discussed. Next, a theoretical discussion and review of drinking refusal self-efficacy literature is addressed. Lastly, other commonly cited factors that influence adolescent alcohol use will be explored.

2.2 Scope of College Alcohol Consumption

Alcohol use and misuse are areas of great concern on college campuses in the United States. Dowdall and Wechsler (2002) even suggest there has not been a more widely studied and discussed topic in all of alcohol research in the past decade. Alcohol use occurs among many different age groups; however, young adults aged 18-24 show the highest rates of use (Ham & Hope, 2003; Hingson et al., 2004). In fact, current research indicates that approximately eighty percent of college students drink and that half of college student drinkers engage in heavy episodic drinking. College students are also unique in that they differ from individuals of the same age that do not attend college. O'Malley and Johnston (2002) found higher rates of drinking in 18-22 year old college

students when compared to the drinking habits of 18-22 year olds that do not attend college.

Straus & Bacon (1953) were the first to report that alcohol on college campuses was a problem nearly fifty-five years ago. Today, there is generally consistency across the major nationally representative studies on college student drinking in terms of prevalence rates for any alcohol use, typical use, and heavy use (Jackson et al., 2005). Approximately 85% of young adults in the Monitoring the Future (MTF) Survey report drinking in the past year (Johnston et al., 2002), and the reported thirty-day prevalence of alcohol use among full-time college students is nearly 70% (O'Malley & Johnston, 2002). Data from the Core Institute (CORE) indicate college students drink on average 6.6 drinks per week. This study also reports modal drinking frequency of a few times per week and modal quantity of 2-4 drinks per occasion. A consistent finding is that approximately 40% of college students report heavy drinking in the past two weeks (Kuther et al., 2003). In addition, 12% of college students in National Household Survey on Drug Abuse (NHSDA) recently reported frequent heavy drinking (defined by heavy drinking on five or more days in the past 30 days).

2.3 Alcohol Use and the First-year Transition

The transition from high school to college is often accompanied by a major change in drinking behavior (Sher & Rutledge, 2007). Unfortunately the occurrence of increased drinking during the transition to college has received relatively little attention in the research literature (Sher & Rutledge, 2007).

Only three prospective studies have been identified that focus on the college-transition period and its relationship to alcohol use. One of the three studies was a multi-campus study (Monitoring the Future [MTF]; Johnston et al., 2005) and the other two studies were conducted within a single campus (Baer et al., 1995; Read et al., 2005). The MTF study provides an overview of longitudinal alcohol use trends among high school students and young adults in the United States which includes those in college; however, very few correlates of pre-collegiate drinking are assessed.

The other two single campus studies mentioned above take a more in-depth approach by examining a number of potential correlates that may influence drinking across the college transition; however, the samples used are relatively small and may not be representative of students at the institutions where the studies were conducted. For example, Baer et al. (1995) found students living in fraternity/sorority residences more likely to increase alcohol use during their freshman year of college. This study however, focused on heavy drinkers and only included those in the sample who indicated drinking heavily in high school while excluding students who may have shown changes from abstinence or light drinking in high school to heavy drinking patterns during the first-year of college. The researchers defined heavy drinking as consuming alcohol at least monthly and consuming 5 to 6 drinks on one or more occasions. Only 25% of students sampled met the two eligibility requirements.

The second single campus study mentioned above, conducted by Read et al. (2005), examined social-influence variables and alcohol use across the college transition. This study however, used a convenience sample that contained fewer than 25% of the entering students at the study university. The results of this study suggested a

relationship between first-year student drinking behaviors and the social environment (Read et al., 2005). The limitations in these studies have led to an increased need for additional studies in which researchers examine the longitudinal changes in freshman drinking patterns using multivariate approaches with more representative samples (Sher & Rutledge, 2007).

Other literature has found first-year students' drinking behavior to be a result of two occurrences. First, Schulenberg & Maggs (2002) have noted that many first-year drinking behaviors are established in high school, which can potentially lead to problem drinking in college. Conversely, for those who abstained from drinking before college, the initiation of alcohol use during the first few weeks of college is thought to be a critical period in which exposure to the new college environment may trigger alcohol use.

Whether a student enters college with pre-established drinking patterns, or initiates drinking during the first few weeks, research indicates several factors specific to increased freshmen alcohol use (Hartzler & Fromme, 2003). Primary factors influencing first-year students include: adapting to a new college environment, the increased influence of peer groups and the absence of parental constraints (Baer et al., 2001). Other factors include being lonely, homesick or isolated. First-year students have also expressed using drinking to gain acceptance and to cope with insecurities felt in a new social atmosphere (Park & Levinson, 2002).

2.4 Measuring Alcohol Consumption

The term 'alcohol consumption' refers to the frequency and/or quantity with which alcohol is consumed over a given time. Frequency refers to the number of days or

occasions on which someone has consumed alcoholic beverages during a specified interval such as a week, month or year. Quantity refers to the amount consumed on a given drinking occasion. Most typically, consumption is assessed using a number of "standard drinks" (i.e. 5 ounces of wine, 12 ounces of beer, or 1.25 ounces of distilled spirits) (Jackson et al., 2005). Quantity and frequency measures can be combined to form a measure of quantity/frequency (QF), which estimates the total volume consumed over a specified time (Dawson, 2003). In its most basic form, the QF approach measures alcohol consumption with two simple questions that inquire about the following: 1) the overall frequency of alcohol consumption within the reference period, and 2) the usual number of drinks consumed on days when the respondent drank alcohol.

The majority of literature surrounding alcohol use in college students is concerned with the frequency of excessive consumption, commonly referred to as binge drinking. Due to the influential work of Wechsler and colleagues (who define "bingeing" as consuming five or more dinks in a row for men and four or more drinks in a row for women), the prevalence of binge drinking has become a key metric in estimating problematic alcohol involvement on college campuses. Not all alcohol researchers agree with using the term "binge drinking." For example, Schukit argues that the term "binge drinking" has historically been used to refer to an extended period of heavy drinking by clinicians and therefore should not be used to describe what is often time a less extreme drinking behavior. However, Wechsler argues that the criterion of 5 (or 4) drinks in a row (in one sitting) is a meaningful threshold and that consumption at these levels is associated with a greatly enhanced likelihood of experiencing a range of negative consequences (Wechsler & Nelson, 2001). Wechsler's widely used definition of binge

drinking commonly specifies the recall time frame in which the alcohol is consumed. For example, on most occasions, a survey question may ask a student to recount bingeing occurrences within the previous two weeks (Wechsler, 2000). Other studies have begun to modify the recall time period by asking about the "typical" day or week of drinking, or asking students to monitor their drinking for a specific period of time (Vik, 2000). Whether terms such as "heavy drinking," "binge drinking," or "drinking to intoxication" are used, research has demonstrated that the consumption of large quantities of alcohol on a single drinking occasion is an important variable in assessing college students' alcohol involvement.

Outside of binge drinking, the literature is not consistent in how drinking is defined or measured among college students (Heck & Williams, 1995). The majority of remaining studies examining adolescent alcohol behavior measure alcohol use by quantity, frequency or a combined QF approach. Many longitudinal college alcohol use studies operationalize alcohol use by creating a scale that represents weekly alcohol consumption (i.e. a QF measure) (Rankin & Maggs, 2006; Bray et al., 2003; Bartholow et al., 2003; Greenbaum et al., 2005; Toumbourou et al., 2003). For example, Greenbaum and colleagues (2005) used a QF approach to measure weekly alcohol consumption of college freshmen over time. Participants were trained to estimate the number of standard drinks (i.e., 12oz of beer; 5oz of wine or wine cooler, or 3.5oz of fortified wine; a mixed drink or one shot of hard liquor) consumed each day for the past thirty days. Although daily drinking data were collected in this study, researchers ultimately computed these results into a weekly alcohol measure because of the cyclic weekly pattern that the daily data provided.

2.5 Longitudinal Studies of Adolescent Alcohol Use

Longitudinal studies play a major role in understanding the change processes and the analysis of change over time (Cook & Campbell, 1979). In the most confined sense, a longitudinal study design attempts to accurately measure the same individuals at several different time intervals (Goldstein, 1979). Several researchers have called for more longitudinal studies that examine alcohol use among first-year students. For example, Dowdall & Wechsler (2002) suggest that future longitudinal studies examine first-year student drinking patterns over time to assess the level of individual student change. Currently, longitudinal studies that examine college student drinking behaviors are limited and even fewer studies focus on first-year student alcohol consumption.

Baer (2002) conducted a review of college drinking literature dating back to 1985. He found the majority of studies conducted were limited to cross-sectional designs that assessed only one point in time and greatly varied in quality. Baer's (2002) review indicated that cross-sectional study designs did not allow for findings to reveal possible developmental processes that occur over time and therefore suggested more longitudinal studies regarding college alcohol use were deemed necessary. Ham & Hope (2003) also suggested there is a pressing need for more longitudinal studies of college drinking behavior and associated psychosocial variables.

To date, the majority of latent class growth modeling (LCGM) that has been applied in studies of adolescent health behavior, focus on youth between the ages of ten to seventeen (Li et al., 2001; Colder et al., 2002; Chassin et al., 2002; Toumbourou et al., 2003; Delucchi et al., 2004). One study conducted by Toumbourou and colleagues (2003), applied LCGM on a sample of 2591 Australian high school students.

Researchers collected data halfway through students' final year of high school, three months after completing high school and on two subsequent occasions each separated by six month intervals. The aim of the study was to identify subgroups of alcohol use through the transition from high school to adulthood. Results revealed three major trajectories: 1) a stable-low sub group consisting of subjects who maintained little to no drinking across time assessments; 2) a stable-high subgroup consisting of subjects who maintained high levels of drinking across time assessments; and 3) an escalating subgroup consisting of subjects who gradually increased their drinking across time assessments. A significant finding revealed females almost twice as likely as males to escalate their drinking behavior. A notable limitation of this study was its high levels of attrition. Drop outs were made up for by incorporating imputed trajectories for those who did not participate in follow-up assessments. Authors pointed to the importance of replicating their study in order to make comparisons of their findings with future investigations.

Another study conducted by Ellickson and colleagues (2005) examined different substance use trajectories from early adolescence to emerging adulthood. This study included subjects ranging in age from 13 to 23. Using participants in the Adolescent/Young Adults Panel Study, the authors aimed to identify similarities and differences in patterns of use across three commonly used substances including smoking, binge drinking and marijuana use. Using growth mixture modeling and six waves of data collection over a ten year period, results showed that for each type of substance use two periods of vulnerability were found: early adolescence and the transition to emerging adulthood. Identified trajectories for each substance use included: 1) an abstinence group

who reported no incidents; 2) a light to moderate use group who exhibited a slight increase in use; 3) a high use group who reported high levels of use; and 4) a steady increase group who reported either no or little use at the first time assessment, but increased their use steadily in a near linear fashion throughout the study period. The authors stressed the limited success in recent research that explains the determinants of different patterns of use and suggested that future studies aim to identify such determinants.

One study conducted by Kidorf et al (1995) surveyed 201 first-year students that participated in an introductory psychology course. Surveys were administered at baseline and two subsequent time assessments during the next two months of the first semester. Results revealed that increases in beer consumption were related to individual alcohol expectancies. Findings also indicated that during the first two months of college, eight out of ten first-year students consumed alcohol at least once. It is worth noting that the sample used in this study was predominantly female (72%), which limits the generalizability of results.

Only one study was identified in the literature that specifically examined variations in drinking during the freshman year in college (Greenbaum et al., 2005). The purpose of this investigation was to determine if a single growth curve adequately characterized the variability in potential individual drinking trajectories. Authors built on previous work conducted by Del Boca et al (2004) and applied latent growth curve modeling to examine this possibility. Before the completion of this research it was unknown whether heterogeneous growth patterns of alcohol use existed within a single college year.

Greenbaum et al (2005) gathered data from 237 participants who reported consuming at least one drink during the academic year. Alcohol use was measured using a Timeline Followback (TLFB) interview. Previous studies using this measurement tool were successful (Sobell & Sobell, 1994; LaBrie et al., 2005) and established the reliability and validity of this method of assessment. Students were asked to estimate the number of standard drinks consumed each day on a calendar commencing 30 days earlier than the survey date. Weekly estimates were computed and complete data was obtained from 67% of the sample; conversely, 33% of the sample was missing one or more data points. Alcohol expectancies were measured using the Alcohol Expectancy Questionnaire (AEQ). This tool is made up of 68 items; however, only the 9-item Social/Physical Pleasure scale was used for this study because it had predicted multiple growth factors in the original work conduced by Del Boca et al (2004). Other measures assessed at baseline included lifestyle variables, personality, alcohol related problems and illicit drug use.

The Greenbaum et al. (2005) study specifically collected baseline data from incoming freshmen during mandatory summer orientation sessions and on three other occasions throughout the first year of college at the University of South Florida. Participants were a random sample of 301 freshmen stratified on gender and family history of alcoholism. The sample included slightly disproportionate percentages of gender (47%male) when compared to the freshmen population (43.5% male); however, was otherwise similar among demographics. Subjects ages ranges from 17 to 20 years ($\bar{x}$ =18.4, SD=.47) and 71% described themselves as Caucasian , 9% as African

American, 12% as Hispanic and 8% as other. The sample size was reduced from *N*=301 to *N*=237 as a result of the exclusion of all non-drinkers from the analysis.

Latent growth curve modeling, conducted using M-plus statistical software, revealed a five class linear model as optimal. This analysis revealed the following five distinct trajectories: 1) freshmen who began as and remained light drinkers throughout the year (light-stable); 2) those who drank little across the year, with the exception of holiday weeks when drinking substantially increased (light-stable plus holiday); 3) students who entered as moderate drinkers but increased consumption across the year (medium-increasing); 4) those who began in the upper range but decreased their drinking over time (high-decreasing); 5) participants who entered as relatively heavy drinkers and continued to drink at that level throughout the year (heavy-stable). Findings illustrated the covariates of gender and alcohol expectancies emerging as significant predictors of class membership. Alcohol expectancy was the strongest and most consistent factor associated with trajectories such that the light-stable groups indicated significantly lower mean expectancy scores than all other trajectories. Gender was also significant such that men were more likely than women to make up the heavy stable group. The authors found the main limitation of their findings was the minimal generalizability of results and therefore recommended independent replication of their work to be essential for generalizing to other college and young adult drinkers.

2.6 Advantages and Limitations of Longitudinal Studies

There are numerous advantages of longitudinal studies when compared to other types of research designs such as cross-sectional studies cited in the literature. First,

cross-sectional studies require larger sample sizes than longitudinal studies to achieve similar levels of statistical power. Statistically, repeated observations from the same subject are rarely perfectly correlated. This results in the repeated measurement of a single subject providing more independent information than one measurement from a single subject.

Second, longitudinal studies allow researchers to differentiate between aging and cohort effects. Aging effects are defined as changes over time within individuals, whereas cohort effects represent differences between subjects at baseline. Heckler and Gibbons (2006) cite cohort effects as commonly mistaken for changes occurring within individuals. Without being able to conduct longitudinal analysis, researchers would not be able to make a distinction between the two competing alternatives.

Third, longitudinal data provide information about individual change and allow for causal inference. Statistical estimates of individual behavior over time can be used to better understand heterogeneity in the population and the determinants of growth and change.

Despite the numerous strengths of conducting longitudinal studies, this type of research design is not without limitations. First, because observations are not by definition independent, and researchers must account for dependency in data, more sophisticated statistical methods are essential. Further, analytical models are not as well developed for longitudinal studies, and there is often a lack of available computer software for application of these more complex statistical models.

2.7 Handling Missing Data

One of the main methodological problems in longitudinal studies is attrition or loss of subjects during the course of a study (Twisk & deVente, 2002). Along with attrition, missing data and dropouts are all terms used for the situation when data on repeated measurements is not available for all subjects. Even in well-controlled situations, missing data invariably occurs in longitudinal studies. Attrition is generally seen at the end of a longitudinal study, although it is also possible for subjects to miss one measurement and return to participate in the study at follow-up measurements. An increasing number of articles reviewing methods for handling missing data in longitudinal analyses has been published (Demirtas, 2004; Gornbein et al., 1992; Hogan & Laird, 1997; Molenberghs et al., 2004). This area is continuing to develop at a rapid pace and the availability of software to deal with missing data has also increased.

A few decades ago, there were limited methods available to analyze longitudinal data. The methods that were available had a major drawback; namely that if one of the repeated measurements was missing, all other available data of that subject were excluded from the analysis. To overcome this problem imputation methods for missing data have been developed. Imputation is a method of adjusting data sets for item non-response. Specifically, imputation replaces each missing data item with one possible response. This is an area of debate in statistical research. The central question of many studies involving missing data has seemed to be "what should be done about the missing outcomes?" One option is to fill in missing outcomes with imputation techniques and the other option is to omit cases with missing data from the analysis. The statistical application used for analyses in this study does not employ imputation techniques. The

application omits cases with missing baseline risk factor data and uses all available dependent variable data without the deletion of any cases.

Another problematic issue that is commonly ignored is the process or mechanism that caused the outcomes to be missing in the first place. One of the earliest citings in the literature regarding the theoretical aspects of this problem was considered by Rubin (1976), in an article that began further initiatives that continue to this day.

In general, there are three types of attrition or missingness: 1) missing completely at random (MCAR); 2) missing at random (MAR); and 3) missing not at random (MNAR). MCAR assumes a missing observation does not depend on observed or unobserved measurements. For example, missing data is considered to be MCAR when given two variables, A and B, the probability of response is independent of variables A and B. Therefore, "missingness" is not related to the specified variables. Conversely, MAR assumes that, given the observed data, an observation being missing does not depend on unobserved measurements. For example, missing data is considered to be MAR when given two variables, A and B, the probability of response depends on A but not on B.

Nagin suggests the simplest form of handling missing data is to assume data is MCAR (Nagin, 2005). He also states incorporating data that is MCAR into group-based modeling is a great advance over the historically used technique which resulted in the removal of subjects with incomplete assessments from the sample. LCGA used in this study treated missing data of the dependent variable (i.e., alcohol use) as MCAR.

2.8 Social Cognitive Theory and Drinking Refusal Self-Efficacy

Social cognitive theory (SCT) attempts to explain how people acquire and maintain certain behavioral patterns while also addressing methods of promoting behavioral change. Commonly used in the fields of psychology and health education, the SCT was developed by Albert Bandura and addresses psycho-social factors influencing health behavior and promotion of behavior change. The theory is easily applied to longitudinal studies because it emphasizes that a person's behaviors and cognitions affect future behavior. SCT incorporates an extensive range of theoretical concepts and has been used in many areas of practice, including the understanding of the development of alcohol abuse and dependence. SCT proposes that drinking behavior is, in part, regulated by expectancies related to the perceived consequences of consuming alcohol. The concept of alcohol expectancies (AEs) is rooted in SCT and stems from research indicating that the effects of alcohol are not solely a factor of alcohol's physiological effects, but rather a function of the beliefs one holds regarding these effects (Oei & Moraskwa, 2004). For example, individuals who believe they have consumed alcohol behave in accordance with their expectations of alcohol effects, even when they actually receive a placebo (Marlatt & Rohensow, 1980). The application of Alcohol Expectancy Theory has also been used in the literature to bridge the gap between drinking related variables and alcohol consumption (Oei & Baldwin, 1994).

Bandura differentiated between two types of expectancies: efficacy expectancies and outcome expectancies. Outcome expectancy is one's belief about the consequences of carrying out that activity, while efficacy expectancy is generally defined as one's confidence to perform a particular behavior. According to Bandura, efficacy

expectancies can determine whether an individual will attempt a behavior, as well as the capacity and length of time to which that effort will be maintained (Bandura, 1977). It is important to note that self-efficacy relates to beliefs about personal capabilities of performing specific behaviors and not one's behavioral intent. Perceived self-efficacy is a major determinant of intention; however, the two constructs are conceptually distinct (Bandura, 2000). Bandura (2001) emphasized this distinction in his *Guide for Constructing Self-Efficacy Scales*, where he stressed that self-efficacy items should be concerned with capability and phrased in terms of "can do" as opposed to "will do."

Self-efficacy has been linked to and shown to predict variance in a variety of behaviors including phobic avoidance, reducing depressive symptoms, smoking cessation and increasing exercise. There is, however, much less research in the area of self-efficacy in adolescents related to substance abuse, specifically alcohol abuse. According to self-efficacy theory (Bandura, 1977, 1986, 1997), individuals decide to engage in a behavior based upon their perceptions of their ability to successfully perform the behavior. Self-efficacy judgments have been hypothesized as central in influencing drinking behavior (Young & Knight, 1989).

In the context of alcohol use, refusal self-efficacy is described as one's perceived ability to refuse or resist alcohol in specific situations. Although the outcome expectancy and efficacy expectancy distinction was proposed by Bandura more than two decades ago, most AE research has focused solely on outcome expectancies. Efficacy expectancy, termed drinking refusal self-efficacy (DRSE) in alcohol literature, has only recently become the target of increasing research interest (Oei & Baldwin, 1994). Although there has been less research examining the relationship of DRSE to alcohol

consumption, among the studies that have been conducted, preliminary findings reveal DRSE plays a more important role than AE in drinking behavior (Oei, et al., 1998).

2.9 Review of Drinking Refusal Self-Efficacy Research

DRSE became the target of increasing research interest in the early 1990's. Prior to this surge of research, some studies linked general self-efficacy with alcohol consumption (Cooper et. al., 1988). Early DRSE studies suggested that the construct played a role in the amount of alcohol consumed among problem drinkers; specifically during relapse and post-treatment recovery (Burling et al., 1989; Oei & Jackson, 1982; Rist & Watzi, 1983). These early studies led to increased attention to DRSE and even suggested that DRSE was a more powerful indicator of drinking behavior than AE (Lee & Oei, 1993).

The earliest study conducted with undergraduate college students that examined the relationship between DRSE and alcohol use was published in 1993. Baldwin et al., (1993) used structural equation modeling techniques on a sample of 118 undergraduate Australian students to determine the relationships between alcohol expectancies and DRSE beliefs on the quantity and frequency aspects of alcohol consumption. It is worth noting that the legal drinking age where this study was conducted was 18 years of age; therefore the generalizability of these results are extremely low for American freshman college students. Authors used the Drinking Expectancy Profile (DEP; Young & Oei, 1990) to measure AE and DRSE. The DEP instrument was developed in Australia and New Zealand and consists of two sections including the Drinking Expectancy Questionnaire (DEQ; Young & Knight, 1989; Young & Oei, 1990) and the Drinking

Refusal Self-Efficacy Questionnaire (DRSEQ; Young, et al., 1991). The DEP has proven to be a psychometrically reliable method of assessing beliefs about the effects of alcohol and the beliefs about the ability to refuse alcohol in a range of situations (Morawska & Oei, 2005). The Khavari Alcohol Test (KAT) was used to assess the quantity and frequency of alcohol use.

Findings indicated that DRSE was related inversely to frequency of drinking, and alcohol expectancies were inversely related to the frequency and quantity of drinking. Gender differences found in the study were expected given previous findings. Females in the sample reported drinking less and had lower expectancy scores than did the males. Also, no age differences were found in this study. These findings support the notion that certain AEs and DRSE beliefs enter into a decision to drink or not to drink.

A second early study examining the roles of AEs and DRSE in predicting alcohol use was conducted using a sample gathered from the general community in two major Australian cities (Lee & Oei, 1993). Researchers administered the DEP in an attempt to replicate the work of Baldwin et al (1993) in a sample of the general community. It was hypothesized that AEs and DRSE would show differential effects with respect to alcohol use.

Findings revealed DRSE was inversely related to frequency of drinking. This result was consistent with the early work of Baldwin et al (1993). However, this study also found DRSE to be predictive of quantity. That is, subjects who believed that they would be less able to resist alcohol drank more than those who did not have this belief. Lastly, AEs were found to be related to frequency, but not quantity of consumption. These results strengthen the importance of investigating AEs and DRSE separately.

After completing this study using a general sample of the population, the authors suggested their findings also presented the need to guide future research toward more specific populations of drinkers in order to fully utilize expectancy measures in practice.

There are two noteworthy limitations regarding the design of the early studies mentioned above. First, there is the issue of using self-report measures in alcohol research. Some literature has shown self-report data of alcohol use to be subject to bias and random error (Babor et al., 1990). However, this can be minimized by specific instructions and assurances of confidentiality and anonymity (Baker & Brandon, 1990). Other literature has found self-report measures to produce accurate results (Osberg & Shrauger, 1986). Research conducted by Baldwin et al (1993) and Lee & Oei (1993) utilized these procedures to increase the accuracy of their self-reported alcohol use results. A second possible limitation of the work conducted by Baldwin et al (1993) and Lee & Oei (1993) was their lack of random sampling techniques to obtain data. This does limit the generalizability of their findings, but also provides an opportunity for future research to build on their work.

There were also several other studies conducted using college student samples that found self-efficacy for avoiding heavy drinking to be significantly related to alcohol use (Greaves & Stephens, 1992; Young, et al., 1991; Burke & Stephens, 1999). For example, a study, conducted by Oei & Sweeney (1993), found that while general self-efficacy was not a useful predictor of alcohol consumption, lower DRSE beliefs did predict higher consumption. Findings from these studies have typically shown that lower levels of self-efficacy for avoiding heavy drinking are predictive of higher levels of

alcohol consumption and a greater frequency of drinking episodes. It is important to note that these cited studies were not longitudinal in nature.

The literature has produced mixed results regarding the importance of studying AEs and DRSE constructs alone or in combination. For example, a model proposed by Oei & Morawska (2004) suggests that both AEs and DRSE are better predictors of drinking behavior when looked at together and can better discriminate between drinker-types than when each is considered individually. However, later work by Morawska and Oei (2005) suggests AEs are more important determinants of binge drinking behavior. Bandura (1977) asserted that the combination of both outcome and efficacy expectancies is important in the acquisition and maintenance of behavior including problem drinking. However, numerous other studies provide support for the conceptual distinction between AEs and DRSE with each construct adding unique variance to the prediction of drinking behavior (Young & Oei, 1996; Williams et al., 1998; Brown et al., 1998). Further, Vik et al (2000) found DRSE to be important in the development of drinking in young people.

Recent research has also investigated whether AEs and DRSE are related only to alcohol consumption, and not to other drug behaviors such as cigarette smoking and caffeine consumption (Oei & Burrow, 2000). A test of specificity theory found AE and DRSE to be predictive of alcohol consumption and not predictive of smoking or caffeine consumption. The finding that DRSE is specifically related to alcohol behavior also provides support for Bandura's (1986) assertion that self-efficacy relates to specific behaviors in specific situations. A more recent study conducted by Young et al (2005) examined the role of AEs and DRSE beliefs in university students. Findings revealed the

DEP as a whole (consisting of the DEQ and DRSEQ) accounted for fifty percent of the variance in alcohol dependence.

The majority of studies linking efficacy to alcohol consumption are cross-sectional in nature, leaving open the possibility that self-efficacy is simply a phenomenon that varies as a function of drinking behavior. Without research examining efficacy of alcohol consumption over time, researchers cannot claim a causal relationship exists. Longitudinal studies are also needed in order to examine prediction of future drinking behavior based on social cognitive constructs (Burke & Stephen, 1999). Although longitudinal studies will not necessarily rule out unidentified third variables that may account for the relationship between efficacy and future drinking behavior, they would enhance confidence in the predictive nature of the SCT (Burke & Stephens, 1999).

2.9.1 History of the Drinking Refusal Self-Efficacy Questionnaire Development

Originally the DRSEQ consisted of 31 items; however, in 2005 its authors conducted a confirmatory factor analysis (CFA) and condensed the questionnaire to 19 items. This revised version of the DRSEQ was called the Drinking Refusal Self-Efficacy Questionnaire—Revised (DRSEQ-R). Prior to conducting CFA, only exploratory factor analysis had been performed on the DRSEQ. Exploratory factor analysis revealed the questionnaire had good psychometric properties, however CFA is a more stringent technique designed to test the underlying theoretical structure about latent processes and was essential to the validation of the DRSEQ (Oei et al., 2005). In an effort to meet the rigorous sample size requirements of CFA, data collected using the DRSEQ in several studies were combined and used for analysis. The final sample (n=2773) was made up of

three groups including a community sample, a student sample and a sample dependent on alcohol. Results of this analysis revealed that the underlying factor structure was reliable in all three groups and consequently, the condensed questionnaire maintained its original three factor composition. The DRSEQ-R was also found to have good construct and concurrent validity (Oei et al., 2005). Construct validity was examined by observing group differences in scores on the questionnaire. If the DRSEQ-R proved to be a valid measure of DRSE, authors expected to see differences between the clinical and non-clinical samples, with dependent drinkers reporting lower levels of DRSE than the community and student drinkers. Results indicated that individuals in the different samples were found to have significantly different scores on each subscale and the total score of the DRSEQ-R, with the alcohol-dependent group reporting lower DRSE across all subscales. Subscale and total scores for the DRSEQ-R were correlated with alcohol consumption to establish concurrent validity of the revised scoring method. All factor scores and the total DRSEQ-R scores were negatively correlated with alcohol consumption across all three samples. In addition, the three-factor solution accounted for 71.92% of the total variance in the community data, 63.29% in the student data and 64.30% in the alcohol dependent data. Cronbach's alpha coefficients were high for all factors in all samples. The social pressures scale yielded Cronbach alpha values of α=0.95, α=0.90, and α=0.90 in the community, student, and alcohol dependent samples respectively. The emotional relief and opportunistic drinking refusal self-efficacy scales yielded Cronbach alpha scores ranging from α=0.84 to α=0.95 across samples. The lowest measure of internal consistency was found for opportunistic self-efficacy in the alcohol-dependent sample (α=0.84); however, this was still well above the accepted limit

of α=0.7 (Cicchetti, 1994). Factors were also moderately to highly correlated in all samples. Specifically, the student sample revealed significant ($p<0.01$) correlations ranging from .81 to .88 between factors.

The latest application of this questionnaire occurred in 2007 and aimed to confirm the factor structure of the DRSEQ-R in an adolescent-only sample. A large sample of 2,020 adolescents between the ages of 12 to 19 completed the DRSEQ-R as well as measures of alcohol consumption. Results confirmed the factor structure of the DRSEQ-R for use in an adolescent sample and provided preliminary evidence of validity of the measure (Young et al., 2007). All three factors were negatively correlated with both frequency and volume of alcohol consumption. Further, drinkers reported lower drinking refusal self-efficacy than non-drinkers. A Cronbach alpha coefficient of α=0.96 was revealed for the total scale score and internal consistency measures of α=0.87, α=0.90, and α=0.90 existed for the social pressures, emotional relief, and opportunistic scales respectively. After this application, the survey was renamed and termed the Drinking Refusal Self-Efficacy Questionnaire—Revised Adolescent Version (DRSEQ-RA).

2.10 Factors Influencing College Alcohol Use

There are many variables cited in the literature that are associated with college alcohol use covering a wide range of biological, psychosocial and social factors (Presley et al., 2002). Hartzler & Fromme (2003) suggest patterns of college drinking are governed by both trait and cognitive influences which may guide first time students into various trajectories of drinking behavior. Factors associated with drinking among college

students relevant to this proposal and discussed below include the following: demographic characteristics, living environment, and high risk college groups. Many other factors, even though not directly addressed in the aims of this study, are associated with the population of interest and are therefore briefly discussed in the remainder of this literature review. These factors include social affiliation, parental alcohol use, alcohol related negative consequences, and peer influence.

2.10.1 Demographics

Gender and ethnicity are the most commonly cited demographic variables associated with drinking among college students in the literature (Ham & Hope, 2003; Yeh et al., 2006). The heaviest, most frequent and most problematic drinking behaviors have been documented in college men. Overall, male students tend to drink more frequently and larger quantities of alcohol than female students (Clements, 1999; O'Malley & Johnston, 2002; Read et al., 2002; Valliant & Scanlan, 1996). Further, male college students are more likely to participate in binge drinking than female college students (Wechsler et al., 1994; Wechsler et al., 1995a). A student's year in college may also be associated with alcohol consumption. For example, according to McCabe (2002), male sophomores, juniors and seniors engage in heavier drinking than freshmen male students. In contrast, the same study revealed upper class female students drank less than freshmen female students. Although there has been a history of research indicating the gender differences in college students mentioned above, some researchers postulate that women are becoming more like men in their drinking patterns (Goodwin, 1989; Maney, 1990; Ham & Hope, 2003). In fact, Martin & Hoffman (1993) found evidence indicating

women living in coed environments may adopt drinking patterns similar to that of the men in their living unit. This is especially dangerous given the biological differences in alcohol absorption. Perkins (2002) explains women can typically reach the same blood alcohol concentration as men while drinking less alcohol due to biological differences in body weight, fat-to-water ratios and metabolic processing.

A number of studies have identified white males as the group with the highest risk for problematic drinking (Wechsler et al., 1995a; Wechsler et al., 1995b). When examining alcohol use across five national sources of data, O'Malley and Johnston (2002) found that white students reported the most heavy drinking and African American students reported lower rates of heavy drinking. The same study also found Hispanic college students to report moderate rates of heavy drinking, and fall in between white and African American students' drinking levels. O'Malley and Johnston (2002) report that these trends in ethnic differences in drinking among college students have been relatively stable since 1980.

Research conducted focusing on Asian and Pacific Islander (API) college student populations have found both the percentage of drinkers and the percentage of heavy drinkers were lower among API students than among Caucasian students (Zane & Kim, 1994; Makimoto, 1998). These findings were consistent with surveys of drinking behavior of APIs in the general population.

2.10.2 Living Environment

One of the most dramatic changes for first time college students is the environmental transition from living with parents to living in a residence hall. For most

students this represents a time of new found freedom and ultimately a large adjustment. A number of studies have found that a college student's living environment affects alcohol consumption (Gfroerer et al., 1997; Harford & Muthen, 2001; Harford et al., 2002; Wechsler et al., 2002).

O'Hare (1990) found that commuters living at home were more likely to drink less than students living on campus. This study also found men who lived on campus twice as likely to be heavy drinkers than men who did not live on campus.

Martin & Hoffman (1993) found living environment to impact alcohol consumption on college campuses. Specifically, students living on campus in facilities such as fraternity, sorority, or residence halls drank more, engaged in binge drinking more often and reported more alcohol related negative consequences than those students living with their parents. Using data from the College Alcohol Study (CAS), which includes over 53,000 participants, Wechsler and colleagues (2002) found living environment had a profound impact on problem drinking. Students who lived in substance-free dorms or at home with their parents reported lower rates of binge drinking and negative secondhand effects of alcohol use when compared to students living in regular dormitories, fraternity/sorority houses, or those living off campus without parents. Overall, students living in fraternity or sorority houses have been shown to drink more and experience more negative secondhand effects of alcohol use than all other students.

Using National Longitudinal Study of Youth (NLSY) data, Harford & Muthen (2001) examined the relationship between change in residence and change in drinking behavior of college students. Students living in residence halls or in off campus housing showed increases in heavy drinking, when compared to those who lived off campus with

their parents who showed no such growth. Their results also revealed a change to a residence hall or independent off campus residence from living off campus with parents was associated with an increase in alcohol use, indicating the powerful influence of the college environment.

The majority of incoming first-year students choose to live on-campus in university housing versus off-campus or with their parents. Perkins (2002) found an increase in on-campus first-year resident alcohol use to be a result of the following factors: heightened socialization with peers, a minimally supervised environment and increased access to peers of legal drinking age willing to purchase alcohol. Wechsler et al (2002) also consistently found first-year on-campus residents to report significantly more alcohol use than commuter students.

Another important aspect of residence hall settings is the relationship between roommates. Some institutions allow first-year students to select their own roommates (which are often high school acquaintances); however, other institutions pair roommates by a set of matching criteria and/or common characteristics. A study conducted by Harford et al (1983) found the number of students assigned to the same room or suite significantly predicted an increase in alcohol consumption. This finding implies an increased number of roommates facilitate greater opportunities for social situations that include alcohol. Drinking patterns of same sex, versus co-ed residence halls have also revealed different findings. Students living in co-ed housing arrangements are more likely to drink than students living in same-sex housing arrangements (Gfroerer et al., 1997; Wechsler et al., 1995a; Jones et al., 1992).

2.10.3 High Risk College Groups

Four campus sub-groups have been identified to be at high-risk for problematic drinking. These subgroups include: athletes, judicially sanctioned students, Greek members and first-year students (Meilman et al., 1990, Larimer et al., 2002).

National data show that participants in college athletics consume greater levels of alcohol and are more prone to binge drinking behaviors than are non-student athletes (Wechsler, 1996a). According to the literature, student-athletes may use alcohol to relax from the physical demands placed on their bodies, to cope with the pressures of competition and the expectation to win. There may also be a culture of peer support for drinking among athletes, which promotes higher rates of consumption in comparison to non-athletes. Another study based on the Core Survey found male and female college student athletes drank more heavily, frequently and reported more negative consequences from drinking compared with nonathletes (Leichliter et al., 1998). Leichliter and colleagues (1998) also found that male leaders of athletic teams drank at higher rates than other team members. Finally, a study conducted by Wechsler and colleagues (1995a) found subjects who indicated athletics as "important," reporting increased rates of heavy drinking, even when controlling for other risk factors.

A second college sub-population at increased risk are those students who have violated university alcohol policies. Typically these students are sanctioned by a university judicial officer and mandated to attend alcohol prevention courses for first offenses or referred to treatment services for additional offenses. In a study conducted by O'Hare (1997), the most common referral to campus judicial programs involving alcohol stemmed from first-year students possessing alcohol in the residence halls.

Due to membership size, financial assets and popularity, the easiest high-risk college sub-population to identify are Greek letter organizations. Many studies have concluded that student members of Greek organizations (fraternities or sororities) are more likely to drink compared to other non-Greek students (Larimer et al., 1997; Cashin et al., 1998; Engs et al., 1996; Wechsler et al., 1995a). According to Wechsler et al (1996b), the increased rate of drinking among Greek members is attributed to the frequent occurrence of large-scale activities where alcohol is present. In addition, a 1998 study concluded that attitudes and expectations regarding alcohol consumption by Greek students were greatly influenced by the social norms of the Greek community as a whole (Alva, 1998). Cashin et al's (1998) study revealed members of Greek organizations felt that alcohol was a vehicle for a variety of behaviors, including friendship, social activity and sexuality. Further, this study found that the leadership within the Greek organizations drank as much or more than the average members. This suggests that leadership within fraternities and sororities may set heavy drinking norms. Wechsler et al's (1995a) study found the strongest predictor of heavy drinking to be membership in a fraternity. It is also noteworthy to state Cashin and Wechsler's studies both involved questionnaire data from multiple colleges which increases the generalizability of their results.

Even though it is well documented that fraternity and sorority members drink more frequently, more heavily and experience more alcohol related problems during college than those students not affiliated with such organizations, it is worth mentioning that nearly all studies conceptualize involvement in Greek life as a dichotomy. Bartholow and colleagues (2003) argue this methodological design could possibly

overlook several important distinctions. For example, students who are not technically members of a Greek organization but closely associate with members (e.g., frequently attend parties), are also influenced by the social environment of the Greek system and therefore may experience many of the same effects of heavy drinking. Many times this difference is disregarded when simply looking at Greek versus non-Greek relationships among alcohol data.

First-year students are the final high-risk group regarding the prevention and consequences of alcohol use and will be the focus of this study. First-year students represent the largest group of students on campus under the legal drinking age of 21. College administrators have recognized the adverse impact that alcohol can have on academic performance, career plans, and overall health and well-being of first-year students. As a result freshmen are usually the target of campus prevention programs. First-year students also represent a significant segment of the college population and are at increased risk for alcohol consumption and associated consequences (Prendergast, 1994; Pope et al., 1990). Recent Core Institute data (O'Malley & Johnston, 2002) reported first-year college students consume 6.2 drinks per week on average, and that 47% of first-year student responders satisfied the definition for binge drinking, while 19% met criteria as heavy-frequent drinkers. Thus, further research on first-year students and the role of alcohol during the transitional first-year of college will strengthen the current body of college alcohol literature specific to this high-risk student sub-population.

The remaining factors discussed in this literature review are strongly associated with college alcohol use, but only briefly reviewed due to their lack of correlation with the specific aims of this proposal.

2.10.4 Social Affiliation

Social context is a term used to describe the environment in which drinking takes place. Research involving social contexts for drinking has been proven to vary depending on participants' demographic characteristics as well as other determinants such as living and work environments. Senchak and colleagues (1998) evaluated the social context of drinking on college campuses and observed group size and gender differences. Men reported greater frequencies of drunkenness in large groups of mixed gender when compared with smaller groups of mixed gender. Conversely women's frequency of drunkenness was unrelated to group size or mixtures of gender.

Other researchers have gone beyond the assessment of drinking context size and composition and assessed psychological and social factors related to drinking contexts. Two different scales have been developed to measure drinking contexts among college students. Thombs and Beck (1994) developed a Social Context Drinking Scale made up of six subscales; social facilitation, emotional pain, peer acceptance, family, sex seeking and motor vehicle. O'Hare (1997) developed a Drinking Context Scale made up of three subscales; convivial drinking, private intimate drinking and negative coping. These drinking scales designed specifically for college students have proven to be stronger predictors of drinking than measures of personality (Beck et al., 1995) and alcohol expectancies (Thombs et al., 1993).

2.10.5 Parental Alcohol Use

The role of parental alcohol use on adolescent drinking is mixed. For example, Engs (1990) reported that rates of drinking were nearly the same when comparing college

students who do and do not report a history of parental drinking problems. Other investigators found similar results (Havey and Dodd, 1993). However, Kushner & Sher (1993) found higher rates of alcohol use disorders among Children of Alcoholics (COAs) (35%) compared with non-COAs (16%) in a large sample of college freshmen. Other researchers reported increased rates of alcohol related problems for COAs compared with non-COAs (Perkins & Berkowitz, 1991; Pullen, 1994).

2.10.6 Alcohol Related Negative Consequences

Alcohol related problems and consequences refer to a variety of negative life events that arise from drinking such as social problems (e.g. physical or verbal aggression, relationship difficulties), legal problems (e.g. arrests for driving while intoxicated, public inebriation), educational/vocational problems (e.g. academic difficulties, termination from employment), and medical problems (e.g. unintentional injury, liver disease).

The consequences of alcohol use while in college, not only affect those who drink, but also those who do not consume alcohol. Common secondhand effects of binge drinking include being insulted or humiliated, experiencing unwanted sexual advances, having interrupted sleep and having to take care of friends or roommates (Wechsler et al., 2002). According to Wechsler (1996a) secondhand effects of binge drinking are widespread and impact most college students.

2.10.7 Peer Influence

Research indicates the influence of peers' attitudes and behaviors about alcohol seems to be related to alcohol consumption (Ham & Hope, 2003). Specifically, peer groups in which heavy drinking is encouraged and perceived as normal tend to have more heavy drinkers than peer groups in which heavy drinking is not encouraged (Ham & Hope, 2003). Martin & Hoffman (1993) found students who associated with more friends who drank were more likely to consume alcohol than students who associated with fewer friends who drank. It is also possible that those who have more social contact and are more sociable, drink higher amounts of alcohol because of greater opportunities to drink as a result of being exposed to more situations where alcohol is present (Ham & Hope, 2003).

CHAPTER 3: METHODS

3.1 Introduction

This study involves a secondary data analysis examining patterns of alcohol use among college freshmen. This chapter includes a description of the study population, data collection procedures, and measurement tool used in the parent study. Operationalization of variables and statistical analyses are also addressed. All procedures involved in recruiting participants and implementing the survey have been approved by The University of Maryland Institutional Review Board (IRB). A copy of the IRB approval can be found as Appendix A.

3.2 Study Population

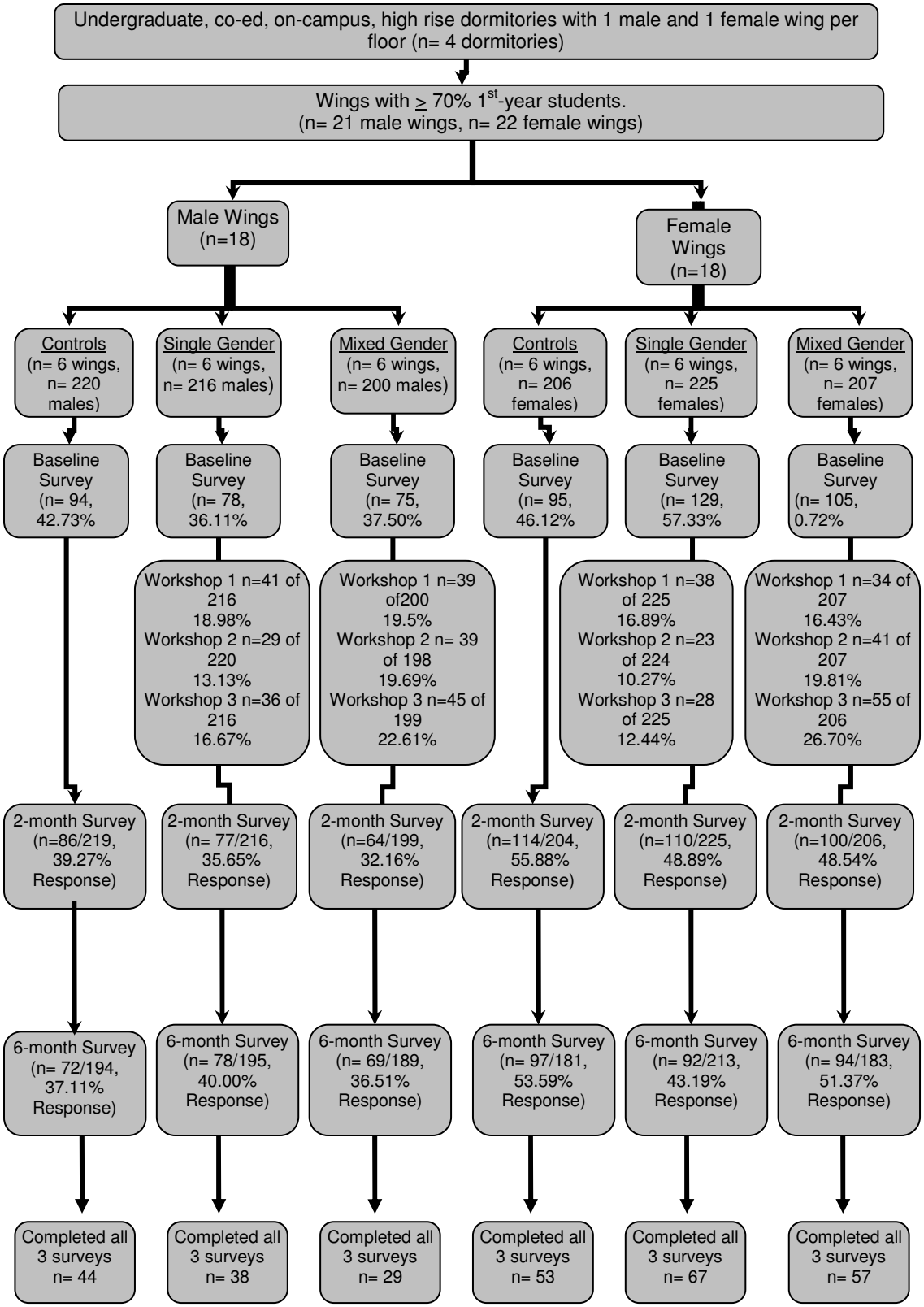
The subjects in the parent study that generated the data for this dissertation were participants in a NIH-funded study entitled *Peers as Family: Preventing Problem Drinking* (PAF). The overall purpose of PAF was to learn more about the social influence of dormitory units on social pressures to drink among college freshmen. PAF implemented an intervention study design with a purposive sampling frame that was designed to identify similarities and differences in alcohol risk-reduction behavior among college freshmen. The conceptual framework of PAF was taken from Fisher and Fisher's (1996) Information-Motivation-Behavioral Skills model (IMB) and modified to include the influence of living unit on risky alcohol behavior. The IMB was based on the principles of three major public health theories; the Theory of Reasoned Action (Fishbein

and Middlestadt, 1989), the Health Belief Model (Strecher et al, 1974) and the Social Cognitive Theory (Bandura, 1977).

In four predominantly freshmen dorms at the University of Maryland, residents who lived on selected study wings, were eligible to participate in the study. A visual description of how the study sample was obtained can be found in Figure 3-1 on the following page. Parental consent for 17-year-olds participating in the study was not obtained. Another comparable study entitled the University New Student Census (UNSC) has electronically gathered data from first-year college students since 1997 and has included those under the age of 18 without parental consent. That study established precedence for 17 year olds included in this type of research to participate without parental permission. Further, the Institutional Review Board does not require parental permission because the "project involves no more than minimal risk to the subjects, the benefits outweigh the risks and, under the circumstances, it is not feasible to obtain parental permission" (University of Maryland Institutional Review Board Co-Chairpersons, personal communication, 2002). In addition, all participants were administered informed consent forms which explained the risks and benefits of participation (See Appendix B).

PAF study residence halls were specifically selected to ensure that gender and special group learning programs were weighted proportionately among all study conditions included in the trial. Special group learning programs, commonly referred to as living-learning programs, exist at the University of Maryland in select dormitory wings. Living-learning communities are residential programs that have direct connections with faculty and specific academic departments within the University's

Figure 3-1: Sample Acquisition Flow Chart



Division of Academic Affairs. In partnership with Resident Life staff and other student services staff, faculty and academic administrators link curricular and residential experiences in ways that create opportunities for deeper understanding and integration of classroom material.

The residence hall inclusion process began by obtaining data from the University's Department of Resident Life that included detailed information about the composition of all dorms that housed undergraduate students. These variables included each student's dorm wing, first-year status, gender, and special group learning status. From this, each hall's number of freshmen, student by gender, special group learning status and number of wings were calculated. First, residence halls that did not have at least four all male and four all female wings were excluded from the study. Once study dorms were chosen, individual wings were selected in each dorm. Selected wings had to meet the following inclusion criteria: 1) a capacity of at least thirty students; 2) a resident advisor assigned to each wing; and 3) a composition of at least seventy percent first-year students. Once a wing was selected, every student on the wing was invited to participate in the study. The final sampling plan provided a total of thirty-six wings (18 male and 18 female) across four residence halls. Wings were specifically assigned to one of three study conditions such that wing gender, dorm and special group learning status were equally distributed across study conditions. Study conditions consisted of one control group, one single gender group and one mixed gender group. Each of the two intervention conditions were based on the IMB model and centered around risky alcohol use behaviors.

The PAF intervention was a three-part workshop series aimed to 1) provide students with alcohol risk reduction information; 2) determine students' alcohol risk reduction motivation; and 3) provide students with risk reduction behavioral skills. The first workshop, provided students with risk reduction information, such as what constitutes a drink, the effects of alcohol on the body, alcohol poisoning, protection strategies, campus policies and state laws. This workshop also included student testimonials about alcohol experiences and incorporated popular and relevant movie clips illustrating alcohol-related behaviors. This workshop was approximately three hours in length.

The second workshop, which lasted approximately two hours, provided students with short skits to act out in groups. Skits focused on alcohol protection strategies, wing-mate confrontation skills, and alcohol use assistance behaviors.

The third workshop, (10-15 minutes in length), provided students with an individualized "choose your own alcohol adventure" decision-making activity. This exercise forced students to make decisions in various alcohol-related situations before, after and during socializing activities.

3.3 Data Collection Procedure

The PAF sampling frame consisted of a list of all undergraduates residing in selected study residence hall wings that was obtained from the University's Department of Resident Life. The listing included each student's name, home address, e-mail address, phone number, gender, and date of birth. Students were initially contacted two weeks prior to their arrival on campus. At this time students were sent a personalized

introductory letter by mail which explained the purpose of the study and contained a token incentive (ink pen with the project name) in the hopes of increasing project participation (See Appendix B). The introductory letter also informed the student he/she would be receiving an e-mail on the following day with more information regarding the study.

The following day students received an e-mail which also welcomed them to the study and invited them to take 20 minutes to complete a survey about college peer experiences. The e-mail also explained that students would be given a $10 University Bookstore coupon for successful completion of the survey. Various reminders such as postcards and emails were used throughout the study to encourage students' completion of survey instruments. Assent forms were necessary because students aged seventeen were included in the eligible sample. Assent and consent forms were combined and included as part of the online survey process (See Appendix B). The initial e-mail sent to students contained a link to the web survey page and the students' unique study identification number. Once entering the PAF survey website, students were first required to read and 'sign' the combined assent/consent form by entering their birth date. Students could then proceed and complete the survey. After survey responses were submitted, students were reminded of any missed items and asked to answer them.

After successfully submitting their surveys, students received instructions explaining how to acquire their $10 bookstore incentives. At this time a confirmation page was shown to students, thanking them for participating and providing information regarding alcohol use behaviors and campus resources. The campus resources listed included telephone numbers to the following sources: the University Police, Health

Center, Counseling Center and night transportation service. Information was also included which described illegal behaviors such as sexual intercourse with intoxicated individuals and other alcohol problems students may encounter during college. The Data Safety and Monitoring Board, which oversaw the PAF project data and subjects, recommended the information that was presented in the confirmation page. All students also received a $10 incentive coupon each time they completed a subsequent survey or attended a workshop as part of the intervention.

Participants completed web surveys at three occasions over two semesters. The first, or baseline assessment, was conducted immediately prior to students' arrival on campus; beginning August 15, 2006 and ending August 28th 2006. The second, or two month follow-up assessment, was conducted two months after the commencement of the academic year. The two month follow-up assessment was administered beginning on October 30th, 2006 and ending November 30th, 2006. The third, or six month follow-up assessment, was conducted six months after the commencement of the academic year. The six month follow-up assessment was administered beginning on February 24th, 2007 and ending March 23rd, 2007.

After submitting their answers online, students' responses were automatically entered into an on-line database. This automatic entry feature eliminated the need for data entry and as a result minimized the likelihood of data-entry error. Online data entry also forces participants to enter legitimate answers by only providing a certain range of valid answer options. The University of Maryland hosted an online database which placed all raw data into a Microsoft Access file. PAF research staff exported survey data from the Access database directly into SPSS files for analysis.

There were 1,276 eligible students at the baseline time assessment. Of the total number of eligible students, 623 participants completed surveys. Nineteen cases were deleted from the sample because their surveys contained no data. Another 25 cases were deleted due to incomplete survey data (i.e., surveys with less than two complete sections). Three cases were deleted due to unreliable data. Data were determined unreliable when multiple survey responses for an individual subject did not make sense. For example, some subjects answered the same response option for lists of questions nonsensically in an effort to complete the survey as soon as possible. As a result, 576 surveys were included in the baseline dataset. The response rate at baseline was 45%. Table 3-1 (on the following page) describes the study participation and loss of subjects to follow-up during each time assessment.

There were 1269 eligible participants at the time of the two month follow-up survey. During the time elapsed between baseline and 2-month follow-up assessments, some students moved out of study dorms (n=25), while others moved into study dorms (n=18). This movement created an eligible participant sample of 1269 students for the 2-month follow-up questionnaire. Of the 1,269 eligible participants, 555 students completed a survey. One subject was deleted due to a duplicate entry and three cases were deleted due to incomplete data. The final sample of 551 participants was assessed at the two month follow-up. The response rate at two month follow-up was forty-three percent.

There were 1,155 eligible participants at the time of the six month follow-up survey. One hundred and sixteen eligible participants moved out of study dorms between 2-month and 6-month follow-up time assessments, while 2 subjects moved into study

dorms. This movement created an eligible participant sample of 1155 students for the 6-month follow-up questionnaire. Of the 1,155 eligible participants, 512 students completed a survey. Two cases were deleted from the sample due to incomplete survey data and eight cases were deleted due to unreliable data. As a result, 502 surveys were assessed at the six month follow-up. The response rate at six month follow-up was forty-three percent.

Table 3-1: Study Participation and Loss to Follow Up

	Time One: Baseline	*Time Two: 2 Month Follow-up*	*Time Three: 6 Month Follow-up*
Total Eligible	1276	1269	1155
Completed Surveys Attained	623	555	512
Total Lost	47	4	10
Incomplete Survey	25	3	2
No Data	19	---	---
Duplicate Entry	---	1	---
Unreliable	3	---	8
Final Analysis Sample	576	551	502
Response Rate	45%	43%	43%

3.4 Peers as Family Web Survey

A pilot survey was created to guide the design of the final instrument used in the PAF study. Five hundred and sixty-eight students living in predominantly freshmen dormitories were recruited to complete the web based pilot survey. Two hundred and thirty-nine students completed a consent form, submitted a pilot survey and, as an incentive, received a $10 coupon from the university bookstore. The response rate for pilot survey completion was forty-two percent. The instrument was designed to take twenty minutes to complete and included the following sections: alcohol knowledge,

social context of drinking, alcohol use, protective behavioral strategies, negative consequences, self-efficacy, helping behaviors, social norms, alcohol expectancies and demographics.

Results from the pilot survey led to changes in the final instrument such as the ordering of questions, as well as elimination and/or combination of items. These changes were made with the goal of improving response rates and increasing the likelihood of receiving complete data. One specific change included formatting the web survey to prompt students to submit their responses before moving on to the next section. Skip patterns were also edited to allow students not reporting any alcohol use to skip the alcohol use questions thus shortening the time required to complete the entire survey. Minor instrument changes were made at the 6-month follow-up time assessment to adjust the survey's wording to reflect the time elapsed from the previous semester. For example, baseline and 2-month follow-up questionnaire wording regarding the alcohol use question, asked students to report consumption levels during a typical week "in the past 30 days." Conversely, the 6-month follow-up questionnaire wording for the same question asked students to report alcohol use during a typical week "since arriving back at UM for the Spring 2007 semester." The baseline version of the final instrument can be found as Appendix C.

3.5 Operationalization of Variables

The conceptual framework of this study requires the key variables of freshman alcohol use and drinking refusal self-efficacy to be clearly operationalized. Information on the specific measurement and scoring of these variables is described in this section.

3.5.1 Alcohol Use

Alcohol use served as the outcome variable in this study. Trajectories, or patterns of use identified, were based on weekly levels of alcohol use among college freshmen. The following question from the PAF survey was used to measure alcohol use at baseline and 2-month follow-up time assessments: "During a typical week in the past 30 days, how many drinks did you consume on each day of the week?" The 6-month follow-up survey used the following question to measure alcohol use: "During a typical week since arriving back at UM for the Spring 2007 semester, how many drinks did you consume on each day of the week?" Alcohol use response options remained the same for each time assessment. The question allowed subjects to select the number of drinks they may have consumed for each day of the week individually. For each day of the week, respondents selected a number of drinks consumed ranging from no drinks to 5 or more drinks. Immediately prior to this question on the survey, students were reminded what constitutes a drink. The PAF survey explains that a drink is the equivalent of the following: a 12oz. bottle or can of beer, a 5oz glass of wine or a wine cooler, or a 1.5oz shot of hard liquor such as rum, gin, vodka or whiskey, straight or in a mixed drink. Answer options to the survey question ranged from the following: 0="no drinks"; 1="1 drink"; 2="2 drinks"; 3="3 drinks"; 4="4 drinks" and 5="5 or more drinks". Individual responses for each day of the week were added and valid totals ranged from 0 to 35 drinks for each subject. A new variable was created containing this total number for each subject and represented typical weekly alcohol consumption.

3.5.2 Drinking Refusal Self-Efficacy

Drinking refusal self-efficacy (DRSE) is the primary explanatory variable in this study. The PAF survey used the following baseline question to measure this variable: "How sure are you that you could resist drinking?" Five items were used to answer this question and each item presented the subject with a different situation in which he or she could demonstrate his/her confidence to resist a drink. The five items included the following situations: "when I am out to dinner, when someone offers me a drink, when my boy/girlfriend or partner is drinking, when my friends are drinking, and when I am out at a party or club." Possible response options ranged from 1 to 6 in the following manner: 1= "I am very sure I could NOT resist drinking"; 2= "I most likely could NOT resist drinking"; 3= "I probably could NOT resist drinking"; 4= "I probably could resist drinking"; 5= "I most likely could resist drinking" and 6= "I am very sure I could resist drinking."

These response options use a 6-point Likert-type scale ranging from "I'm very sure I could NOT resist drinking" to "I'm very sure I could resist drinking." In this 6-point Likert format, respondents are not given a middle option in which they could report an undecided response. This scale format forces respondents to make a decision of likelihood for each statement. The five items asking about DRSE were used to create a summative scale measuring a freshman's ability to resist alcohol. In order to create a total scale score, responses for each of the five items were coded from 1 to 6 and added together. This created a scale with total valid scores ranging from 5 to 30. A score of 30 represented the highest possible DRSE scale score equating to students with the highest confidence to resist alcohol. Conversely, a score of 5 represented the lowest DRSE scale

score equating to students reporting the lowest possible confidence in resisting alcohol. Table 3-2 below describes the DRSE construct coding used in this study.

Table 3-2: Scale Score Coding of Drinking Refusal Self Efficacy Construct

Survey Question: How Sure are you that you could resist drinking?	Response Option	Scale Score Coding
When I am out at dinner	I am very sure I could NOT resist drinking	1
	I most likely could NOT resist drinking	2
	I probably could NOT resist drinking	3
	I probably could resist drinking	4
	I most likely could resist drinking	5
	I am very sure I could resist drinking	6
When someone offers me a drink	I am very sure I could NOT resist drinking	1
	I most likely could NOT resist drinking	2
	I probably could NOT resist drinking	3
	I probably could resist drinking	4
	I most likely could resist drinking	5
	I am very sure I could resist drinking	6
When my boy/girlfriend or partner is drinking	I am very sure I could NOT resist drinking	1
	I most likely could NOT resist drinking	2
	I probably could NOT resist drinking	3
	I probably could resist drinking	4
	I most likely could resist drinking	5
	I am very sure I could resist drinking	6
When my friends are drinking	I am very sure I could NOT resist drinking	1
	I most likely could NOT resist drinking	2
	I probably could NOT resist drinking	3
	I probably could resist drinking	4
	I most likely could resist drinking	5
	I am very sure I could resist drinking	6
When I am out at a party or club	I am very sure I could NOT resist drinking	1
	I most likely could NOT resist drinking	2
	I probably could NOT resist drinking	3
	I probably could resist drinking	4
	I most likely could resist drinking	5
	I am very sure I could resist drinking	6

*Summative Scale Scores range form 5 to 30

Inter-item consistency reliability was examined using Cronbach's α. A low Cronbach α score would suggest this set of items is not reliable and one or more items may need to be eliminated from the scale. Inter-item consistency reliability results for the DRSE scale are presented in Chapter 4 of this document.

Questions used to asses drinking refusal self-efficacy were taken from the Drinking Refusal Self-Efficacy Questionnaire (DRSEQ) originally developed by Young

et al (1991). Since it was first developed, the DRSEQ has been used in investigating the association between drinking refusal self-efficacy and drinking behavior. The DRSEQ measures three factors including social pressure self-efficacy, opportunistic self-efficacy and emotional relief self-efficacy with adequate reliability. Upon its development, reliability was established in a sample of 251 university students. Test-retest reliability (r = .84-.93) and internal consistency (α = .87-.94) indicated that the three factors were reliably assessing the constructs (Young et al., 1991).

The Drinking Refusal Self-Efficacy Questionnaire—Revised Adolescent Version (DRSEQ-RA) represents the most recent variation of the DRSEQ instrument. Details of its development are explained in the literature section of this document (pages 34-36). The five scale items used in the PAF study and consequently the current study, to measure DRSE, were taken from the social pressures factor scale within the DRSEQ-RA. The social pressures scale was selected by PAF researchers primarily due to its highly applicable relationship to university freshmen and overall research goals. Items in this portion of the instrument were most closely aligned with common environments of college students such as partying, eating and hanging out with friends. This particular factor relates the magnitude of common social pressures experienced in the collegiate environment to a student's ability to resist alcohol. Also, the DRSEQ-RA scale items included in the PAF web survey were part of a much larger PAF instrument. Keeping the PAF web survey as short as possible without compromising research goals was also a concern of PAF investigators, thereby serving as another reason to focus solely on the social pressures aspect of the DRSEQ-RA.

The wording of one question from the DRSEQ-RA social pressures scale was slightly adjusted for use in the PAF study. The original statement of "when I am at a nightclub or concert" was adjusted to "when I am at a party or club." This wording adjustment resulted in a question more applicable to students in a university setting.

3.6 Statistical Analysis

Semi-parametric group-based modeling (or latent class growth analysis) is a relatively new statistical technique that was chosen for this study to analyze longitudinal alcohol patterns among college freshmen. The terms group-based modeling and latent class growth analysis will be used interchangeably in this study. The remainder of this section includes a discussion of the following: a rationale for modeling strategy selection, a conceptual description of group based modeling, advantages of group based modeling, a statistical strategy for choosing the appropriate number of groups in the final model, preliminary analyses conducted, and a detailed analysis plan applied to the research questions examined.

3.6.1 Rationale for Model Selection

Unfortunately, there is no single statistical procedure for analyzing longitudinal data. The choice of a statistical procedure depends on the nature of the phenomenon under investigation and the research questions of the analysis. Strategies for analyzing longitudinal data can be thought of in two broad categories entitled variable-centered and person-centered analyses (Muthen & Muthen, 2000). The most common strategies for studying stability and change in substance use have taken a variable-centered approach

(Schulenberg et al., 1996). This approach focuses on the relationships among variables and utilizes statistical methods such as regression analysis, factor analysis, and structural equation modeling. The goal of variable-centered methods is to predict outcomes, relate independent and dependent variables, and study how constructs influence their indicators (Muthen & Muthen, 2000). As powerful and widely used as they are, variable-centered approaches are not necessarily the best way to study longitudinal data (Schulenburg et al., 1996). Because this approach focuses on average change and does not attend to individual patterns, it may poorly portray intra-individual change. Intra–individual change refers to each subject's individual change and does not involve change relative to a large group.

However, a broad class of newly developed statistical techniques that are better suited to study individual differences in development and change has become recently available (Xie et. al., 2006). These recently developed methods are often referred to as random coefficient models and take a person-centered statistical approach. The goal of person-centered analysis is to group individuals into categories that contain subjects who are relatively similar to each other and relatively dissimilar from subjects in other categories. Many alcohol research questions require methods that take a person-centered approach (Muthen & Muthen, 2000). This approach focuses on relationships among individuals and includes such methods as finite mixture analysis and latent class growth analysis. A person-centered focus is extremely useful in alcohol research because data often include heterogeneous groups of subjects and such an approach allows for the representation of heterogeneity in growth trajectories (Muthen & Muthen, 2000).

According to Nagin (2005), plotting and understanding trajectories are among the most fundamental and important research topics in the social and behavioral sciences. Longitudinal data are data with a time based dimension and provide the foundation for the analysis of developmental trajectories. Traditional approaches to longitudinal analysis do not provide a means of identifying and/or analyzing distinctive trajectories. This inability has led researchers to resort to using a blend of analyses that is subjective and filled with statistical dangers. The most common risks involve the creation of groups that reflect only random variation and fail to identify developmental patterns. Group based modeling provides an alternative approach based on a formal statistical model, used for analyzing processes that evolve over time.

Conventional group based modeling methodology was first proposed by Rao (1958) and Tucker (1958) and later extended and refined by Meredith and Tisak (1990) as well as other statisticians (McArdle & Epstein, 1987; Muthen, 1994). Historically, these methods can be traced to the fields of biostatistics, education, and psychometrics. During the 1980s, major advances were made in methods for analyzing individual level developmental trajectories (Ellickson et al., 2005). The social sciences articulated the two main branches of this methodology as being hierarchical linear modeling and structural equation modeling of growth curves (Nagin, 1999). These advanced methods allowed researchers to move beyond ad hoc categorization procedures for creating growth trajectories. However, these methods were still variable-centered and not ideally suited for testing theories that suggest the existence of different developmental pathways or subpopulations. Starting in the early 1990s, a group-based approach for longitudinal data emerged and person-centered, random coefficient models became the focus of

longitudinal data analysis. Nagin and colleagues developed an approach termed "semi-parametric group-based modeling of development," or "latent class growth analysis (LCGA)" (Xie et. al., 2006).

For several reasons, a group-based modeling strategy is appropriate for use in this study. First, the research questions in this study take a person-centered approach in that they focus on the relationship among individuals (alcohol patterns of college freshmen). The goals of this study and person-centered analyses are equivalent. They both aim to identify clusters of subjects who are similar to each other and different from subjects in other categories.

A second reason the group-based modeling strategy is an ideal approach for use in this study resides in its ability to examine heterogeneity. A brief description of this important feature follows below. An important issue in substance use research is the consideration of population heterogeneity with regard to different developmental trajectories (Ellickson et al., 2005). During the 1990s, research on growth curve modeling of alcohol use routinely applied conventional latent variable growth modeling techniques. Although useful in estimating trajectories and accounting for individual differences in growth processes, conventional modeling has several limitations, as noted by Duncan and colleagues (2002). For example, conventional modeling assumes that a single population can account for all types of individual differences and risk factors have the same influence on the growth factors for all individual trajectories in the population. These assumptions have been found to be unrealistic in research studying adolescent alcohol use problems. Further, if heterogeneity is ignored, statistical analyses and their effects can be seriously biased (Lubke & Muthen, 2005).

Population heterogeneity can be observed or unobserved. Heterogeneity is observed if it is possible to define subpopulations based on an observed variable. For example, it is known that gender commonly introduces heterogeneity in health behaviors, and one can define two subpopulations (i.e. males and females) based on the observed variable gender. When dealing with observed heterogeneity, subpopulations are called groups and group membership is known for each participant. However, unobserved heterogeneity differs in that group membership is not known prior to analyzing the data. In this case, subpopulation membership of participants has to be inferred from the data. When dealing with unobserved heterogeneity, the subpopulations are called latent classes because subpopulation membership is not observed but latent (Lubke & Muthen, 2005).

The group-based modeling strategy takes into account unobserved heterogeneity in the population and assumes the population is composed of a mixture of distinct (heterogeneous) groups defined by their trajectories. In addition, because public health literature routinely finds adolescent alcohol study populations heterogeneous in nature, group based modeling is an appropriate statistical choice for this study. This form of modeling provides a flexible and robust means of analyzing longitudinal adolescent alcohol data.

3.6.2 Conceptual Description of the Group-Based Modeling Approach

Group based trajectory models are a specialized application of finite mixture models whose premise is that patterns of repeated measures reflect a finite number of trajectory types, each of which corresponds to an unobserved or latent class in the population (Bauer & Curran, 2003). The term “finite mixture” refers to the modeling

assumption that the population comprises a mixture of a finite number of unobserved groups. The conceptual aim of group based models is to provide a flexible and easily applied approach for identifying clusters of individuals with similar trajectories. The group based approach uses mixtures of probability distributions to identify groups of relatively homogenous clusters of trajectories within the population. The approach assumes that the population is composed of a mixture of distinct (or heterogeneous) groups defined by their trajectories. The object of the analysis is to determine if subgroups (or latent classes) exist within the population and if so, that they display distinct growth curves.

The underlying rationale of the group based modeling strategy is rooted in psychology. The field of psychology has a long tradition of group-based theorizing about development, including theories of personality, substance use, learning and other health behaviors (Nagin, 2005). Therefore, this group based approach is well suited to analyze questions about trajectories that are categorical in nature such as the following: "Do certain types of people tend to have distinctive developmental trajectories?" That general question translates to the following when specified to this study: "Do college freshmen tend to have different patterns of alcohol use during their first-year in college?" In sum, the group based modeling strategy can test whether the trajectories predicted by theories are actually present in the population. It can also test key predictions such as whether a specific pattern of alcohol use is characterized by an initial level of behavior such as drinking refusal self-efficacy.

A basic group based model is made up of two latent factors, termed the intercept and slope. This intercept represents the initial status of the growth trajectory at the first

time assessment. The intercept value is conventionally fixed at the constant value of one across time points. As a result, the intercept is commonly called the constant by statisticians and represents the construct being measured if there were no growth. The second latent factor, termed the slope captures the growth rate over time.

3.6.3 Advantages of Group-Based Modeling

One advantage to using a group-based modeling approach lies in its ability to address questions that standard growth modeling will not. For example, standard modeling measures change in the form of a common longitudinal pattern, either an increase or a decrease in the entire population. In doing this, individual members of the population are assumed to follow a common pattern. However, this is not a practical assumption because there are large classes of longitudinal phenomena for which common growth processes do not fit. Adolescent alcohol consumption has been proven to reveal heterogeneous populations in which some are frequent drinkers, some drink very little, and others may gradually increase their consumption rates. For phenomena like these, in which the population is heterogeneous, group based modeling is an appropriate application.

Another advantage of this modeling strategy is its ability to allow for the simultaneous examination of the influences of risk factors on the subpopulations. Conventional modeling techniques assume that the influence of outside explanatory variables is equal among all growth trajectories. This assumption is not always realistic and as a result may lead to inappropriate conclusions regarding longitudinal studies. Group based modeling can estimate class membership probability as a function of a set of

risk factors which adds to its statistical power and ability to provide more information regarding what influences group membership. One goal of this proposal is to examine the influence of drinking refusal self-efficacy on alcohol use patterns of college freshmen. The group based modeling strategy will allow for exploration of this relationship.

3.6.4 Statistical Strategy for Choosing the Appropriate Number of Groups

The problem of how many groups to include in a finite mixture model are among the most challenging in statistics (Nagin, 2005). There is a combination of statistical criteria and subjective judgment that is required for making a well-founded decision on the number of groups to include in the final model (Nagin 2005). This plan of selection is usually decided at the outset of analysis and because these decisions greatly affect the outcomes of longitudinal studies, Nagin (2005) suggests they deserve close attention.

One widely recommended option is the Bayesian Information Criterion (BIC). Kass and Raftery (1995) suggest the BIC can be used to select the number of groups in a mixture model. Other researchers, including D'Unger and colleagues (1998) and Nagin (1999), also use the BIC as a basis for selecting the optimal model. The BIC is always negative, so the maximum BIC will be the least negative value. Researchers recommend selecting the model with the maximum BIC value (Kass & Raftery, 1995; Nagin, 2005). Two other commonly used alternatives are the Akaike Information Criterion (AIC) and the Integrated Classification Likelihood-BIC (ICL-BIC) (Nagin, 2005). The AIC is similar to BIC but does not vary with sample size. Nagin (2005) found the AIC as being more vulnerable to selecting a model that includes a misleading group. Nagin (2005)

also found the ICL-BIC to perform poorly, by always selecting a smaller number of groups than necessary.

Nagin suggests one possible methodology to select the optimal number of groups is to exhaustively search all the possibilities. This strategy is impossible to implement because theoretically the upper limit on the number of groups to test is the number of individuals in the sample. Fortunately, a more limited but practical approach to constructing a model choice procedure is available. This strategy, favored by Nagin, begins by placing a limit on the number of possible groups and exploring all model possibilities within that limitation on the number of groups. This plan involves two stages. The first stage consists of multiple steps that involve estimating the model for one group and then consecutively adding a group up to a preset maximum number of groups. The number of groups in the final model selected should contain the highest BIC score. The second stage in this approach involves determining the optimal shape of the trajectories given the first-stage decision on the optimal number of groups. In this stage the exploration of optimal linear and/or quadratic growth curves are performed. The BIC value and the two-stage approach to determining the model that best fits the data were used in this study.

3.6.5 Preliminary Analyses

In order to reveal basic associations among variables including potential confounders and provide a general description of variables used in this study, the following preliminary analyses were conducted:

1) Frequency data of all variables used in this study to describe the sample were conducted at the baseline time assessment. These variables included: gender, race, age, special group learning status, study condition, weekly alcohol use and DRSE.
2) Means and standard deviations were conducted at all time assessments for weekly alcohol use and at baseline for drinking refusal self-efficacy.
3) Missing outcome data (i.e., weekly alcohol use) was described at each time assessment.
4) Weekly alcohol use rates were compared between the current study's respondents and those of a general population of college freshmen to assess external validity. Publicly available college alcohol use statistics, taken from the CORE Alcohol and Drug Survey, were used for this comparison. The CORE Alcohol and Drug Survey is a national, web survey created to assess the nature, scope and consequences of alcohol and other drug use on college campuses (Presley & Meilman, 1994). This instrument is discussed further in the results chapter of this document.
5) Reliability analysis was conducted on the DRSE scale used in this study.
    a. Reliability of the DRSE scale was measured using internal consistency which measures how consistently individuals respond to items within a scale. Cronbach alpha is the most common estimate of internal consistency and was estimated using SPSS at the baseline time assessment.

3.6.6 Statistical Analysis Plan to Address Research Questions

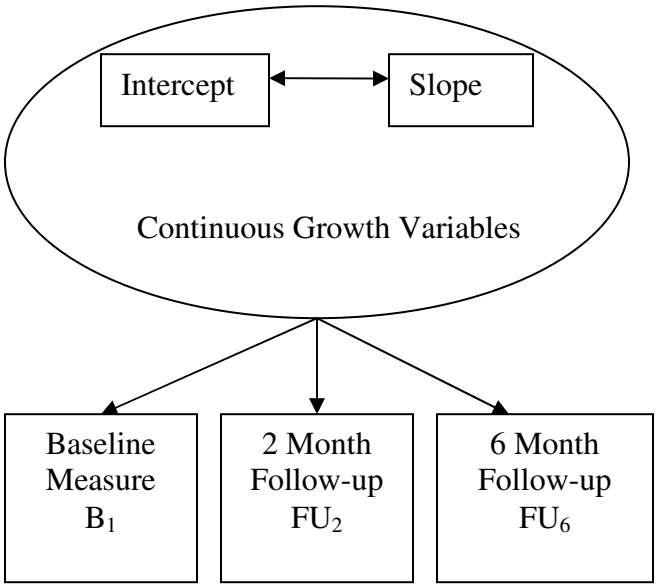
It is common when analyzing longitudinal data and using growth analysis techniques to employ a step by step methodology of statistical analysis. First, unconditional modeling was completed and followed by conditional modeling techniques. Unconditional analyses focus on the population under investigation without allowing for the influence of outside variables to affect the model. Conversely, conditional analysis takes into account influences from risk factors or predictor variables by including them in the model. Conditional models are designed to explain variability in the population by relating trajectory parameters to one or more explanatory variables.

In order to address this study's research questions, statistical analyses were conducted in five progressive steps using group based modeling. The purpose of this analysis plan was to ultimately secure the best fitting statistical model to explain the nature of the data. Each step of the following statistical analysis corresponds to a separate latent growth model found in Figures 3-2 through 3-6.

Step #1:

Conduct conventional modeling to estimate the average growth curve of the population. This step revealed one curve representing the average pattern of alcohol use among college freshmen. Using SAS PROC TRAJ, weekly alcohol use at all three time assessments was used to determine the shape of the average trajectory. The results of this model are presented in the following chapter.

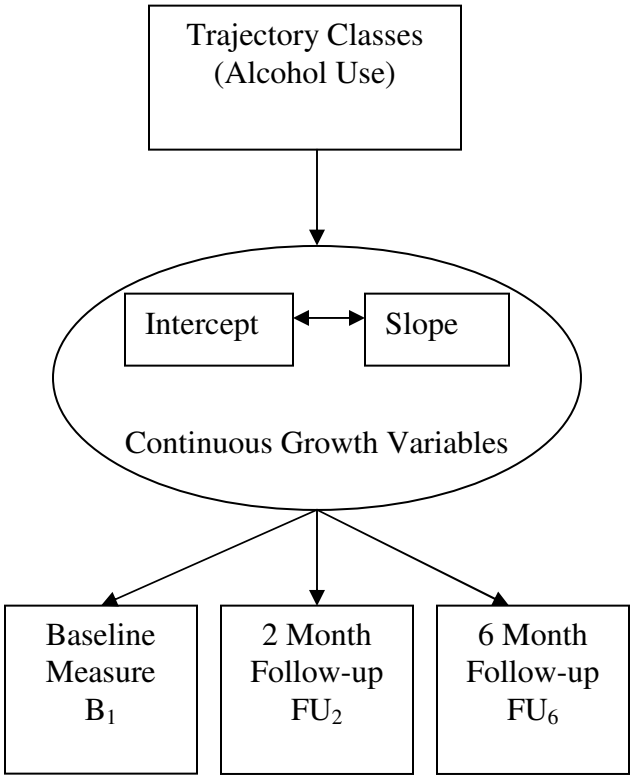
Figure 3-2: Conventional Growth Model Estimating the Average Pattern of Alcohol Use Among College Freshmen



Step #2:

Conduct latent growth analysis to estimate the drinking trajectories of the entire population. This step revealed categorical patterns of alcohol use among college freshmen without any outside influences, or risk factors, affecting the model. LCGA was used to determine the appropriate number of trajectory groups that best fit the data. The results of this model are presented in the following chapter.

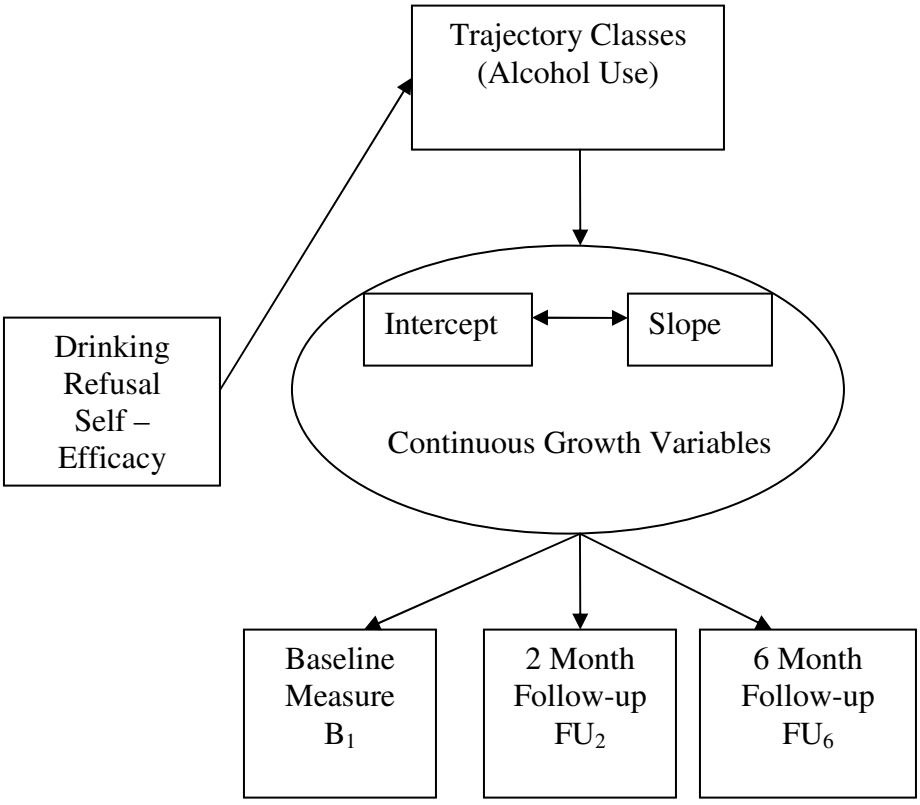
Figure 3-3: Latent Growth Analysis Estimating Alcohol Use Trajectories Among College Freshmen



Step #3:

Add drinking refusal self-efficacy to the model. This step revealed different patterns or trajectories of use among the population relative to initial levels of drinking refusal self-efficacy. LCGA was used to determine the likelihood of initial DRSE levels on subjects' likelihood of belonging to trajectory groups that best fit the data. The results of this model are presented in the following chapter.

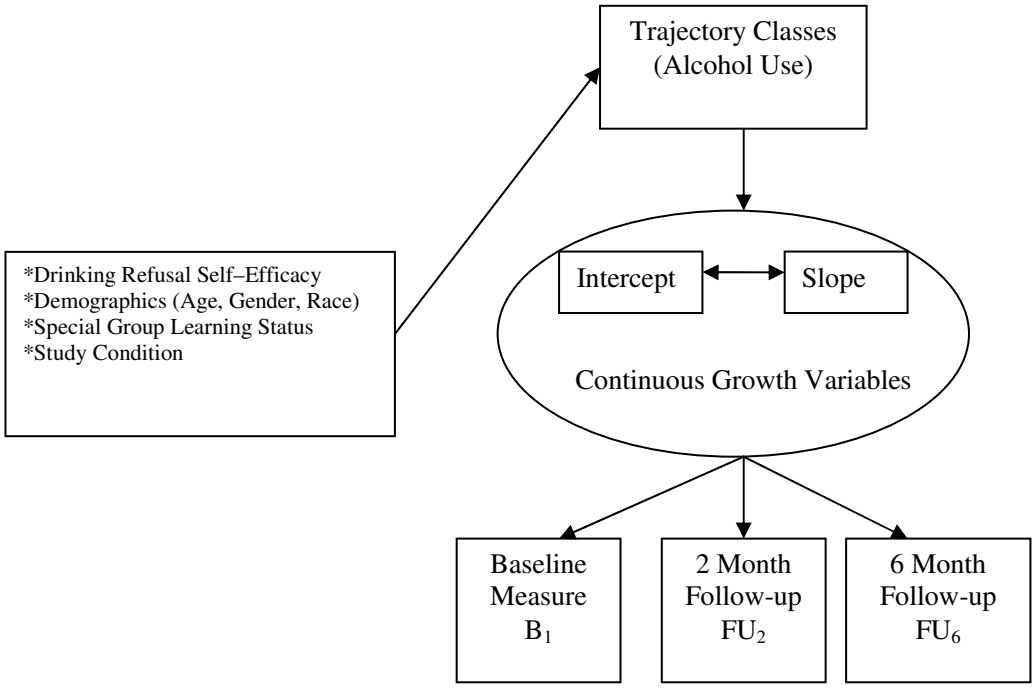
Figure 3-4: Latent Growth Analysis Estimating the Influence of Drinking Refusal Self-efficacy on Alcohol Use Trajectories Among College Freshmen



Step #4:

Add all possible confounding factors to the model. This step revealed different patterns or trajectories of use among the population relative to potential confounders. LCGA was used to determine the likelihood of initial DRSE levels and all possible confounding factors on subjects' likelihood of belonging to trajectory groups that best fit the data. The results of this model are presented in the following chapter.

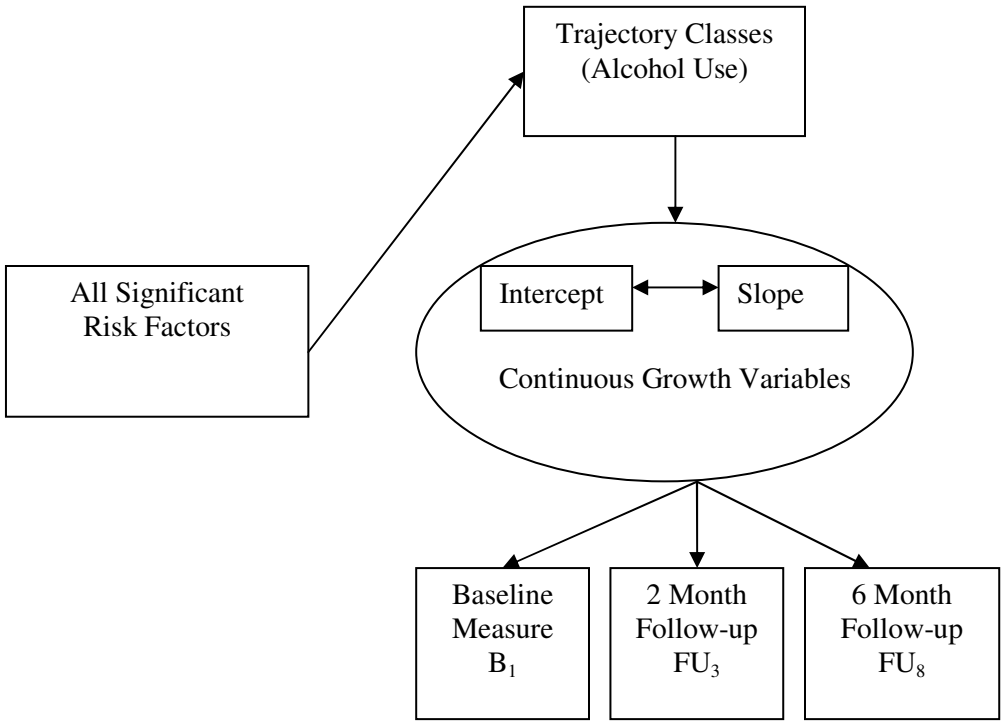
Figure 3-5: Latent Growth Analysis Estimating the Influence of Drinking Refusal Self-efficacy and Potential Confounding Factors on Alcohol Use Trajectories Among College Freshmen



Step #5:

Eliminate all confounding factors that do not significantly influence the model. This step revealed drinking trajectories of the population and all factors that significantly influenced subpopulation membership. The results of this model are presented in the following chapter.

Figure 3-6: Latent Growth Analysis Estimating Significant Influences on Alcohol Use Trajectories Among College Freshmen



CHAPTER 4: RESULTS

4.1 Introduction

The following chapter presents the results of all statistical analyses conducted for this study. First, a description of study samples will be presented, followed by descriptions of all main study variables. Next, unconditional and conditional growth trajectory models will be described. Finally, trajectory analysis results will be applied to study hypotheses.

4.2 Sample Selection and Description

The total eligible sample (N = 1294) consisted of all college students who lived on study dormitory wings that were monitored over the period of the study. Within the total eligible sample, three distinct sub-samples were analyzed for all growth models evaluated in this study. Table 4-1 (on page 77) describes each study sample analyzed and its respective demographic characteristics. Further, the sub-samples described below and in Table 4-1 are not mutually exclusive.

The first sub-sample (N = 831) was made up of respondents who answered one or more surveys and completed the alcohol use question. This first sample is referred to as the "unconditional respondent" sample in the context of this study. This sample contained complete baseline data on risk factor variables including gender, race, age, study condition and living learning status.

Table 4-1: Baseline Unconditional Respondent Sample, Conditional Respondent Sample, and Repeater Sample Demographics

	Total Eligible Sample *N*=1294 *N*(%)	Unconditional Respondent Sample *N*=831 *N*(%)	Conditional Respondent Sample *N*=561 *N*(%)	Repeater Sample *N*=288 *N*(%)
Gender				
Female	644 (49.8)	452 (54.4)	321 (57.2)	177 (61.5)
Male	650 (50.2)	379 (45.6)	240 (42.8)	111 (38.5)
Age				
17	327 (25.3)	212 (25.5)	154 (27.5)	64 (22.2)
18	859 (66.4)	556 (67.0)	374 (66.7)	207 (71.9)
19+	108 (8.3)	63 (7.6)	33 (5.9)	17 (5.9)
Race				
Black	209 (16.1)	108 (13.0)	73 (13.0)	21 (7.3)
White	741 (57.3)	488 (58.7)	336 (59.9)	177 (61.5)
Hispanic	91 (7.0)	56 (6.7)	39 (7.0)	18 (6.3)
Asian	168 (13.0)	119 (14.3)	75 (13.4)	48 (16.7)
Mixed/Other	85 (6.6)	60 (7.2)	38 (6.8)	24 (8.3)
Special Group Learning Status				
Living Learning	605 (46.8)	443 (53.3)	308 (54.9)	190(66.0)
Non-Living Learning	689 (53.2)	388 (46.7)	253 (45.1)	98(34.0)
Study Condition				
Single Gender Intervention Group	452 (34.9)	285 (34.3)	199 (35.5)	105 (36.5)
Mixed Gender Intervention Group	414 (32.0)	267 (32.1)	177 (31.6)	86 (29.9)
Control Group	428 (33.1))	279 (33.6)	185 (33.0)	97(33.7)

When compared to the total eligible sample, the unconditional respondent sub-sample contained a higher percentage of females and students residing in living learning communities. Specifically, 54.4% of the unconditional respondent sample was female, while 49.8% of the total eligible sample was female. Similarly, 53.3% of the unconditional respondent sample was enrolled in the living learning program, compared to 46.8% of the total eligible population. Racially, Blacks made up a smaller percentage of the unconditional respondent sample (13.0%), than the total eligible population

(16.1%). There were no major differences identified among age and study condition between the two samples.

The second sub-sample ($N = 561$) consisted of all participants who answered one or more surveys, completed the alcohol use question and also completed the DRSE scale items at the baseline time assessment. This sample is referred to as the "conditional respondent" sample and contained complete baseline data on risk factor variables including gender, race, age, study condition and living learning status.

When compared to the total eligible sample, the conditional respondent sample, like the unconditional respondent sample, contained a higher percentage of females and students enrolled in the living learning program. Specifically, 57.2% of the conditional respondent sample was female, compared to 49.8% of the total eligible population. Also, 54.9% of the conditional respondent sample resided in living learning communities, compared to 46.8% of the total eligible population. Finally, Blacks made up a smaller percentage of the conditional respondent sample (13.0%) than the total eligible sample (16.0%).

The third sub-sample consisted of participants who completed surveys at all three time assessments ($N = 288$) and is referred to as the "repeater" sample in the context of this study. This sample contained complete baseline data on all risk factor variables under investigation including DRSE, gender, age, race, study condition and living learning status. The repeater sample was analyzed separately because it represented a complete longitudinal data set with no missing data. Although this sample did not contain missing data, it may have provided the least generalizable results because most

longitudinal datasets contain considerable amounts of missing data (Twisk et al., 2002; Schafer, 2002; Brown, 1990). This issue is explored further in the following chapter.

When compared to the total eligible population, the repeater sample, like both respondent samples (unconditional and conditional), also contained higher percentages of females and students enrolled in the living learning program. Sixty-one percent of the repeater sample was female, compared to 49.8% of the total eligible population. Further, 66% of repeaters resided in living learning communities compared to 46.8% of the total eligible sample. Among race, Blacks made up a noticeably smaller percentage of repeaters (7.3%) than the total eligible sample (16.1%).

4.3 Main Study Variables

4.3.1 Alcohol Use

Tables 4-2, 4-3, and 4-4 describe the number of drinks per week and the average weekly alcohol use (with standard deviation), at each time assessment, for each sub-sample analyzed in this study. (A detailed description of the survey question used to measure alcohol use can be found on page 56 in Chapter Three). Average weekly alcohol consumption was nearly identical at each time assessment for the unconditional and conditional respondent samples. The unconditional respondent sample reported 2.4 drinks per week at baseline; 4.6 drinks per week at 2-month follow-up; and 3.9 drinks per week at 6-month follow-up. The conditional respondent sample reported 2.4 drinks per week at baseline; 4.5 drinks per week at 2-month follow-up; and 3.9 drinks per week at 6-month follow-up. A similar trend occurred in the repeater sample; however, baseline average alcohol consumption was much lower (i.e., 1.8 drinks per week at baseline; 4.0

drinks per week at two-month follow-up; and 3.9 drinks per week at 6-month follow-up). It is also worth noting that the 6-month average weekly alcohol use was the same for all three samples under investigation (3.9 drinks per week). Average weekly alcohol use over time for all sub-samples is also displayed graphically in Figure 4-1 (on page 81).

Table 4-2

Unconditional Respondent Sample
Alcohol Use Across Time Assessments
N=831

Number of Drinks per Week	Baseline *N*=576 *N*(%)	Mean(SD)	2 Month Follow-up *N*=551 *N*(%)	Mean(SD)	6 Month Follow-up *N*=502 *N*(%)	Mean(SD)
0	372 (64.5)	2.4(4.7)	251 (45.5)	4.6(6.1)	250 (49.8)	3.9(5.3)
1-5	110 (19.0)		116 (21.0)		100 (19.9)	
6-10	59 (10.2)		89 (16.1)		88 (17.5)	
11-20	30 (5.2)		86 (15.6)		60 (11.9)	
21-29	2 (0.3)		6 (1.0)		3 (0.5)	
30-35	3 (0.5)		3 (0.5)		1 (0.1)	

Table 4-3

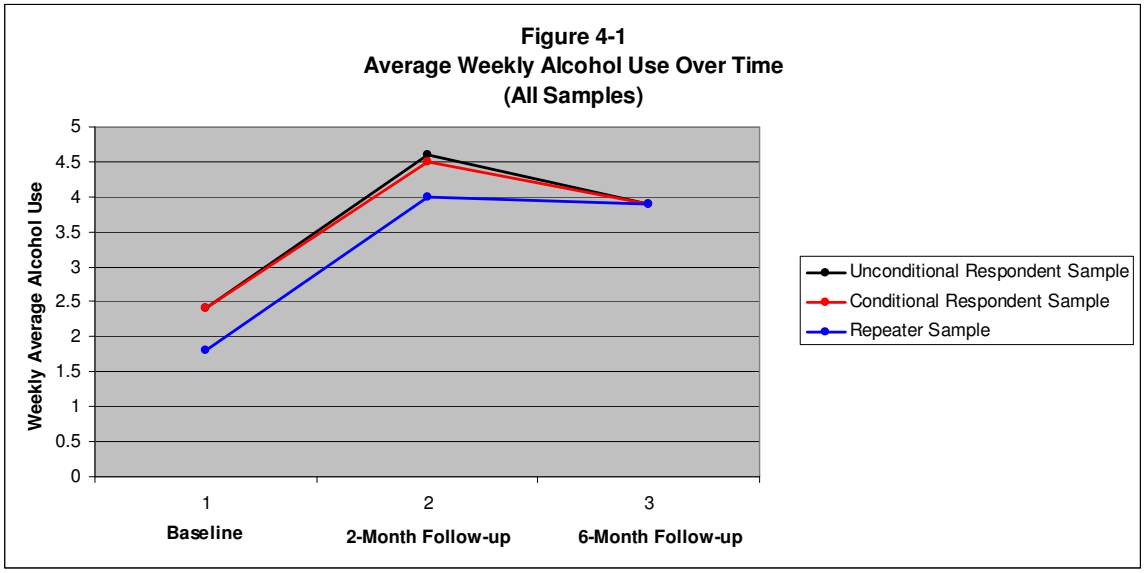
Conditional Respondent Sample
Alcohol Use Across Time Assessments
N=561

Number of Drinks per Week	Baseline *N*=556 *N*(%)	Mean(SD)	2 Month Follow-up *N*=365 *N*(%)	Mean(SD)	6 Month Follow-up *N*=323 *N*(%)	Mean(SD)
0	359 (64.6)	2.4(4.7)	167 (45.6)	4.5 (6.1)	158 (48.9)	3.9 (5.4)
1-5	107 (19.2)		84 (23.0)		64 (19.8)	
6-10	57 (10.3)		51 (14.0)		65 (20.1)	
11-20	28 (5.0)		58 (15.9)		32 (9.9)	
21-29	2 (0.4)		3 (0.8)		3 (0.9)	
30-35	3 (0.5)		2 (0.5)		1 (0.3)	

Table 4-4

Repeater Sample
Alcohol Use Across Time Assessments
N=288

Number of Drinks per Week	Baseline		2 Month Follow-up		6 Month Follow-up	
	N=288 *N*(%)	Mean(SD)	*N*=288 *N*(%)	Mean(SD)	*N*=288 *N*(%)	Mean(SD)
0	195 (67.7)	1.8(3.6)	138 (47.9)	4.0(5.6)	142 (49.3)	3.9(5.3)
1-5	59 (20.4)		66 (22.9)		54 (18.7)	
6-10	23 (7.9)		40 (13.8)		57 (19.7)	
11-20	10 (3.4)		42 (14.5)		32 (11.1)	
21-29	1 (0.3)		1 (0.3)		2 (0.6)	
30-35	0 (0.0)		1 (0.3)		1 (0.3)	



Weekly alcohol use rates were also compared between the current study's respondents and those of a general population of college freshmen in an effort to assess the generalizability of results found in this study. Data was taken from the CORE Alcohol and Drug Survey to make this comparison. Beginning in 1990, the Core Alcohol and Drug Survey was created to assess the nature, scope and consequences of alcohol and

other drug use on college campuses (Presley & Meilman, 1994). Using data from the CORE Alcohol and Drug Survey collected in 2005, a sample of 33,379 undergraduate students across 53 colleges in the U.S. participated. All participating institutions used methods to insure a random and representative sample of their respective student bodies. Results revealed freshmen drinking an average of 5.7 drinks per week (www.siu.edu/departments/coreinst/ public_html). The current study, conducted on University of Maryland students, revealed freshmen drinking an average of 3.6 drinks per week in the unconditional respondent sample; 3.6 drinks per week in the conditional respondent sample; and 3.2 drinks per week in the repeater sample. Further, the highest weekly average alcohol consumption for the current study (i.e., 4.6 drinks per week at 2 month follow-up; unconditional respondent sample), was still lower than the CORE survey weekly average alcohol use (i.e., 5.7 drinks per week). Overall, this comparison revealed the current study's respondents drank less alcohol per week than the CORE survey respondents.

Tables 4-5 and 4-6 (on pages 83 and 85) describe missing data associated with the alcohol use variable for the unconditional and conditional respondent samples respectively. The repeater sample did not contain missing alcohol use data and was therefore not included in this section. In addition, Tables 4-5a and 4-6a (on pages 84 and 85) describe repeat alcohol cases associated with the alcohol use variable for the unconditional and conditional respondent samples respectively.

As illustrated in Table 4-5, the frequency of missing cases slightly increased at each time assessment for the unconditional respondent sample and ranged from 30.7% at baseline to 39.6% at 6-month follow-up. On average, 34.6% of the unconditional

respondent sample did not complete the alcohol use question on at least one occasion during the course of the study.

When assessing repeat responders to the alcohol use question over the three survey administrations, in the unconditional respondent sample, Table 4-5a shows students were most likely to respond at 2-month and 6-month follow-up time points (46.3%). Approximately 44.9% of respondents completed the alcohol use question at baseline and 2-month follow-up, and 39.5% of respondents completed the alcohol use question at baseline and 6-month follow-up. Repeaters, (i.e., students who completed all three surveys and answered the alcohol use question) made up 34.7% of the unconditional respondent sample.

Table 4-5

Unconditional Respondent Sample
Missing Alcohol Consumption Cases Description
(*N*=831)

	Did not complete alcohol use question
	n (%)
Baseline	255 (30.7)
2-Month Follow-up	280 (33.7)
6-Month Follow-up	329 (39.6)

Table 4-5a

Unconditional Respondent Sample Repeat Alcohol Consumption Cases Description (*N*=831)	
	Completed alcohol use question
	n (%)
Baseline and 2-Month Follow-up	373 (44.9)
Baseline and 6-Month Follow-up	328 (39.5)
2-month and 6-Month Follow-up	385 (46.3)
Baseline, 2-Month and 6-Month Follow-ups	288 (34.7)

As illustrated in Table 4-6, the conditional respondent sample contained nearly complete alcohol use data at the baseline time assessment (i.e., 99.1% of respondents completed the alcohol use question); however, the frequency of missing cases increased at the 2-month and 6-month follow-up time assessments. On average, 26.0% of the conditional respondent sample did not complete the alcohol use question on at least one occasion during the course of the study.

Table 4-6a displays repeat alcohol use cases in the conditional respondent sample and indicates that 64.2% of the sample completed the alcohol use question at baseline and 2-month follow-up time points. At subsequent time assessments this percentage slightly decreased, with 56.9% of respondents completing the alcohol use question at baseline and 6-month follow-up, and 51.3% completing at 2-month and 6-month follow-up.

Table 4-6

Conditional Respondent Sample Missing Alcohol Consumption Cases Description (*N*=561)	
	Did not complete alcohol use question
	n (%)
Baseline	5 (0.8)
2-Month Follow-up	196 (34.9)
6-Month Follow-up	238 (42.4)

Table 4-6a

Conditional Respondent Sample Repeat Alcohol Consumption Cases Description (*N*=561)	
	Completed alcohol use question
	n (%)
Baseline and 2-Month Follow-up	360 (64.2)
Baseline and 6-Month Follow-up	319 (56.9)
2-month and 6-Month Follow-up	283 (50.4)
Baseline, 2-Month and 6-Month Follow-ups	288 (51.3)

In an effort to examine the characteristics of those who did not provide alcohol use data, Table 4-7 (on the following page) describes demographic comparisons between subjects who completed the alcohol use question at baseline and subjects who did not complete the alcohol use question at baseline. There were significant differences found between the two samples among age, gender and race. The majority of subjects were 18

years of age; however, non-respondents were more likely to be 19 years of age than respondents. Males made up over half of those who did not complete the alcohol use question (51.8%), whereas females made up over half of the sample that did complete the alcohol use question (57.1%). Over half of participants in each sample were Caucasian; however, non-respondents were more likely to be African American, Asian or of mixed and/or 'other' decent. There were no differences between respondents and non-respondents on special group learning status or study condition.

Table 4-7: Baseline Unconditional Respondent Sample Missing Cases Comparison For Weekly Alcohol Consumption

	Total Sample *N*=831 *N*(%)	Missing Cases *N*=255 *N*(%)	Complete Cases *N*=576 *N*(%)	*p* Value[1]
Gender				
Female	452 (54.4)	123 (48.2)	329(57.1)	$p < 0.011$
Male	379 (45.6)	132 (51.8)	247(42.9)	
Age				
17	212 (25.5)	56 (22.0)	156(27.0)	
18	556 (67.0)	170 (66.7)	386(67.0)	$p < 0.000$
19+	63 (7.6)	29 (11.4)	34(5.9)	
Race				
Black	108 (13.0)	34 (13.3)	74(12.8)	
White	488 (58.7)	143 (56.1)	345(59.9)	
Hispanic	56 (6.7)	16 (6.3)	40(6.9)	$p < 0.000$
Asian	119 (14.3)	41 (16.1)	78(13.5)	
Mixed/Other	60 (7.2)	21 (8.2)	39(6.8)	
Special Group Learning Status				
Living Learning	443 (53.3)	127 (49.8)	316 (54.9)	
Non-Living Learning	388 (46.7)	128 (50.2)	260 (45.1)	$p < 0.56$
Study Condition				
Single Gender Intervention Group	285 (34.3)	78 (30.6)	207 (34.0)	
Mixed Gender Intervention Group	267 (32.1)	87 (34.1)	180 (31.3)	$p < .185$
Control Group	279 (33.6)	90 (35.3)	189 (32.3)	

[1] Tests of significance were calculated for differences between non-respondents (n=255) and respondents (n=576) using the Chi Square statistic.

The significant findings in Table 4-7 indicate missing data is not a random phenomenon regarding gender, age, and race in this study. PROC TRAJ assumes that missing data are missing completely at random (MCAR), and adjusts growth models such that missing observations do not contribute to the sample size or analytical outcome. Under MCAR, a missing observation does not depend on observed or unobserved measurements. For example in the context of this study, the likelihood of participants providing alcohol use data is the same for everyone regardless of their alcohol use and other demographic variables. MCAR is considered a safe and conservative approach and is the default solution in many statistical packages (Little & Rubin, 2002).

Specifically, the PROC TRAJ macro uses all data that is available to estimate the growth models by using a maximum likelihood (ML) approach for parameter estimation. Literature indicates that ML methods have the advantage of being theoretically unbiased under MCAR conditions because the algorithms account for the dependencies of missingness on other variables in the data set (Newman, 2003). For example, in the context of this study, because missing alcohol use data is significantly impacted by gender, the ML algorithms produced parameter estimates that incorporated conditional distributions of missing alcohol use data relative to gender. Thus, although non-random missingness was identified in this study based on the variables provided, it was controlled for in conditional growth models analyzed by the inclusion of gender, age and race as covariates in the models. Unfortunately, there is always the probability of another variable that was not collected or not identified that may affect missingness in a dataset; however, under the MCAR assumption, missingness does not depend on unobserved

measurements. Theoretically, the occurrence of another variable that was unidentified or unmeasured influencing missing data is controlled for when assuming data is MCAR.

4.4 Drinking Refusal Self-Efficacy

Table 4-8 presents summary information about the DRSE scale for the conditional respondent and repeater samples. Growth modeling with DRSE was not conducted with the unconditional respondent sample; therefore, it is not included in this section. (A detailed description of the survey question used to measure DRSE can be found on page 57 in Chapter Three). On a scale of 5 to 30, where higher scores equate to students with high amounts of confidence to resist alcohol, the conditional respondent sample mean score was 25.2, while the completer sample mean score was 24.8.

Table 4-8

Baseline DRSE Descriptive Statistics

Sample	*N*	Min	Max	Median	Mode	Mean	SD
Conditional Respondent Sample DRSE	561	8.0	30.0	26.0	30.0	25.2	4.8
Repeater Sample DRSE	288	8.0	30.0	26.0	30.0	24.8	5.6

In order to examine the reliability of the DRSE scale at baseline, Cronbach's α was computed for the conditional respondent and repeater samples and is presented in Table 4-9. Results indicate the DRSE scale was adequately reliable at the baseline time assessment for both samples.

Table 4-9

Baseline DRSE Scale Reliability

Sample	*N*	Cronbach α
Conditional Respondent Sample DRSE	561	.891
Repeater Sample DRSE	288	.893

4.5 SAS Trajectory Procedure

A SAS trajectory procedure (PROC TRAJ) is a finite mixture model add-on that is designed to run on the SAS platform. Written by researchers Bobby Jones, Daniel Nagin and Kathryn Roeder in 2001, PROC TRAJ is not part of the base SAS program and was downloaded separately from the Bobby Jones' PROC TRAJ homepage (http://www.andrew.cmu.edu/user/bjones/). Once the application was downloaded, all files were copied into the appropriate folders (as specified by Bobby Jones) on the computer's hard drive. This completed the installation process and activated PROC TRAJ as functional within the SAS platform.

4.6 Data Organization

PROC TRAJ data must be organized in a multivariate or 'wide' format, where there is only one row of data for each subject and multiple observations are included in one line of data. Data for this study was compiled in SPSS and imported to SAS for all growth model analyses. First, alcohol use and DRSE scales scores were created for each study participant at each time point. Weekly alcohol use was computed for each participant at each time point by summing reported amounts of the number of drinks for

each day of the week. Baseline DRSE scale scores were computed by summing the five scale items coded 1 to 6. PROC TRAJ does not allow for distinctions between continuous and categorical predictors; therefore, it was necessary to create dummy-coded variables for all categorical predictors being analyzed. These variables included the following potential confounders: gender, race, study condition and living learning status. Gender and living learning status were dichotomous variables and were recoded to contain only 1's and 0's. (i.e., 1= female, 0= male and 1=living learning, 0= non-living learning). Race and study condition were non-ordered categorical; therefore, multiple individual variables (i.e., *k*-1 where *k*= number of levels) were created for each category containing only 1's and 0's. Once data were properly configured in SPSS, it was saved as a portable file, and automatically converted variable names were saved and documented for identification in SAS. This process was completed multiple times depending on the model being analyzed and the sample being used (i.e., unconditional respondent, conditional respondent, and repeater samples).

4.7 Selecting the Best Fit Model

The model fitting procedure used with PROC TRAJ is iterative and requires *a priori* decisions based on substantive knowledge of the research study. The following is a description of the steps taken to identify the best-fitting model. The steps used in the following description were repeated for each of the eight models identified in this study.

First, as Nagin suggests, a maximum number of groups (six) was initially decided upon (Nagin, 2005). Next, models were run using PROC TRAJ syntax that utilized the most basic polynomial equation (i.e., a linear parameter). Starting with one group and

consecutively adding a group until the maximum number of six groups were fit, models were run individually. This process was repeated with a more complex polynomial equation (i.e., a quadratic parameter) until the best-fitting model was identified. In order to identify the best-fit model, other indicators in the output were assessed at each step in the process. The BIC value, *p*-value and group membership percentages were examined and recorded at each step of analysis. The BIC is the log-likelihood adjusted for the number of parameters and the sample size. In the PROC TRAJ application, the BIC values given in the output are negative; therefore, the best-fitting model is the one with the smallest negative value. Start values were also assessed and adjusted as necessary in the syntax in order to allow for a solution to the equations. Bobby Jones specifically states, "Due to model complexity and possible data oddities, some trajectory models are difficult to fit. There is no guarantee that the procedure will be able to fit a model successfully beginning at the default starting point that the procedure provides" (Jones, 1995). The PROC TRAJ procedure supplies default start values, but in the context of this study, start values were adjusted for all conditional models run. In addition, all models run in this analysis also incorporated Zero-Inflated Poisson (ZIP) estimates to account for heavily skewed and not normally distributed alcohol use data. Syntax (including adjusted start values) and output for each model run in this study can be found as Appendix D. The remainder of this chapter will focus on growth model results, beginning with the most basic unconditional models fit and progressing through all other models ending with a description of the final best fit optimal models.

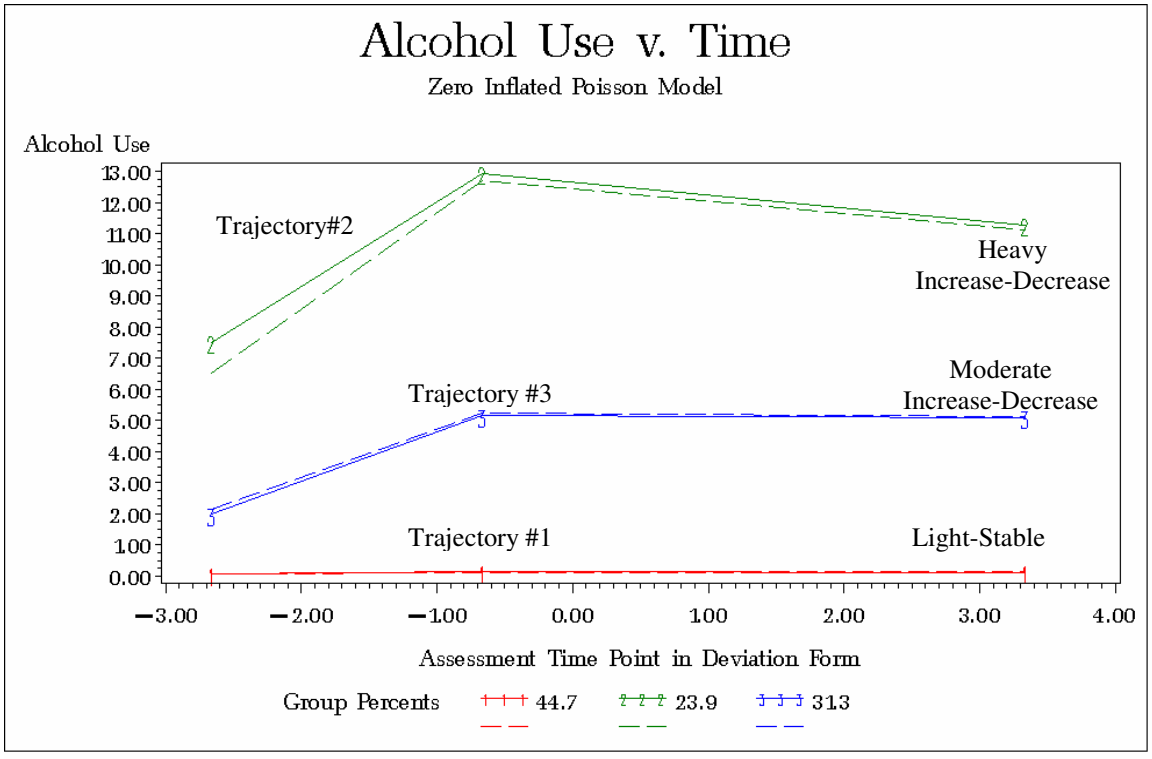
4.8 Unconditional Models

Unconditional growth trajectory models were first completed using the unconditional respondent and repeater samples separately. These models present alcohol use across time assessments for the two samples without the inclusion of risk factors and represent the most basic models conducted in this study. The following is a description of the respondent and repeater sample unconditional growth model results found in this study.

4.8.1 Unconditional Respondent Model

The unconditional respondent model revealed three distinct trajectories of alcohol use for the population and is demonstrated graphically in Figure 4-2.

Figure 4-2: Unconditional Respondent Model

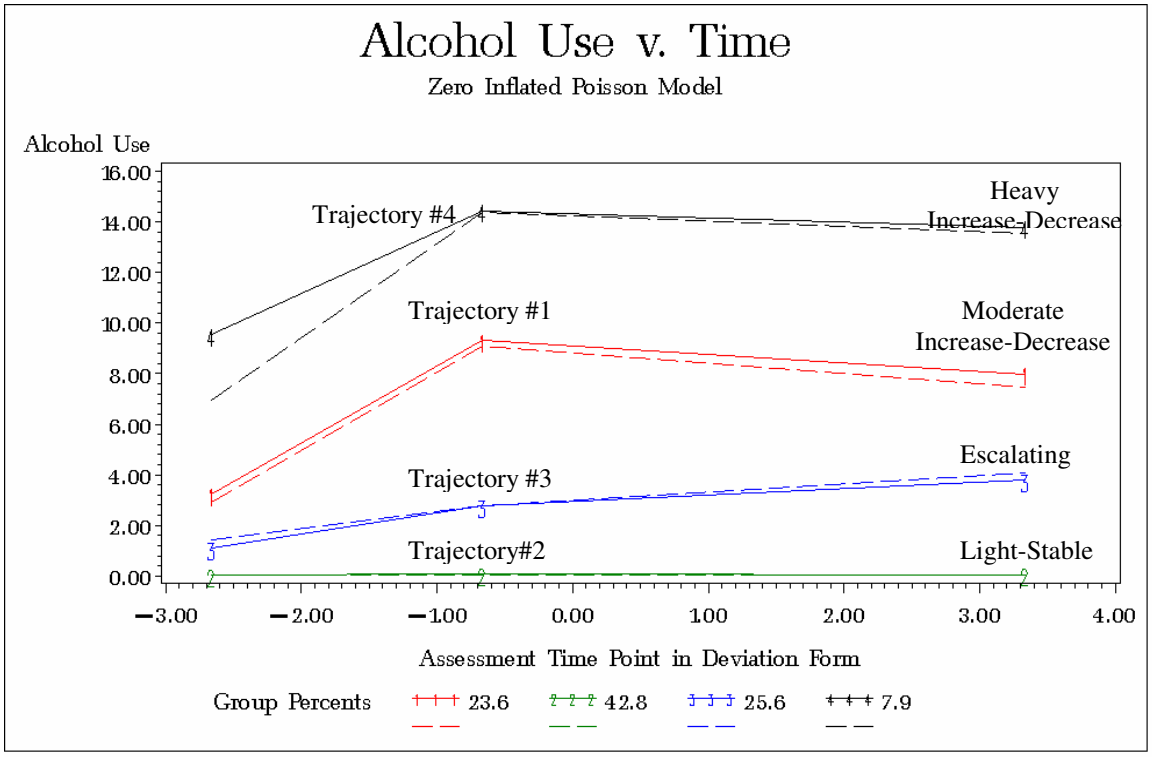


Trajectory #1 represents students who drank very little or no alcohol throughout the freshman year and was fit with an intercept parameter ($p < .0001$). This group is commonly referred to as the 'light-stable' trajectory in the literature (Toumbourou et al., 2003, Ellickson et al., 2005, Geenbaum et al., 2005). In the context of this study, 44.7% of the unconditional respondent sample resided in this group. Moving from the bottom upward in Figure 4-2, trajectory #3 represents moderate drinkers who increased consumption between baseline (2 drinks per week) and 2-month follow-up (5 drinks per week) time assessments, and ultimately maintained consumption levels between 2-month and 6-month follow-up time points at five drinks per week. This trajectory was fit with a quadratic parameter ($p < .0001$) and will be referred to as the 'moderate increase-decrease' group in the context of this study. Thirty-one percent of the unconditional respondent sample resided in this group. The final group, trajectory #2, represents heavy drinkers who increased consumption between baseline (7.5 drinks per week) and 2-month follow-up (13 drinks per week) assessments and slightly decreased consumption between 2-month (13 drinks per week) and 6-month follow-up (11.5 drinks per week) time assessments. The decrease in consumption between 2-month and 6-month follow-up measurements did not fall below this trajectory's initial baseline consumption level of 7.5 drinks per week. This drinking pattern was not easily identified in the literature; however, for the purposes of this study, will be referred to as the 'heavy increase-decrease' group. Twenty-three percent of the unconditional respondent sample resided in this trajectory. In addition, this trajectory was fit with a quadratic parameter ($p < .0001$).

4.8.2 Unconditional Repeater Model

The unconditional repeater model revealed four distinct trajectories of alcohol use among the population and is demonstrated graphically in Figure 4-3.

Figure 4-3: Unconditional Repeater Model



Starting at the bottom of Figure 4-3, trajectory #2 consisted of students who drank very little or no alcohol throughout the freshman year. This 'light-stable' group accounted for 42.8% of the repeater sample and was fit with an intercept parameter ($p <$ .0001). Trajectory #3 consisted of drinkers who exhibited a steady incline in consumption across time assessments and was fit with a linear parameter ($p < .0001$). Students in this group drank one drink per week at baseline, three drinks per week at 2-month follow-up and four drinks per week at the 6-month follow-up time point. This

'escalating' group accounted for 25.6% of the repeater sample. Trajectory #1 consisted of moderate drinkers who greatly increased consumption between baseline (3 drinks per week) and 2-month follow-up (9 drinks per week) time assessments and slightly decreased consumption between 2-month and 6-month follow-up (8 drinks per week) measurements. In the context of this study, this group will be referred to as the 'moderate increase-decrease' trajectory and accounted for 23.6% of the repeater sample. This moderate increase-decrease group was fit with a quadratic parameter ($p < .0001$). The final group in this model, trajectory #4, consisted of heavy drinkers who increased consumption between baseline (11.5 drinks per week) and 2-month follow-up (15 drinks per week) assessments and slightly decreased consumption between 2-month and 6-month time assessments from 15 to 14 drinks per week. This 'heavy increase-decrease' group accounted for 7.9% of the repeater population and was also fit with a quadratic parameter ($p < .0152$).

BIC values for respondent and repeater unconditional growth models discussed above can be found as Table 4-10 on page 96. BIC values were recorded at each step of analysis from models fit with one group to models containing the maximum number of groups. BIC values were used to determine the probability of the appropriate number of groups for each model selected. This probability was computed using the formula below (Figure 4-4), (Kass & Wasserman, 1995) and results are presented in Table 4-10.

Figure 4-4: Formula Used To Compute BIC Probability of Correct Model

$$p_{j=} \frac{e^{BIC_j - BICmax}}{\sum_j e^{BIC_j - BICmax}}$$

Table 4-10: Unconditional Respondent and Repeater BIC Values and Probabilities

Number of Groups	Unconditional Respondent Model BIC	Probability of Correct Model		Number of Groups	Unconditional Repeater Model BIC	Probability of Correct Model
1	-3933.96	0.00		1	-1968.02	0.00
2	-3448.80	0.00		2	-1730.35	0.00
3	-3255.38	0.00		3	-1605.62	0.00
4	-3170.60	0.00		4	-1576.37	0.01
5	-3161.50	0.00		5	-1574.37	0.05
6	-3155.45	**0.96**		6	-1571.34	**0.95**
7	-3158.73	0.03		7	-1580.27	0.00

Using BIC values to determine the probability of the best-fitting model, six groups were estimated as optimal for both the unconditional respondent and repeater models. Although six groups were pre-determined as the maximum number of groups to fit, seven groups were run in this portion of the analysis because BIC values continued to decrease at the six group mark. When a seventh group was added to the model, BIC values in both samples increased. Simultaneously, as the number of groups increase, group membership (i.e., number of students estimated in each group) drastically decreases. Therefore, in the context of this study, although BIC probability values indicate six-group unconditional models as optimal, multiple groups in each six-group model contained no students and were therefore not legitimate trajectories. After reaching three groups in the respondent model and four groups in the repeater model, BIC values leveled off and group membership percentages beyond three and four groups, respectively became very small. Therefore, a three-group respondent model and a four-group repeater model were selected as the best fit unconditional models in this study.

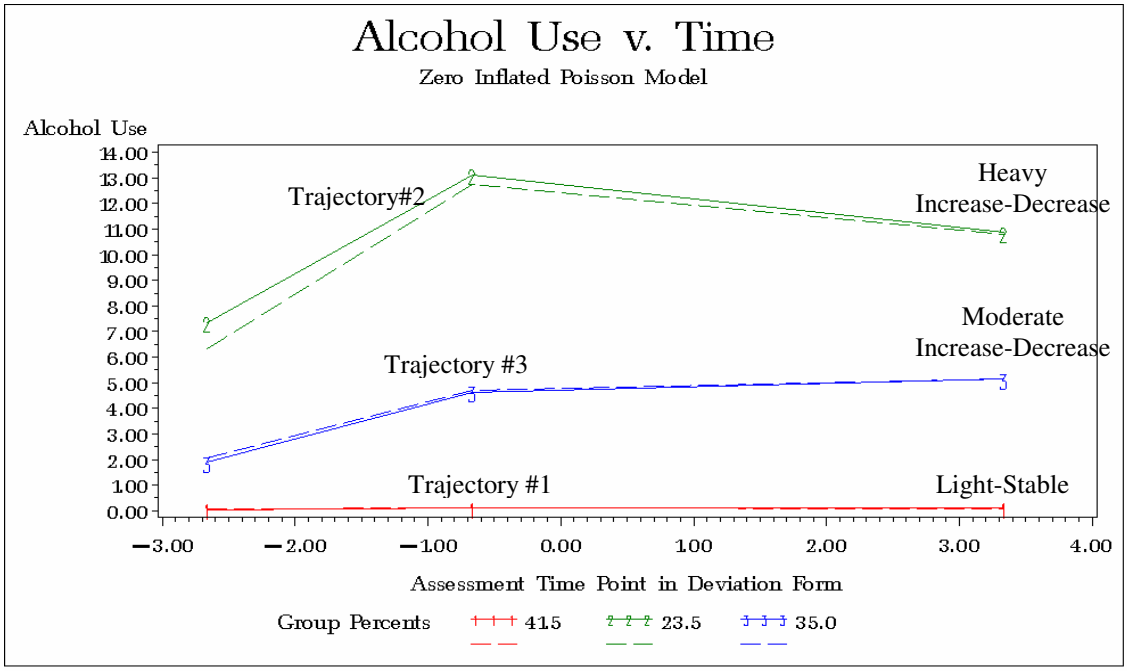
4.9 Conditional Models

The following is a description of all conditional growth model results found in this study. Three conditional growth models were completed using the conditional respondent and repeater samples separately. First, models were run with DRSE as the only risk factor in each model (i.e., conditional DRSE models). Next, all potential confounding factors (including DRSE) were added to each model including age, gender, race, special group learning status, and study condition (i.e., conditional all risk factor models). Finally, only risk factors emerging as significant in the all risk factor models were run again providing results for optimal respondent and repeater growth models (i.e., optimal models).

4.9.1 Conditional Respondent DRSE Model

The conditional respondent DRSE model revealed three distinct trajectories of alcohol use and is demonstrated graphically in Figure 4-5.

Figure 4-5: Conditional Respondent DRSE Model



Trajectory #1 consisted of students who drank very little or no alcohol throughout the freshman year and was fit with an intercept parameter ($p < .0001$). This 'light-stable' trajectory made up 41.5% of the population. Trajectory #3 consisted of students who drank moderately and increased consumption across time assessments. Students in this group drank 2 drinks per week at baseline, 4.5 drinks per week at 2-month follow-up, and 5 drinks per week at the 6-month follow-up time point. This 'moderate increase-decrease' trajectory represented 35.0% of the population and was fit with a quadratic parameter ($p < .0002$). Trajectory #2 consisted of heavy drinkers who increased consumption between baseline (7.5 drinks per week) and 2-month follow-up (13 drinks per week) time assessments and slightly decreased consumption between 2-month (13 drinks per week) and 6-month follow-up (11.5 drinks per week) measurements. This

'heavy increase-decrease' group accounted for 23.5% of the population and was also fit with a quadratic parameter ($p < 0.0001$).

Once PROC TRAJ determined the best-fitting model, there were other statistical subtests conducted for all remaining conditional growth models analyzed. The first such tests determined whether risk factor coefficient estimates were individually and significantly different from zero. In the context of this study, this would imply that a particular risk factor was a significant predictor of alcohol use among freshmen over time. If this relationship was established, additional subtests were run to determine if particular risk factor coefficient estimates significantly differed across individual trajectory groups. Differences in their magnitude would imply that the risk factors being tested, differentially predicted membership in various alcohol use trajectories. Alternatively, if risk factor estimates proved significantly different from zero, but were not significantly different between trajectory groups, this would imply that while the risk factor was a significant predictor of freshmen alcohol use overall, it did not significantly predict different patterns of use. As suggested by Nagin (2005), the Wald Test was used to test these relationships. The Wald Test is a χ^2-based test with degrees of freedom equal to the number of equality constraints being tested. A SAS macro called TRAJTEST was used to conduct Wald Tests of the equality of risk factors in all conditional growth models analyzed in this study.

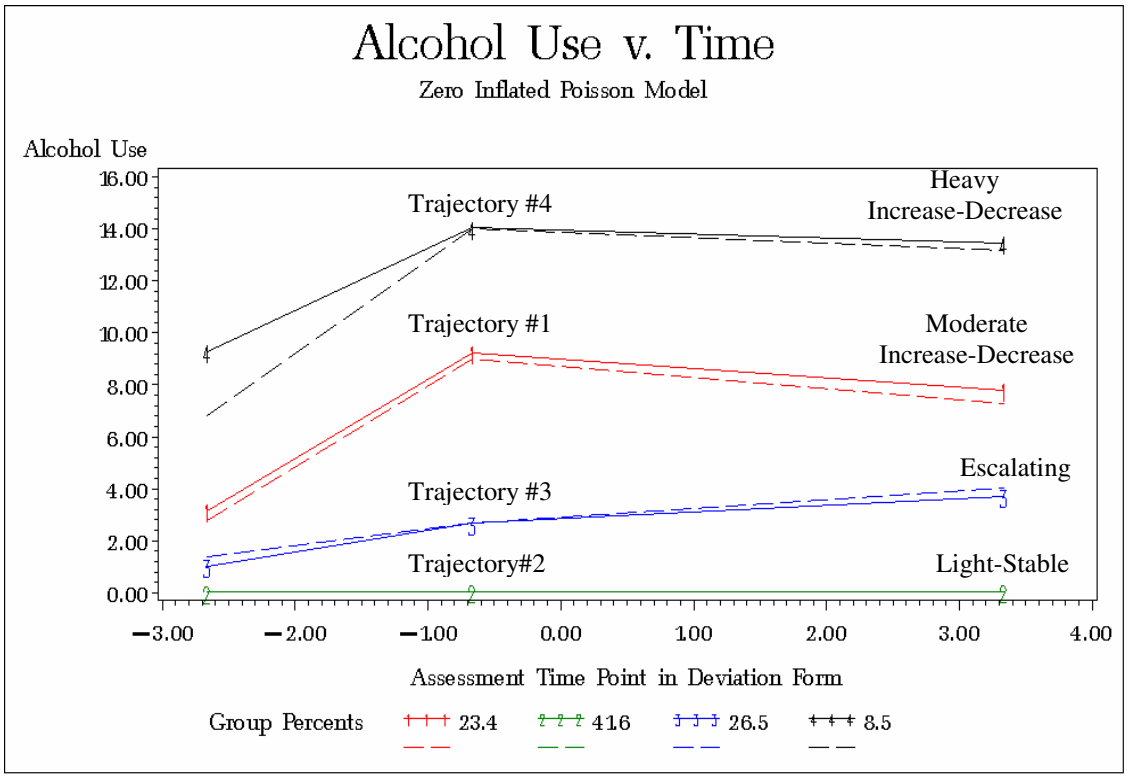
Using the Wald Test, the conditional respondent DRSE model revealed statistically significant differences from zero among the three trajectories identified in the model ($p < .0001$). This indicates that DRSE significantly predicted group membership in the model (i.e., DRSE was a significant predictor of alcohol use among the sample

over time). The Wald Test was also run to identify whether DRSE predicted group membership differently in each trajectory, and results indicated all three growth trajectories as statistically different from each other relative to DRSE. Specifically, DRSE significantly predicted membership in group one differently when compared to group two ($p < .0001$), as well as group one when compared to group three ($p < .0001$) and, group two when compared to group three ($p < .0011$).

4.9.2 Conditional Repeater DRSE Model

The conditional repeater DRSE model revealed four distinct trajectories of alcohol use and is demonstrated graphically in Figure 4-6.

Figure 4-6: Conditional Repeater DRSE Model



Starting from the bottom of Figure 4-6, trajectory #2 consisted of students who drank very little or no alcohol throughout the freshman year and was fit with an intercept parameter ($p < .0001$). This 'light-stable' trajectory made up 41.6% of the population. Trajectory #3 consisted of students who increased alcohol consumption across time assessments. Students in this group drank one drink per week as baseline, three drinks per week at 2-month follow-up, and four drinks per week at the 6-month follow-up time point. This 'escalating' group accounted for 26.5% of the population and was fit with a linear parameter ($p < .0001$). Trajectory #1 consisted of moderate drinkers that tripled consumption between baseline (3 drinks per week) and 2-month follow-up (9 drinks per week) time assessments. Alcohol consumption decreased slightly between 2-month (9 drinks per week) and 6-month (8 drinks per week) follow-up measurements. This 'moderate increase-decrease' group accounted for 23.4% of the population and was fit with a quadratic parameter ($p < .0001$). The final group, represented in trajectory #4, consisted of heavy drinkers that increased alcohol consumption between baseline (9 drinks per week) and 2-month follow-up (14 drinks per week) time assessments. Alcohol use decreased slightly between 2-month (14 drinks per week) and 6-month follow-up (13 drinks per week) time points. This 'heavy increase-decrease' group accounted for 8.5% of the population and was also fit with a quadratic parameter ($p < .0156$).

Using the Wald Test, the conditional repeater DRSE model revealed statistically significant differences from zero among the four trajectories identified in the model ($p < .0117$). This indicates that DRSE significantly predicted group membership in this model. The Wald Test was also run to identify if DRSE predicted group membership differently in each group, and results indicated that DRSE significantly predicted

membership in group one differently than group two (p <.0045), group two differently than group four (p < .0022), and group three differently than group four (p < .0275). Conversely, group one was not statistically different from groups three or four regarding DRSE (p < .16, p < .29) and group two was not statistically different from group three (p < .055) on this risk factor.

BIC values for the conditional respondent and conditional repeater DRSE models can be found as Table 4-11. BIC probability values suggested the adoption of a three-group conditional respondent DRSE model (p=1) and a four-group conditional repeater DRSE model (p=1).

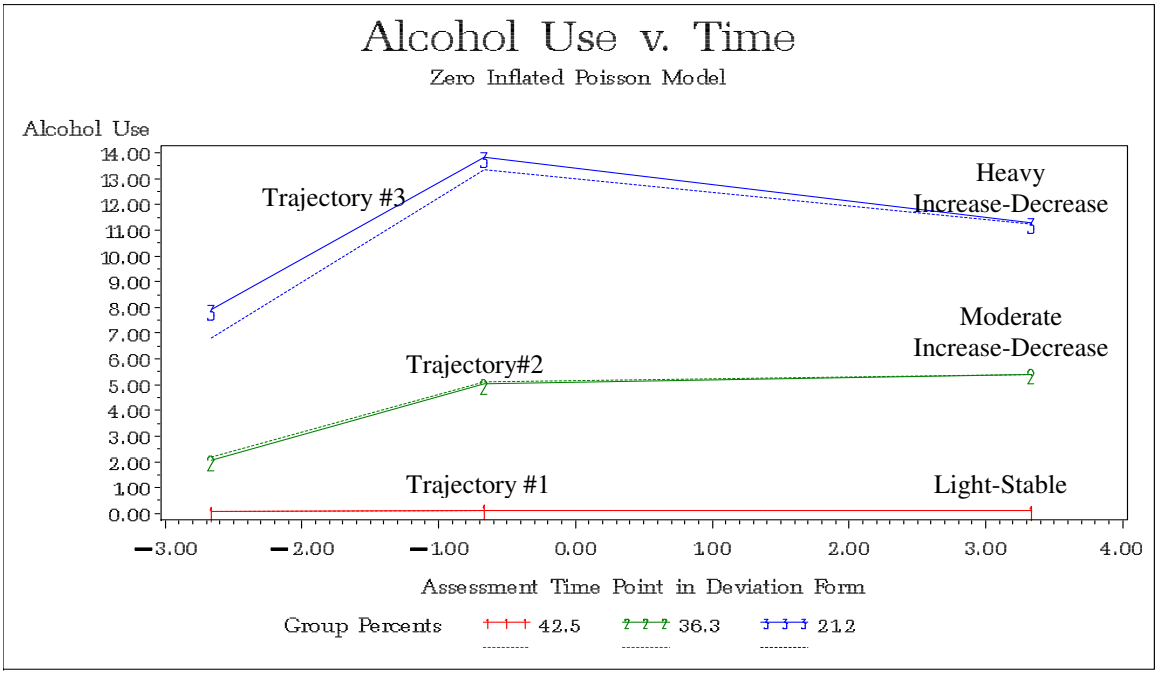
Table 4-11: Conditional DRSE Model BIC Values and Probabilities

Number of Groups	Conditional Respondent DRSE Model BIC	Probability of Correct Model		Number of Groups	Conditional Repeater DRSE Model BIC	Probability of Correct Model
~~1~~	~~-3933.96~~	~~0.00~~	-	~~1~~	~~-1956.61~~	~~0.00~~
2	-2631.57	0.00		2	-1728.51	0.00
3	-2446.78	**1.00**		3	-1597.89	0.00
4	-2754.11	0.00		4	-1563.94	**1.00**
5	-2471.97	0.00		5	-1626.21	0.00
6	-2480.44	0.00		6	-1640.37	0.00

4.9.3 Conditional Respondent All Risk Factor Model

The conditional respondent all risk factor model revealed three distinct trajectories of alcohol use and is demonstrated graphically in Figure 4-7.

Figure 4-7: Conditional Respondent All Risk Factor Model



Trajectory #1 consisted of students who drank very little or no alcohol throughout the freshman year and was fit with an intercept parameter ($p < .0001$). This 'light-stable' group accounted for 42.5% of the population. Trajectory #2 consisted of moderate drinkers who increased consumption between baseline (2 drinks per week) and 2-month follow-up (5 drinks per week) assessments, and maintained consumption between 2-month and 6-month follow-up time points at five drinks a week. This 'moderate increase-decrease' group accounted for 36.3% of the population and was fit with a quadratic parameter ($p < .0001$). Trajectory #3 consisted of heavy drinkers who increased alcohol consumption between baseline (8 drinks per week) and 2-month follow-up (14 drinks per week) time assessments. This group slightly decreased alcohol use between 2-month (14 drinks per week) and 6-month (12 drinks per week) follow-up

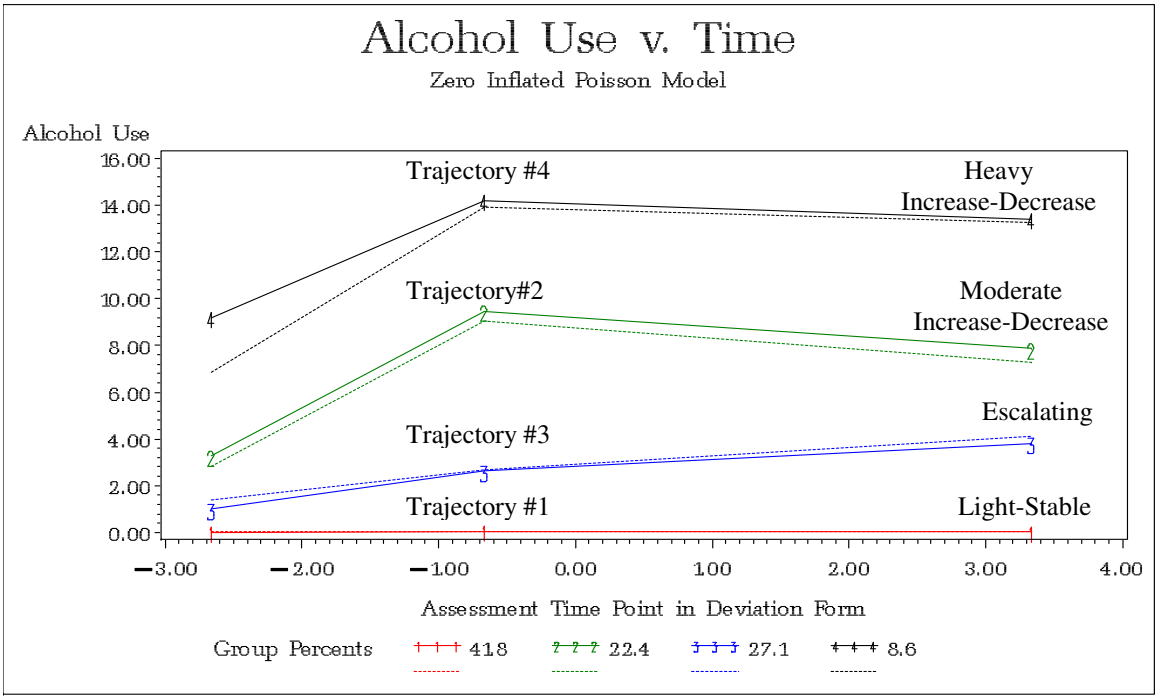
time points. This 'heavy increase-decrease' group accounted for 21.2% of the population and was also fit with a quadratic parameter ($p < .0001$).

The following risk factors were included in this model: DRSE, age, race, gender, study condition, and special group learning status. DRSE ($p < .0001$) and gender ($p < .0128$) were the only risk factors identified by PROC TRAJ as significant predictors in the growth model. This significance indicates that DRSE and gender predicted group membership in this model. Because the other potential confounding factors including age ($p < .84$), race ($p < .14$), study condition ($p < .38$), and special group learning status ($p < .06$) were not found to significantly predict group membership overall, pairwise tests were not necessary for theses variables. Additional subtests were also not needed for gender in this model because it is a dichotomous variable. The Wald Test, was however, conducted on DRSE. Results indicated statistically significant differences from zero among the three trajectories identified ($p < .0001$), as well as DRSE significantly predicting group membership differently in all three trajectories. Specifically, DRSE predicted membership in group one differently from group two ($p < .0001$), group one differently than group three ($p < .0001$), and group two differently than group three ($p < .0004$).

4.9.4 Conditional Repeater All Risk Factor Model

The conditional repeater all risk factor model revealed four distinct trajectories of alcohol use and is demonstrated graphically in Figure 4-8.

Figure 4-8: Conditional Repeater All Risk Factor Model



Trajectory #1 consisted of students who drank very little or no alcohol across time assessments. This 'light-stable' group accounted for 41.8% of the population and was fit with an intercept parameter ($p < .0001$). Trajectory #3 consisted of students who gradually increased alcohol consumption throughout the freshman year. Students in this group reported drinking one drink per week at baseline, two drinks per week at 2-month follow-up, and three drinks per week at the 6-month follow-up time point. This 'escalating' group accounted for 27.1% of the population and was fit with a linear parameter ($p < .0001$). Trajectory #2 consisted of moderate drinkers who greatly increased consumption between baseline (3 drinks per week) and 2-month follow-up (9 drinks per week) time assessments. This 'moderate increase-decrease' group also decreased consumption between 2-month (9 drinks per week) and 6-month follow-up (8 drinks per week) measurements and accounted for 22.4% of the population. A quadratic

parameter was used to fit this trajectory ($p < .0001$). Trajectory #4 consisted of heavy drinkers who increased alcohol consumption between baseline (9 drinks per week) and 2-month follow-up (14 drinks per week) time points, and slightly decreased alcohol consumption at 6-month follow-up (13 drinks per week). This 'heavy increase-decrease' group accounted for 8.6% of the population and was also fit with a quadratic parameter ($p < .0222$).

The following risk factors were included in this model: DRSE, age, race, gender, study condition, and special group learning status. DRSE ($p < .0020$) was the only risk factor identified by PROC TRAJ as a significant predictor in the growth model. This significance indicates DRSE predicted group membership in this model. Because the other potential confounding factors including age ($p < .7921$), race ($p < .9470$), gender ($p < .5252$), study condition ($p < .1334$), and special group learning status ($p < .1332$) were not found to significantly predict group membership overall, pairwise tests were not necessary for theses variables. The Wald Test was conducted on DRSE and results indicated statistically significant differences from zero among the four trajectories identified ($p < .0020$), as well as DRSE significantly predicting group membership differently in group one differently than group two ($p < .0024$), group one differently than group four ($p < .0004$), and group three differently than group four ($p < .0214$).

BIC values for respondent and repeater conditional all risk factor models can be found in Table 4-12. BIC probability values suggested the adoption of a three-group conditional respondent all risk factor model (p=1) and a four-group conditional repeater all risk factor model (p=1).

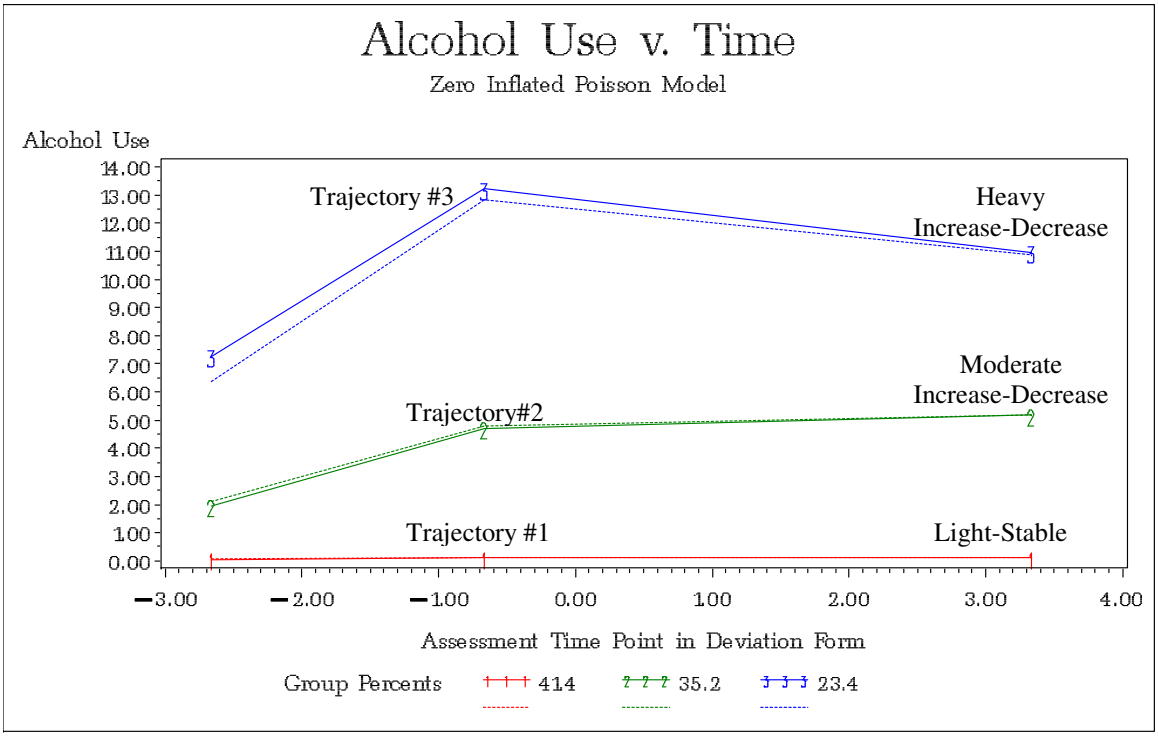
Table 4-12: Conditional All Risk Factor Model BIC Values and Probabilities

Number of Groups	Conditional Respondent All Risk Factor Model BIC	Probability of Correct Model		Number of Groups	Conditional Repeater All Risk Factor Model BIC	Probability of Correct Model
~~1~~	~~-3933.96~~	~~0.00~~	-	~~1~~	~~-1956.61~~	~~0.00~~
2	-2539.94	0.00		2	-1748.32	0.00
3	-2368.22	**1.00**		3	-1633.93	0.00
4	-2417.24	0.00		4	-1622.92	**1.00**
5	-2461.27	0.00		5	-1681.86	0.00
6	-2490.60	0.00		6	-1783.55	0.00

4.9.5 Optimal Respondent Model

The optimal respondent model revealed three distinct trajectories of alcohol use and included DRSE and gender as significant risk factors. This model is graphically presented as Figure 4-9.

Figure 4-9: Optimal Respondent Model



Trajectory #1 consisted of students who drank very little or no alcohol across time assessments as was fit with an intercept parameter ($p < .0001$). This 'light-stable' group accounted for 41.4% of the population. Trajectory #2 consisted of moderate drinkers who increased alcohol consumption between baseline (2 drinks per week) and 2-month follow-up (5 drinks per week) time points. This 'moderate increase-decrease' group maintained consumption levels between 2-month and 6-month follow-up assessments at 5 drinks per week and accounted for 35.2% of the population. A quadratic parameter was used to fit this trajectory ($p < .0002$). Trajectory #3 consisted of heavy drinkers who increased alcohol consumption between baseline (7.5 drinks per week) and 2-month follow-up (13 drinks per week) time points and slightly decreased consumption at the 6-month follow-up (11.5 drinks per week) measurement. This 'heavy increase-decrease'

group accounted for 23.4% of the population and was also fit with a quadratic parameter ($p < .0001$).

DRSE ($p < .0006$) and gender ($p < .0027$) were the only risk factors included in this model and were both identified by PROC TRAJ as significant predictors in the growth model. This significance indicates DRSE and gender predicted group membership in this model. The Wald Test was conducted on DRSE and results indicated statistically significant differences from zero among the three trajectories identified ($p < .0001$), as well as DRSE significantly predicting group membership differently in group one when compared to group two ($p < .0001$), in group one when compared to group three ($p < .0001$), and in group two when compared to group three ($p < .0006$).

Logistic regression was also run in SAS to estimate mean DRSE scale score differences by trajectory. This analysis indicated average DRSE scale scores for group one ($\bar{x} = 27.7$), group two ($\bar{x} = 23.8$) and group three ($\bar{x} = 19.7$). Significant trajectory relationships and DRSE scale scores by trajectory are also displayed in Table 4-13 on the following page. Group one had significantly higher DRSE scale scores than groups two and three. Conversely, group three had significantly lower DRSE scale scores than groups one and two. Group two had significantly higher DRSE scale scores than group three, and significantly lower DRSE scale scores than group one. These results indicate trajectories containing students who drank more alcohol, were made up of students with significantly lower DRSE scale scores (i.e., less ability to resist alcohol) than trajectories containing students who drank less alcohol during the freshman year in college.

Table 4-13: Optimal Respondent Model	
Trajectory Relationships	***p* Value**
Light-Stable vs. Moderate Increase-Decrease	$p < 0.0001$
Light-Stable vs. Heavy Increase-Decrease	$p < 0.0001$
Moderate Increase-Decrease vs. Heavy Increase-Decrease	$p < 0.0001$
Trajectory Mean DRSE Scale Scores and Standard Deviation	**Mean (95% Confidence Limits)**
Light-Stable	27.7 (27.1 - 28.4)
Moderate Increase-Decrease	23.8 (23.3 - 24.8)
Heavy Increase-Decrease	19.7 (18.7 - 20.5)

Odds ratio results revealed the following significant relationships regarding DRSE and group membership: 1) average DRSE of students in group two were 1.3 times less than average DRSE of students in group one; 2) average DRSE of students in group three were 1.4 times less than average DRSE of students in group one; 3) average DRSE of students in group two were 1.1 times greater than average DRSE of students in group three.

Significant gender differences also emerged in this model. Once trajectories were identified with gender significantly impacting the model, cross-tabulations were run with gender by group in SAS. Results revealed, group two contained more females (69.0%) than males (31.0%), while group three contained more males (57.6%) than females (42.4%). In addition, of all females participating in the model, 38.6% were in group two, while 17.0% were estimated in group three. This indicates that males were more likely to reside in heavy drinking trajectories than females.

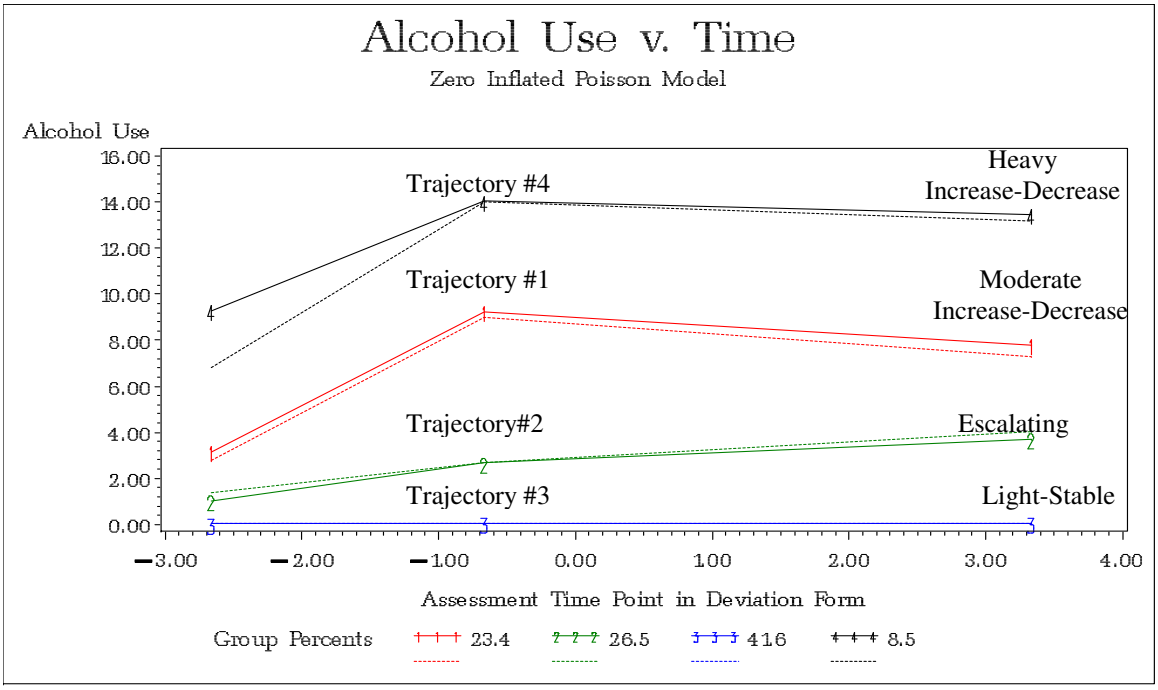
Odds ratio results revealed the following significant relationship regarding gender and group membership: 1) males were 2.6 times more likely to reside in group three than

in group one, and 2) males were 3.5 times less likely to reside in group two than in group three.

4.9.6 Optimal Repeater Model

The optimal repeater model revealed four distinct trajectories of alcohol use and included DRSE as the only significant risk factor. This model is graphically presented as Figure 4-10.

Figure 4-10: Optimal Repeater Model



Starting at the bottom of Figure 4-10, trajectory #3, consisted of students who drank very little or no alcohol throughout the freshman year. This 'light-stable' group accounted for 41.6% of the population and was fit with an intercept parameter ($p <$ .0001). Trajectory #2 consisted of students who gradually increased alcohol consumption

throughout the freshman year. Students in this group reported drinking one drink per week at baseline, three drinks per week at 2-month follow-up, and four drinks per week at the 6-month follow-up time point. This 'escalating' group accounted for 26.5% of the population and was fit with a linear parameter ($p < .0001$). Trajectory #1 consisted of moderate drinkers who increased consumption between baseline (3 drinks per week) and 2-month follow-up (9 drinks per week) time points. This 'moderate increase-decrease' group also decreased consumption levels between 2-month (9 drinks per week) and 6-month follow-up (8 drinks per week) measurements and accounted for 23.4% of the population. This trajectory was fit using a quadratic parameter ($p < .0001$). The final group, represented in trajectory #4, consisted of heavy drinkers who increased alcohol consumption between baseline (9 drinks per week) and 2-month follow-up (14 drinks per week) time points, and slightly decreased consumption levels at the 6-month assessment (13 drinks per week). This 'heavy increase-decrease' group accounted for 8.5% of the population and was also fit using a quadratic parameter ($p < .0156$).

DRSE was the only risk factor identified as a significant predictor in this growth model. The Wald Test was conducted on DRSE and results indicated statistically significant differences from zero among the four trajectories identified ($p < .0115$). In addition, DRSE significantly predicted membership differently in group one when compared to group three ($p < .0045$), group two when compared to group four ($p < .0274$) and group three when compared to group four ($p < .0021$). DRSE did not significantly differentiate group one from groups two ($p < .01617$) or four ($p < .2978$). This risk factor also did not significantly predict membership in group two differently from group three ($p < .0550$).

The general linear model (GLM) procedure indicated average DRSE scale scores for group one ($\bar{x}$ = 23.1), group two ($\bar{x}$ = 24.7), group three ($\bar{x}$ = 26.7), and group four ($\bar{x}$ = 21.0). The light-stable trajectory contained students with the highest DRSE scale scores and the heavy-increasing trajectory contained students with the lowest DRSE scale scores. Significant trajectory relationships and DRSE scale scores by trajectory are also displayed in Table 4-14 below.

Table 4-14: Optimal Repeater Model

Trajectory Relationships	***p* Value**
Light-Stable vs. Moderate Increase-Decrease	$p < 0.0045$
Light-Stable vs.Heavy Increase-Decrease	$p < 0.0021$
Escalating vs. Heavy Increase-Decrease	$p < 0.0274$
Trajectory Mean DRSE Scale Scores	**Mean (95% Confidence Limits)**
Light-Stable	26.7 (25.7 - 27.6)
Escalating	24.7 (23.5 - 26.0)
Moderate Increase-Decrease	23.1 (21.8 - 24.4)
Heavy Increase-Decrease	21.0 (18.7 - 23.2)

BIC values for the optimal respondent and repeater models can be found in Table 4-15. BIC probability values suggested the adoption of a three-group optimal respondent model (p=0.95) and a four-group optimal repeater model (p=1).

Table 4-15: Optimal Model BIC Values and Probabilities

Number of Groups	Optimal Respondent Model BIC	Probability of Correct Model		Number of Groups	Optimal Repeater Model BIC	Probability of Correct Model
~~1~~	~~-3933.96~~	~~0.00~~	-	~~1~~	-1956.61	~~0.00~~
2	-2628.02	0.00		2	-1728.51	0.00
3	-2441.92	**0.95**		3	-1597.89	0.00
4	-2444.85	0.05		4	-1563.94	**1.00**
5	-2485.13	0.00		5	-1617.25	0.00
6	-2482.99	0.00		6	-1636.95	0.00

Finally, it is worth noting that the conditional respondent and repeater samples used in this analysis contained small numbers of subjects who were not classified as freshmen. Because purposive sampling techniques used in the PAF study included dormitory wings made up of a minimum of 70% first-year students, a small number of upper classmen were included in the sample. The conditional respondent sample contained 84 students who were not classified as freshmen by the Department of Resident Life. The repeater sample contained 23 students who were not classified as freshmen by the Department of Resident Life. To ensure this issue did not impact the results of this study, both optimal models (respondent and repeater) were re-run with databases that excluded all non-freshmen subjects. Results of both optimal respondent and repeater models were identical to the optimal models presented in this chapter with the exception of slightly smaller sample sizes and consequently minimal changes in group membership percentages. Both re-run optimal model outputs can be found in Appendix E.

4.10 Study Hypotheses Application of Results

The first hypothesis of this study stated LCGA would reveal homogeneous clusters of college freshmen alcohol use. This hypothesis was tested by determining the best-fitting optimal respondent and repeater models. All other models fit in this study (including the unconditional respondent model, unconditional repeater model, conditional respondent DRSE model, conditional repeater DRSE model, conditional respondent all risk factor model, and conditional repeater all risk factor model) provided the path to achieve the best fit optimal respondent and repeaters models which both revealed homogeneous clusters of college freshmen as hypothesized. The first hypothesis stated above consisted of four sub-points. These sub-points included specifying the characteristics of potential homogenous clusters of freshmen drinking patterns. Based on relevant literature, four types of groups were hypothesized including the following: 1) a light-stable group made up of freshmen who reported no drinking or low levels of drinking across time assessments; 2) an escalating group made up of freshmen who reported no drinking or light drinking at the first time assessment and gradually increased alcohol consumption over time; 3) a heavy-declining group made up of freshmen who reported high levels of drinking at the first time assessment and gradually decreased alcohol consumption over time; and 4) a heavy group made up of freshmen who reported high levels of alcohol consumption across time points.

Results indicated a light-stable group in each optimal model found (respondent and repeater), and an escalating group in the optimal repeater model only. The optimal respondent model contained a light-stable group which consisted of 41.4% of the total population, and the optimal repeater model contained a light-stable group which

consisted of 23.4% of the population. The optimal repeater model contained a group in which alcohol consumption gradually increased over time. Specifically, this escalating group consisted of 26.5% of the optimal repeater model population.

Two of the hypothesized drinking patterns (heavy declining and heavy) were not found in the study. This study did consistently reveal heavy drinking trajectories; however, they did not share the characteristics of those hypothesized. Both respondent and repeater optimal models revealed a heavy increase-decrease drinking pattern among college freshmen. This trajectory (in both samples) reported high baseline consumption (optimal respondent model, 7 drinks per week; optimal repeater model, 9 drinks per week) followed by an even higher 2-month follow-up level of consumption (optimal respondent model, 13 drinks per week; optimal repeater model, 14 drinks per week). Both heavy increase-decrease trajectories lowered slightly at 6-month follow-up, however never dropping below initial, high baseline levels of consumption.

In addition, both respondent and repeater optimal models revealed a second trajectory pattern not hypothesized in this study. This moderate increase-decrease pattern was characterized by a large increase in drinking between baseline and 2-month follow-up time measurements in both optimal models (i.e., 3 drinks per week to 9 drinks per week in the optimal repeater model, and 2 drinks per week to 5 drinks per week in the optimal respondent model). Students in both moderate increase-decrease trajectories made up 23.4% of the optimal repeater model population and 35.2% of the optimal respondent model population.

The second hypothesis in this study stated that DRSE would predict membership in homogeneous clusters of freshmen alcohol use. This hypothesis was also tested by

determining the best-fitting optimal respondent and repeater models. DRSE was found to significantly predict membership in both the respondent ($p < .0006$) and repeater ($p < .0115$) optimal models as hypothesized. In addition, gender ($p < .0027$) was also found to significantly predict membership in the optimal respondent model. The second hypothesis stated above had three sub points. These sub-points described how DRSE would influence membership in hypothesized trajectories. Specifically, it was hypothesized that light-stable drinkers would be more likely to report high levels of DRSE than all other growth patterns, escalating and heavy-declining drinkers would be more likely to report moderate levels of DRSE than all other growth patterns, and heavy drinkers would be more likely to report the lowest levels of DRSE when compared to all other growth patterns.

Results indicated light-stable drinkers reported significantly higher levels of DRSE than all other growth patterns identified in both optimal respondent ($\bar{x} = 27.7$) and repeater ($\bar{x} = 26.7$) samples as hypothesized. In addition, escalating and moderate increase-decrease groups reported moderate levels of DRSE in both the respondent and repeater optimal models as hypothesized. Finally, heavy drinking trajectories identified in this study contained students reporting significantly lower levels of DRSE than all other growth patterns found in both the respondent ($\bar{x} = 19.7$) and repeater ($\bar{x} = 21.0$) optimal models as hypothesized. These relationships will be discussed and interpreted in detail in the following chapter.

CHAPTER 5: DISCUSSION

5.1 Introduction

Drinking on college campuses is a well known social and health issue in the U.S. Most longitudinal studies conducted on college drinking come from a few large landmark studies and do not focus on changes in drinking patterns over time on the same set of individuals. Thus, less is known about the types of drinking trajectories that may exist over time in college-aged students. This study aimed to identify patterns of drinking among college freshmen during the first year in college and evaluate the impact of DRSE on potential patterns of alcohol use over time. The following chapter will present a discussion of major findings, including descriptive data results, interpretation of answers to study hypotheses and a discussion of other unique research findings. Theoretical findings, study limitations, contributions to the field of public health, and further research needs will also be discussed.

5.2 Major Findings

5.2.1 Descriptive Data Analysis Results

Descriptive analyses were completed to explain, in detail, the characteristics of the population being assessed. Within the total eligible sample, there were three sub-samples analyzed in this study, including: 1) an unconditional respondent sample; 2) a conditional respondent sample; and 3) a repeater sample. Analyzing three variations of the total eligible sample individually allowed for a more complete and informative assessment of its characteristics.

First, all sub-samples were compared to the total eligible sample across demographic variables. This comparison revealed that females made up higher percentages of each sub-sample than the total eligible sample. This margin was greatest between repeaters (61.5% female) and the total eligible sample (49.8% female). This finding is not surprising, as research shows that college women are more likely than college men to participate in surveys (Porter & Umbach, 2006). The gender differences identified in this study are also consistent with literature (Greenbaum et al., 2005) that showed freshmen females were more likely to participate in a longitudinal alcohol use study than freshmen males. Other literature has also found college women more likely to respond to online web-based surveys than college men (Sax et al., 2001). All of these findings help to explain why all three sub-samples in the current study consistently contained higher percentages of women than men.

The repeater sub-sample also contained the highest percentage of living learning students (66.0%) when compared to the total eligible sample (46.8%). Research indicates that college students with higher GPAs and self-ratings of their academic ability are also more likely to respond to surveys while in college (Porter & Umbach, 2006). This may help to explain why the repeater sample contained a higher percentage of students enrolled in the living learning program; a program designed to enhance a student's academic experiences while in college. The living learning program may have increased students' self-rating of their academic abilities, making them more likely to respond to all three surveys. It may also be possible that students residing in living learning communities had an increased sense of responsibility as a result of the nurturing

environment that living learning programs provide, which in turn made them more likely to participate in each survey assessment.

Sub-sample and total eligible sample comparisons by race revealed that African American students were less likely to participate in the study. African Americans made up 16.1% of the total eligible sample, but only 7.3% of the repeater sample, which was the lowest percentage of any other minority population in that sample. There may be numerous reasons for this finding. Historically, literature indicates difficulty in getting African Americans to participate in research studies for reasons ranging from mistrust of researchers and the medical community, to researcher's concerns about the generalizability of results conducted on minority populations (Giselle et al., 1999). Further, one study identified in the literature, found minority college students to have less experience with technology than their White and Asian American peers, even after controlling for differences in technological preparedness that are due to parental education, parental income and high school type (Sax et al., 2001). This finding suggests the PAF online survey format used in the current study may have deterred African Americans from participating and therefore resulted in their limited presence in all three sub-samples.

Age and study condition differences were mostly consistent across sub-samples when compared to the total eligible sample, with smaller percentages of 19 year olds participating in the study than 18 and 17 year old students.

5.2.2 Alcohol Use

Alcohol use served as the outcome variable in this study and was first assessed by evaluating average weekly consumption rates by sub-sample. The two respondent samples (unconditional and conditional) reported nearly identical average weekly alcohol use rates over time. This may be related to how the conditional respondent sample was formed. Participants in the conditional respondent sample (*n*=561) were also part of the unconditional respondent sample (*n*=831). Respondents who either did not complete a baseline survey (*n*=255) or complete the DRSE scale at baseline (*n*=15) were dropped from the unconditional respondent sample. The remaining subjects made up the conditional respondent sample. The make up of these two samples regarding the alcohol use variable were nearly identical because the majority of subjects removed did not complete a baseline survey (i.e., or the alcohol use question); therefore, the absence of those subjects did not greatly affect weekly average consumption rates.

Missing alcohol use cases were also assessed. The respondent models (unconditional and conditional) did contain missing cases of alcohol use at each time assessment (see tables 4-5 on page 83 and 4-6 on page 85). On average, the unconditional model contained 34.6% of subjects who did not complete the alcohol use question on at least one occasion during the course of the study, while the conditional respondent model contained 26.0% of subjects who did not complete the alcohol use question on at least one occasion during the course of the study. Research suggests that response rates to surveys among college students have declined dramatically over time. There may be many reasons that led students to not complete surveys at each time assessment. For example, college students receive a large amount of junk e-mail that

may lead them to delete messages before they are even read. Also, large scale student assessments are increasing, and college students may feel bombarded with questionnaires causing them to decline responding. Further, the college experience is becoming increasingly fast-paced, which places growing demands on a student's time. As a result, students may be less willing to commit themselves to a voluntary activity such as completing a survey. Finally, little is known about the extent to which students check their campus e-mail addresses. While the popularity of other Internet e-mail sources is increasing among college students, such as G-mail and Facebook, there is a possibility that students are more likely to use these resources instead of campus e-mail accounts.

Although there were considerable amounts of missing data identified in this study, this is a common occurrence in longitudinal research (Twisk et al., 2002; Schafer, 2002; Brown, 1990; Lairel, 1988). It is difficult to ascertain whether the missing data in this study directly affects the reliability of the results identified. The Greenbaum study (2005), which represents the only other study identified in the literature that specifically looked at freshman alcohol use using LCGA, did have comparable amounts of missing data and similar findings when compared to the current study. Greembaun and colleagues found 33% of their sample had one or more missing alcohol use values, while the optimal respondent sample identified in the current study found 26% of respondents had one or more missing alcohol use values. One notable difference that may have contributed to the higher amount of missing data in the Greenbaum study was the increased number of time assessments; the Greenbaum study had four time points, while the current study had three time points. An additional time assessment may have increased the likelihood of a higher frequency of missing alcohol use values.

Nevertheless, this comparison shows that similar amounts of missing data identified in the current study were also identified in the other most closely comparable study found in the literature.

In addition, PROC TRAJ treats missing data as missing completely at random (MCAR) (see pages 87 and 25-26 for a discussion of MCAR). Future replications of this study would also handle missing data in the same manner, which most likely would increase the reliability of study findings.

5.3 Answers to Study Hypotheses

The first hypothesis stated the following: "LCGA will reveal homogeneous clusters of college freshmen alcohol use." PROC TRAJ was used to estimate both optimal growth models (for respondent and repeater samples) to address this hypothesis. Using the best-fit model selection procedure described in chapter four, three homogeneous growth patterns were estimated for the optimal respondent model, while four homogeneous growth patterns were estimated for the optimal repeater model. These models provide results that show LCGA did reveal homogeneous clusters of college freshmen alcohol use. Therefore, the first hypothesis in this study was accepted.

Hypothesis #1 described above contained four sub-points (1a thru 1d on pages 5 and 6) that described characteristics of the expected trajectories. Hypothesis 1a stated the following: "LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as light-stable drinkers who report no drinking or low levels of drinking across time assessments." Both respondent and repeater optimal models estimated a drinking trajectory made up of light-stable drinkers, therefore satisfying hypothesis 1a in

this study. Further, this drinking pattern was consistently present in all growth models run and was the easiest pattern to identify of all hypothesized trajectories because of its distinct linear and near zero consistent pattern over time. The light-stable group in this study was the most closely aligned with its hypothesized pattern of growth; i.e., that students would consume very little or no alcohol consistently throughout the study. Subjects in this group made up 41.4% of the optimal respondent model and 41.6% of the optimal repeater sample.

The light-stable trajectory was commonly identified in the literature among studies using LCGA. The majority of these studies were conducted over longer time periods, and samples were made up of younger age groups; however, the current study's finding of a light-stable trajectory remains consistent with similar studies found in the literature (Toumbourou et al., 2003; Ellickson et al., 2005; Geenbaum et al., 2005).

Hypothesis 1b stated the following: "LCGA will reveal a homogenous cluster of college freshmen that can be characterized as escalating drinkers who report no drinking or light drinking at the first time assessment and gradually increase alcohol consumption over time." This hypothesis was satisfied in the repeater models only. The optimal repeater model did estimate an escalating drinking trajectory in which students gradually increased consumption over time. Because this trajectory was fit with a linear parameter, beginning with one drink per week and ending with three drinks per week, it was proven that the level of alcohol consumption gradually increased over time and never decreased during the study period. Although the optimal respondent model contained a similar trajectory (moderate increase-decrease), it was fit with a quadratic parameter which indicates a bend in the trajectory. Visually, the trajectory appears to be nearly linear, but

PROC TRAJ estimated a significant bend in the curve indicating a period of increase and then decrease in alcohol use. A significant quadratic parameter excludes the option of categorizing this trajectory as escalating. Therefore, only the optimal repeater model satisfies hypothesis 1b.

Hypothesis 1c stated the following: "LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as heavy declining drinkers who report high levels of drinking at the first time assessment and gradually decrease alcohol consumption over time." This hypothesis was not proven. There were no trajectories identified in any respondent or repeater models that contained students who reported high baseline levels of consumption followed by decreased use over time. In fact, the trajectories identified in this study produced an increase in consumption between baseline and 2-month follow-up time assessments. The only exception to an increase in use was not a decrease, but occurred in the light-stable growth patterns identified, in which consumption stayed the same over time. Therefore, hypothesis 1c was rejected.

For all drinkers in the study, consumption increased between baseline and 2-month follow-up. There were no overall decreasing or declining trajectories found in this study. One could make the assumption from this finding that the majority of all college freshmen who drink before entering college, whether moderately or heavily, will increase alcohol consumption during the first semester. Further all 6-month follow-up consumption levels were higher than baseline alcohol levels for all subjects reporting alcohol use. This indicates that the majority of all college freshmen who drink before entering college (whether moderately or heavily) will not only increase consumption during their first semester, but also ultimately drink more during their second semester

than they did before entering college. Further, students who enter college drinking very little or no alcohol will maintain this pattern during the first year in college. This is an interesting finding because over half of the study population entered college consuming alcohol and increased consumption by their second semester on campus. This supports the notion of the freshman year being a time of increased alcohol use and calls for more attention to be placed on the college freshman population for interventions that may reduce alcohol consumption.

Because so few studies exist in the literature that have used growth analysis to investigate drinking patterns during the first year of college, it is difficult to determine why a heavy declining pattern was not found in the current study. There was one study identified that specifically examined variations in drinking during the freshman year in college (Greenbaum et al., 2005). Before this study was conducted, it was unknown whether heterogeneous growth patterns existed within a single college year. The Greenbaum study did identify a heavy declining group; however, other studies conducted with younger age groups and over longer time periods did not identify heavy declining trajectories (Toumbourou et al., 2003; Ellickson et al., 2005). This inconsistency is one reason more research should be conducted in this area. The more studies that investigate drinking patterns of college freshmen, the more researchers may understand about why certain trajectories do or do not occur.

Hypothesis 1d stated the following: "LCGA will reveal a homogeneous cluster of college freshmen that can be characterized as heavy drinkers who report high levels of alcohol consumption across time assessments." This hypothesis was also not proven by the results of this study. The heavy increase-decrease trajectory identified in both

optimal respondent and repeater models did indicate an increase in consumption overall from baseline to 6-month follow-up time points; however, this trajectory was fit with a quadratic parameter in both samples. This indicates a significant bend in the curve, such that students estimated in this group increased and decreased use during the course of the study. Therefore, this trajectory could not be characterized by students who entered college drinking heavily and maintained that behavior over time. Hypothesis 1d was rejected.

The second hypothesis of the current study incorporated the main risk factor of interest and stated the following: "DRSE will predict homogeneous clusters of college freshmen alcohol use." This hypothesis was addressed in both optimal respondent and repeater models. Both optimal models proved DRSE to significantly predict group membership in freshmen alcohol use trajectories. In addition, DRSE significantly predicted group membership differently in each of the three patterns in the optimal respondent model. In the optimal repeater model, DRSE significantly predicted group membership differently in the light-stable group when compared to the heavy increase-decrease group and the moderate increase-decrease group. DRSE also predicted group membership differently in the escalating group when compared to the heavy increase-decrease group. DRSE did not predict group membership differently in the moderate increase-decrease group versus the heavy increase-decrease group, or the moderate increase-decrease group versus the escalating group. Finally, DRSE did not affect whether students were escalating or light-stable drinkers. These relationships indicated DRSE was more likely to significantly predict trajectory membership between heavier drinking trajectories versus lower drinking trajectories.

Hypothesis #2 described above contained three sub-points that described the expected relationships between DRSE scale scores and alcohol use growth trajectories. Specifically, hypothesis 2a stated the following: "Light-stable drinkers will be more likely to report high levels of initial DRSE than all other growth patterns." This hypothesis was accepted. Both optimal respondent and repeater models contained light-stable trajectories and in both samples the light-stable group contained students with the highest levels of DRSE respectively. (Higher DRSE scale scores represent students with high confidence in resisting alcohol). Therefore light-stable drinkers were more likely than all other growth patterns identified to report high levels of DRSE.

This is an important finding because DRSE has not been used as a risk factor in growth analysis research on college drinking. This finding reveals that students entering college with high alcohol refusal self-efficacy skills are more likely to follow light-stable drinking patterns during the freshman year than all other potential patterns of use. This finding also exposes more information than solely the relationship between baseline DRSE and baseline college drinking behavior, which has been studied and proven to have an inverse relationship (Baldwin et at., 1993; Connor et al., 2000; Hasking & Oei, 2002; Lee & Oei, 1993; Young & Oei, 2000). This finding takes our knowledge of this relationship a step further and suggests that baseline DRSE predicts alcohol use over time and specifically during the first year in college.

Hypothesis 2b stated the following: "Escalating and heavy declining drinkers will be more likely to report moderate levels of DRSE than all other growth patterns." Heavy declining drinkers were not identified (see hypothesis 1c); however, escalating drinkers were identified in the optimal repeater model and did report moderate levels of DRSE

when compared to all other growth patterns in the model. Therefore, this hypothesis was accepted. In fact, as average DRSE scale scores decreased (i.e., as student's ability to resist alcohol increased), corresponding trajectories containing students reporting more alcohol use over time increased.

Finally, hypothesis 2c stated the following: "Heavy drinkers will be more likely to report low levels of DRSE than all other growth patterns." Heavy drinkers as defined in hypothesis 1d were not identified in the study; therefore, this hypothesis could not be tested. Each final optimal model (respondent and repeater) did however estimate a heavy drinking pattern made up of students who reported high baseline consumption levels, increased consumption at 2-month follow-up and slightly decreased alcohol use at the 6-month follow-up time assessment. In each final optimal model, the heavy increase-decrease trajectory contained students reporting the lowest levels of DRSE when compared to all other growth patterns in their respective models. Therefore, the heaviest drinkers found in this study did in fact report the lowest levels of DRSE.

5.4 Unique Findings

One consistent major finding that emerged in this study was the significance of DRSE in all conditional growth models run. DRSE was the main risk factor of interest in this study and was the only risk factor that significantly predicted group membership in all freshmen drinking trajectories. Literature has shown DRSE to have an inverse relationship to alcohol consumption in college-age students; however, the majority of studies linking DRSE to alcohol use have been cross-sectional in nature. Without longitudinal analysis, researchers are unable to prove a causal relationship between

DRSE and alcohol consumption. The results of this study add to our knowledge regarding the relationship between DRSE and alcohol use in college freshmen by suggesting that particular levels of DRSE directly predict the drinking patterns of college freshmen during the first year of college. DRSE has not been studied using LCGA; therefore, the results of this study will greatly enhance our current understanding of this concept and its application to college drinking.

A second interesting finding emerging from the results of this study was the number of groups consistently fit to the respondent and repeater models. The respondent models were fit with three groups, while the repeater models were consistently fit with four groups. Although repeaters (i.e., students completing all three surveys) were included in the conditional respondent sample, had these two distinct variations of the population not been assessed, these differences would not have been discovered. One may have also expected a repeater model to contain less variation (or fewer types of trajectories) because the sample was smaller and all students in the sample completed all three surveys. Three of the drinking patterns in the optimal respondent model and optimal repeater models were similar and included: 1) the light-stable groups; 2) the moderate increase-decrease groups; and 3) the heavy increase-decrease groups. However, the moderate increase-decrease group that emerged in the optimal repeater model contained students who drank at much higher rates, between baseline and 2-month follow-up, than their counterparts in the optimal respondent model. For example, the optimal respondent, moderate increase-decrease trajectory consisted of students who tripled their alcohol use between baseline and 2-month follow-up time points.

There may be numerous reasons the optimal repeater models contained an additional trajectory (escalating drinkers). From a statistical standpoint, perhaps the repeater model contained an additional trajectory because there were no missing alcohol use values and was simply a result of more complete longitudinal dataset. However, one can speculate that students who completed all three surveys exhibited more responsible behavior and therefore were possibly more likely to be more truthful in their survey responses leading to the distinction of an additional group.

Further, all other trajectories (except light-stable drinkers), had a distinct increase at the two month follow-up time assessment followed by a significant decrease at the last time point. Perhaps a homogeneous cluster of repeaters did not succumb to the initial influx of potential drinking activities such as parties, football games and tail-gaiting that occurs during the first semester as severely as others. Conversely, maybe the optimal repeater model produced the only trajectory that did not significantly decrease at the 6-month measurement because students in that group were more cautious and decided to wait slightly longer before partying and consuming more alcohol, and would have exhibited a decrease at a future time assessment.

The heavy drinking groups among the two optimal models (respondent and repeater) were similar in shape but only accounted for 8.5% of the repeater population and a larger 23.4% of the respondent population. This may be a result of less heavy drinking among repeaters, or a result of smaller sample size and higher number of trajectories identified in the repeater model. The optimal repeater model heavy increase-decrease trajectory was also slightly higher than the optimal respondent model heavy increase-decrease trajectory such that repeaters transitioned from nine to fourteen drinks

per week and the respondent model contained students who transitioned from seven to thirteen drinks per week during baseline and 2-month follow-up time points.

A third interesting finding was the lack of a hypothesized heavy-stable group or a trajectory of students who entered college drinking heavily and maintained this behavior throughout the first year. It is important to note that the heavy increase-decrease group identified in this study (in both optimal models) always maintained high levels of alcohol use. The respondent model heavy increase-decrease group drank 7 drinks a week at baseline, 13 drinks a week at 2-month follow-up and 11 drinks a week at 6-month follow-up. The repeater model heavy increase-decrease group drank 9 drinks a week at baseline, 14 drinks a week at 2-month follow-up and 13 drinks a week at 6-month follow-up. However, PROC TRAJ used quadratic parameters to fit both groups indicating one significant bend in each trajectory. Both heavy drinking groups increased and decreased which distinctly separates them from the hypothesized heavy-stable group. The time frame may have been related to the absence of a linear heavy drinking trajectory such that over a longer period of time heavy drinking may have been more consistent. The majority of longitudinal studies on this topic (that have identified heavy-stable trajectories) have focused on longer time periods and younger age groups (Toumbourou et al., 2003; Ellickson et al., 2005; Geenbaum et al., 2005). The Greenbaum study (2005) found a heavy-stable trajectory, but was the first of its kind and a precedent has not yet been set for college-aged drinking trajectories. Before the Greebaum (2005) study was completed it was unknown whether heterogeneous growth patterns of alcohol use existed at all within a single college year. Therefore, the results of the current study will greatly add to the literature regarding growth patterns of drinking during the freshman year;

however, it still remains difficult to decipher whether the lack of a heavy stable group was a result of a shorter time frame or other unknown factors. Additional studies that identify drinking patterns over time will help researchers better understand the types of drinking patterns that exist during the first year in college.

Finally, gender emerged as a significant predictor of group membership in the optimal respondent model only (and not among repeaters). The Greenbaum study (2005) also found gender to predict college freshmen drinking trajectories, such that men were more likely to make up the heavy stable group than women. Although the current study did not identify a heavy-stable group, the heavy increase-decrease group contained significantly more males than females, while the moderate increase-decrease group was more likely to contain females than males. This finding is consistent with the Greenbaum conclusions surrounding gender, and strengthens our knowledge regarding the predictive nature of gender on patterns of alcohol consumption. Specifically, college males not only drink more than their female counterparts, but are also more likely to maintain heavy drinking patterns over time.

Perhaps a reason females might drink less than males in college is a result of recent efforts on college campuses to reduce date-rape. Campaigns to reduce sexual assaults on college campuses commonly focus on getting women to drink less to avoid situations in which they may be taken advantage of sexually. Men are not the focus of such messages. This may also play a role in the reason women are more likely to reside in drinking trajectories that consume less alcohol over time than men.

Although the Greebaum (2005) study was the only other study identified in the literature that used LCGA to address drinking trajectories of college freshmen, there were

distinct methodological differences between its research design and that of the current study that should be considered. The most apparent difference between the two studies was sample selection. For example, the Greenbaum study acquired participants using random sampling techniques and later stratified on gender and family history of alcoholism. Conversely, the current study utilized a purposive sampling technique in which study residence halls were specifically selected to ensure that gender and living learning programs were weighted proportionately among study conditions included in the trial. Further, weekly alcohol consumption was collected in each study using different survey instruments and data was collected on paper-based questionnaires in the Greenbaum study; however, web-based online questionnaires were used in the current study. These methodological differences may limit the ability to compare the findings identified in the current study to those found in the Greenbaum study.

5.6 Theoretical Findings

SCT is commonly applied to studies investigating alcohol use. Further, the theory is easily applied to longitudinal studies because it suggests a person's current behavior affects future behavior. Bandura's self-efficacy construct, found within SCT, when applied to drinking behaviors, suggests that one's perceived ability to refuse or resist alcohol in specific situations affects alcohol consumption. Literature has shown that DRSE has an inverse relationship to alcohol consumption such that participants with lower ability to resist alcohol consume higher levels of alcohol than subjects with higher ability to resist alcohol. However, the majority of literature focusing on this relationship between DRSE and alcohol use is cross-sectional in nature. Without longitudinal

research on this topic, researchers cannot claim a causal relationship exists, leaving open the possibility that DRSE only varies as a function of drinking behavior.

The current study addressed this relationship over time and found the construct to predict how college students drink over time. This relationship was unknown before the completion of this study, and this new information moves researchers closer to a position of developing interventions to abate college drinking. Further, this finding adds to the predictive power of the SCT by suggesting one of its constructs directly predicts alcohol use over time. Burke and Stephen (1999) specifically state that more longitudinal studies are needed in order to examine the prediction of future drinking behavior based on social cognitive constructs. This is not to say that even when conducting longitudinal research a third variable may not account for a portion of the relationship between DRSE and drinking over time; however, this study's finding still enhances confidence in the predictive nature of the SCT and allows for a causal conclusion to be drawn.

5.7 Study Limitations

The current study produced meaningful results regarding how college freshmen consume alcohol over time; however, it was not without limitations. The following is a discussion of limitations that possibly affected the results found in this study.

First, the current study used self-report data. The use of self-report data increases the likelihood that subjects report socially desirable answers to survey questions instead of actual valid reports of a particular health behavior. For example, students may be embarrassed about true amounts of alcohol consumed or afraid of getting in trouble for under age drinking, which may lead to untruthful responses. This results in inaccurate

data which may in turn result in less accurate conclusions. However, the current study implemented a web survey which increased the likelihood of truthful responses by creating a more confidential environment than paper or face to face survey methods. In addition, truthful responses were encouraged in the current study by providing subjects with assent and consent forms as part of the online survey process. Self-report data has been proven as an effective and common means of data collection among college students (Del Boca & Darkes, 2003).

A second limitation of this study is generalizability. The generalization of the findings in this study is limited to college freshmen, living in on-campus dorms, at a large land grant university on the east coast of the U.S. The majority of students in the current study were Caucasian and 18 years of age. In addition, the PAF study design focused on students in specific dormitory wings; therefore, all participants in this study also lived on campus in specially selected dormitory wings, which also limits generalizability.

Further, the sample used in this study was also not completely representative of college freshmen on the University of Maryland campus. When compared to the total eligible sample, all samples analyzed (respondent and repeater) had higher percentages of females (than males) and living learning students (than non-living learning students). These differences indicate the samples analyzed in this study have distinct differences from the total population of college freshmen on the campus where the study was conducted. This may present a larger challenge when generalizing the current study's findings to other collegiate populations.

In an effort to further assess external validity, average alcohol use rates among the current study's population, and a general population of college freshmen were compared.

Results indicated the current study's respondents drank less than CORE Alcohol and Drug survey respondents, which may limit the generalizability of the results found in this study. However, this difference may have occurred, in part, as a result of the different methods used to collect alcohol use data in the two populations. The CORE Alcohol and Drug Survey assessed college freshmen alcohol use in one question (i.e., students were asked in one item to report the average number of drinks consumed in a week). The PAF study asked students to report the number of drinks consumed on each day of the week and responses were summed. Also, the CORE survey is disseminated to all varieties of higher education institutions ranging from degree-granting community colleges to the largest research based universities in the country. Perhaps the wide variety of school types included in the CORE survey significantly impacted freshmen alcohol use rates reported. For example, small rural colleges may have reported significantly different consumption rates than inner city, larger institutions where there are more opportunities for students to drink at sporting activities (i.e., football and basketball tailgaiting), or local clubs and bars. These research design differences between the PAF study and the CORE survey may have limited the appropriateness of this comparison.

Another issue regarding the external validity of this study involves the tradeoffs that exist between the optimal repeater model and the optimal respondent model results. The optimal repeater sample had no missing data; therefore, making it the most statistically complete model. However, it is extremely unlikely to conduct a longitudinal study and not experience some missing data. This means that the results identified in the optimal repeater sample, although the most statistically complete, were the least generalizable. On the other hand, the optimal respondent sample did contain missing

data; however, this model is more generalizable because it represents a more realistic longitudinal sample by containing considerable amounts of missing data. Because it is so unlikely to conduct a longitudinal study and not encounter missing data, coupled with the statistical advances that have been made regarding growth analysis and its ability to handle missing data, the optimal respondent model results are the overall most generalizable results identified in this study.

A third limitation is that the study design aspects were pre-determined, as this was a secondary data analysis dependent upon PAF study design; however, it is worth noting that subjects were recruited for the PAF study using purposive sampling techniques. This sampling technique selected participants in a manner that ensured equal weight among study conditions and gender. This limitation also reduces the external validity of findings revealed in this study.

The statistical analysis used in this study although innovative and powerful such that it allows for the determination of causal relationships (not just associations), also has its limitations. The model fitting procedure is not an exact science and requires *a priori* decisions such as the maximum number of groups to fit to a particular model as well as statistical criteria and subjective judgment. The problem of determining how many groups to fit to a model is among the most challenging in statistics (Nagin, 2005). Therefore this is a common and universal limitation in most group-based modeling approaches.

Another possible limitation involves the validity of the DRSE construct. The DRSE scale used in this study was found to have good construct and concurrent validity. (A detailed discussion of the scale's validity can be found on pages 34-36). It is also

important to note that self-efficacy relates to beliefs about personal capabilities of performing specific behaviors and not one's behavioral intent. According to Bandura (2000), perceived self-efficacy is a major determinant of intention; however, the two constructs are conceptually distinct. Specifically, Bandura (2001) stresses that self-efficacy items should be concerned with capability and phrased in terms of "can do" as opposed to "will do." There is a possibility that subjects may have answered the DRSE scale questions in this study with behavioral intent in mind rather than capability; therefore further exploration about whether the DRSE construct is truly addressing a person's perceived capability or perceived behavioral intent may be warranted.

DRSE scale scores remained high overall for the total sample in the current study (i.e., $\bar{x}$ =26.0 out of 30). There may be many factors associated with the high DRSE scale scores identified in this study. For example, social desirability biases may have resulted in underreporting of risky behaviors such as subjects not being capable of resisting alcohol. However, the online questionnaires used in the current study were completed along with consent forms and unique study identification numbers to minimize possible social desirability biases among the sample. It is also possible that participation bias contributed to the overall high DRSE scale scores identified in this study. For example, students who were more likely to report favorable health behaviors, such as those who have higher abilities to resist alcohol, may have also been more likely to participate in the study.

It is difficult to ascertain whether the high DRSE scale scores identified in this study were normative. The DRSEQ-RA was divided into three subscales (only the social pressures subscale was used in the current study) and not all articles in the literature

reported raw data by subscale, but rather a total DRSEQ-RA scale score. However, two studies were identified in the literature that reported average social pressures subscale scores conducted among adolescent populations. The first, was conducted with a sample of 2,020 adolescents ranging from 12 to 19 years of age and reported an average social pressures DRSE scale score of $\bar{x}$ =26.89 (SD=10.56) (Young et al., 2007). The second, was conducted with a sample of 1,333 university students and reported an average social pressures DRSE scale score of $\bar{x}$ =14.55 (SD=4.55) (Young et al., 2005). The first study, conducted with adolescents ages 12 to 19 reported a nearly identical average DRSE scale score as the current study; however, the second study reported a much lower average DRSE scale score than the current study. Because the studies identified revealed such vast differences in average DRSE scale scores, it is difficult to determine what true normative social pressure subscale scores are among university populations and whether scores in this study were unusually high. Additional literature that reports detailed results of the DRSE scale, including each of the three subscales individually, is needed to further assess whether the scores identified in the current study are commonly found in other studies.

5.8 Contributions to the Field of Public Health

This study contributes important information to the field of public health and specifically enhances our knowledge about a critical health issue in this country. Drinking on college campuses causes death and injury to many each year and continues to be a major problem among most universities in the U.S.

First, this study confirms that heterogeneity does exist among college freshman alcohol consumption within a single year. This was unknown before Greebaum's (2005) investigation, and the current study is only the second to validate this finding. It is important to understand the different patterns of use to develop the most effective and appropriate interventions to address such behaviors. For example, knowing with confidence that two distinct populations of drinkers, including moderate and heavy drinkers, exist within a population may more specifically dictate how an intervention is formed to reduce drinking on college campuses. For example, once a sample is obtained for an intervention of first year college students, participants can be divided into groups of moderate and heavy drinkers. Alcohol reduction messages can then be tailored to the appropriate group of participants as well as tailored to handle expected spikes in drinking patterns. This would avoid moderate drinkers receiving educational messages or skills that may be more appropriate and effective for heavy drinkers.

Also, light-stable drinkers identified before arriving to campus in this study proved to consistently maintain very little or no alcohol use throughout the freshman year. It may prove helpful if pre-identified moderate and heavy drinkers (who increased consumption throughout the year in this study), are assigned to dorm rooms with light-stable drinkers in an effort to curb alcohol consumption. Because light-stable drinkers have shown to consistently drink nothing or very little during the first year, which is an indication that the pressures of entering college and fitting in did not cause them to drink, they may be able, if specifically given a chance, to positively influence the behaviors of moderate and/or heavy drinkers by reducing the amount of alcohol they consume if placed in the same living unit.

A second major contribution of this study resides in its finding of two predictive determinants of how college students drink over time. Results of this study suggest that DRSE and gender differentiate and predict college freshmen drinking patterns. Gender was found to predict alcohol use over time previously in one study (Greenbaum, 2005); however, this was the first application of DRSE to a longitudinal study of this nature. Establishing these relationships will also dictate the creation of more effective interventions aimed to assist in the reduction of drinking on college campuses. For example, because low levels of baseline DRSE significantly predicted high alcohol consumption throughout the first year in college, educators may want to ensure DRSE levels are as high as possible among those entering college. Therefore, this finding might lead to intervention programs targeting college-bound high school seniors to increase DRSE levels.

Completion of this study also immensely adds to our knowledge of the application of LCGA. Because this is a relatively new form of statistical analysis, continued use of the procedure adds to the literature base and strengthens its statistical robustness. In addition, before completion of this study DRSE had not been used in LCGA studies. Results found in this study use a relatively new statistical procedure in an innovative way by incorporating a previously unused theoretical concept (DRSE) into LCGA models.

Finally, results from this study suggest DRSE significantly predicts alcohol use over time. This is a new finding that should impact future college alcohol studies. DRSE was a significant predictor of alcohol use over time in each growth model analyzed in this study; therefore, making a case for more applications in future college alcohol studies. There are numerous reasons why DRSE may have caused this effect in college students.

For example, students with low refusal self-efficacy skills who consume high amounts of alcohol may also have lower self-esteem, or may be more likely to succumb to peer pressure leaving them more vulnerable to consume more alcohol. Also, low alcohol refusal skills may also be a result of a lack of parental guidance at home, or having parents who consume high amounts of alcohol. Students who are taught at home before entering college that it is acceptable to drink by messages from their parents may be more likely to resist less while in college.

There are also implications of the trajectories identified in this study in regard to adolescent risk. Overall, results prove college freshmen are at a high risk of alcohol consumption upon entering college and further, significant numbers of students participate in heavy drinking consistently throughout the first year. This leads to possible problem drinking implications. For example, the students in the heavy increase-decrease trajectory might be more likely to have alcohol addiction problems. Binge drinking was not a focus of this study, but the heavy increase-decrease group may have also contained the majority of binge drinkers within the sample. Although average weekly estimates of the heavy increase-decrease groups were the highest, the majority of those drinks may have occurred in one sitting for some students whereas others may have consumed two drinks everyday, which may be more related to alcohol dependence.

5.9 Further Research Needs

The results found in this study open the door to various continued research implications. First, continued research is necessary to validate trajectories of college freshmen. The current study is only the second such study to specifically evaluate

growth trajectories of freshmen over the course of one year. Continued investigations in this area will strengthen the fields' knowledge base of the types of drinking patterns that exist within this population.

Second, future studies may want to add the nuance of focusing on specific event related effects in freshmen alcohol use trajectories. The Greenbaum study (2005) did reveal that college spring break was a time of increased drinking, creating high peaks in identified trajectories. There may be other event related effects that also help shape drinking trajectories that have not been investigated, such as mid-term examinations, homecoming activities, or fraternity and sorority pledging periods.

Thirdly, DRSE was consistently identified as a significant predictor of freshman alcohol use. This knowledge may lead to increased research surrounding this construct among college freshmen populations. The DRSE construct was measured directly before students arrived on campus in the current study, possibly suggesting that college-bound high school seniors may be a special population to target future alcohol and DRSE related studies. For example, focus groups made up of college-bound high school seniors may be conducted to further investigate the relationship between DRSE and alcohol use among this population and possibly reveal other related risk factors and processes that affect longitudinal alcohol use patterns. Literature also calls for a broader range of biopsychosocial risk processes to relate behavioral alcohol use patterns of university students to their genetic and biological underpinnings (Greenbaum et al., 2005).

Ultimately the results of this study are extremely beneficial to the field of public health and will increase our knowledge regarding a relatively new statistical procedure (LCGA). Understanding more about patterns of drinking over time and what

significantly impacts such patterns will lead to interventions that reduce drinking on college campuses and at the end of the day, save lives.

Appendix A: University of Maryland IRB Approval

UNIVERSITY OF MARYLAND
INSTITUTIONAL REVIEW BOARD

2100 Blair Lee Building
College Park, Maryland 20742-5121
301.405.4212 TEL 301.314.1475 FAX
irb@deans.umd.edu
www.umresearch.umd.edu/IRB

November 26, 2007

MEMORANDUM

Application Approval Notification

To:	Dr. Bradley O. Boekeloo Keisha Watson Melinda Griffin Department of Public & Community Health
From:	Roslyn Edson, M.S., CIP IRB Manager University of Maryland, College Park
Re:	**IRB Application Number: # 01398** **Project Title:** "Peers as Family: Preventing Problem Drinking"
Approval Date:	**November 20, 2007**
Expiration Date:	**November 20, 2008**
Type of Application:	Renewal
Type of Research:	Nonexempt
Type of Review For Application:	Expedited

The University of Maryland, College Park Institutional Review Board (IRB) approved your IRB application. The research was approved in accordance with 45 CFR 46, the Federal Policy for the Protection of Human Subjects, and the University's IRB policies and procedures. Please reference the above-cited IRB application number in any future communications with our office regarding this research.

Recruitment/Consent: For research requiring written informed consent, the IRB-approved and stamped informed consent document is enclosed. The IRB approval expiration date has been stamped on the informed consent document. Please keep copies of the consent forms used for this research for three years after the completion of the research.

Continuing Review: If you intend to continue to collect data from human subjects or to analyze private, identifiable data collected from human subjects, after the expiration date for this approval (indicated above), you must submit a renewal application to the IRB Office at least 30 days before the approval expiration date.

Modifications: Any changes to the approved protocol must be approved by the IRB before the change is implemented, except when a change is necessary to eliminate apparent immediate hazards to the subjects. If you would like to modify the approved protocol, please submit an addendum request to the IRB Office. The instructions for submitting a request are posted on the IRB web site at: **http://www.umresearch.umd.edu/IRB/irb_Addendum%20Protocol.htm.**

Unanticipated Problems Involving Risks: You must promptly report any unanticipated problems involving risks to subjects or others to the IRB Manager at 301-405-0678 or **redson@umresearch.umd.edu.**

Student Researchers: Unless otherwise requested, this IRB approval document was sent to the Principal Investigator (PI). The PI should pass on the approval document or a copy to the student researchers. This IRB approval document may be a requirement for student researchers applying for graduation. The IRB may not be able to provide copies of the approval documents if several years have passed since the date of the original approval.

Additional Information: Please contact the IRB Office at 301-405-4212 if you have any IRB-related questions or concerns.

Appendix B: Introductory Letter & Informed Consent Forms

UNIVERSITY OF MARYLAND

OFFICE OF THE VICE PRESIDENT FOR STUDENT AFFAIRS

2108 Mitchell Building
College Park, Maryland 20742
301.314.8428 TEL 301.314.9606
FAX

August 14, 2006

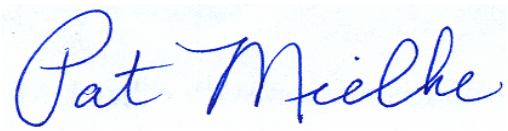
Dear <Student Name>,

You have been selected to participate in the "Peers As Family" project sponsored by the University of Maryland and the National Institutes of Health. You were selected because you are living in a residence hall that has many first-year students. As part of the project, you will complete periodic surveys regarding campus peer experiences. Besides making a very important contribution to research about campus life, you will receive various incentives for your participation along the way. Upon completion of this survey, you will receive a $10 gift coupon for the University Book Center. There may be an added $20 bonus gift if at least 85 percent of the people on your residence hall wing participate!

You should already have received an e-mail from "Peers As Family" which included a survey website address and your personal on-line access code. Once logged into the website, you will find the informed consent form. This form includes the information you should know about the survey before you participate.

If you have any questions regarding the "Peers As Family" project, you can email (melgrif3@umd.edu) or call (301-405-2551) Melinda Griffin, Project Manager. We hope you enjoy the enclosed small gift of appreciation and accept our thanks for your contribution to this important project. Be on the lookout for future "Peers As Family" emails and flyers. Welcome to the University of Maryland!

Sincerely,



Dr. Pat Mielke

Assistant Vice President for Student Affairs
(Phone: 301-314-8431)

Dr. Bradley Boekeloo
Principal Investigator
Department of Public and Community Health
(Phone: 301-405-8546)

Informed Consent/Assent: Implementation

Identification of Project: Peers as Family.

Statement of age of subject: I understand that I must be at least 17 years of age to participate in this research. If I am 17 years of age, then I assent to this research as a minor. If I am over 17 years of age, then I consent to this research as an adult. My assent or consent indicates that I wish to participate in this program of research being conducted by Bradley O. Boekeloo, PhD, MS in the Department of Public and Community Health at the University of Maryland, College Park, MD 20742 (Telephone: 301-405-8546).

Purpose: The purpose of this research is to investigate methods to improve health and safety of college students.

Procedures: As a study participant, I understand that I will be emailed and asked to complete either an online web-based or paper survey, once in the middle of Fall and Spring semester. I will receive an email link and password for each on-line survey. If I do not complete the on-line survey, then I will be mailed a paper copy of the survey and return mail envelope so that I can complete it and return it via campus mail. The surveys will ask me about my knowledge, attitudes and behaviors related to alcohol use. I agree to complete all study surveys in private, without anyone else watching me. I also agree to the release of notification of my participation in resident hall workshops to the researchers for this project. The research team will review the University Police records to determine if I have had any alcohol-related citations and I consent to the release of this information. They will review Residence Life records to determine if I have had alcohol-related medical emergencies and I consent to the release of this information. Finally, the research team will search the Registrar's records and will obtain information from my academic transcripts and I consent to the release of this information. The data obtained from these outside sources will be used to assess the effect of alcohol on student life. I understand that in the event I leave UMCP, I will no longer be eligible for the study.

Confidentiality: The research staff is committed to protecting my privacy, and the information I provide will be treated confidentially. My name will not appear on the survey or other data about me. I agree to complete the survey privately without discussing it with anyone or allowing anyone to look at my answers. I understand that no attempt will be made to match my name with my survey responses or any other information that is collected about me. All information that I provide and all information that is collected will identify me by a unique study identification number that is not my university identification number or social security number. To link each of my surveys and my police and university records, the researchers must match my study identification with my identity but the list that matches my study identification with my identity will be directly protected and supervised by Dr. Boekeloo. It will be destroyed as soon as data collection is completed (within two years). I understand that while my name and student identification number will be used to search Police and University records, any information that is collected about me by the researchers will be identified by a unique study identifying number (a new number assigned by the research team and not my university ID or social security number) and no identifying information (name, university ID, social security number) will appear with this information. All information about me with my study identification numbers will be kept in locked cabinets in the locked offices of Dr. Boekeloo or in password protected computer files of Dr. Boekeloo. The data I provide will only be used for scientific reporting, and data will always be presented in the aggregate.

The research staff has also obtained a Confidentiality Certificate (CC) from the US Department of Health and Human Services (DHHS) to protect the researchers from being forced, even by court order or subpoena, to identify me. (The Certificate does not imply approval or disapproval of the project by the Secretary of DHHS. It adds special protection for the research information about me.) I know that researchers may provide information to appropriate individuals or agencies if harm to myself, harm to others, or if information about child abuse is disclosed. In addition, the federal agency funding this research may see my information if it audits the research staff.

Risks: I may feel uncomfortable answering questions about my alcohol use. The researchers will protect my confidentiality as stated above but inadvertent disclosure of my identity, particularly related to illegal behaviors, could cause me embarrassment or legal problems. The only cost to me for participating is my time.

Right to Withdraw: I may refuse to answer any question and I may choose not to respond to specific questions. I may withdraw from the study at any time, without penalty.

Benefits: I understand that this study is not designed to help me personally but that the investigators hope to learn more about preventing adverse consequences of alcohol use among college students. If the researchers learn that I am in danger from alcohol use, the researchers may call me to advise me about my risk of harm and that I should contact a health professional.

Incentives: I understand that I will receive a $10 University Book Center coupon for completing and submitting each survey. The coupon is to let me know that my help in this study is important and appreciated. Also, if 85% of the residents in my residence hall wing participate, then for each survey, my wing will be entered into a raffle and the winning wing participants will each receive a $20 gift certificate.

Where medical care is available: In the event that I suffer psychological stress from my participation in this study I understand that the University Health Center has support programs regarding these issues if I desire further information. However, I understand that the University of Maryland does not provide any medical or hospitalization insurance coverage for participants in the research study nor will the University of Maryland provide any compensation for any injury sustained as a result of participation in this research except as required by law.

If I have questions about my rights as a research subject or wish to report a research-related injury, I will contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-4212. **By entering my study ID number, birthdate, and today's date below, I signify that I have read and understand this assent/consent from and am willing to participate in this study. The study ID entered below must match the number that has been provided on the top right corner of the first page of the survey.**

Bradley O. Boekeloo, PhD
Professor
Public & Community Health
University of Maryland

Subject's Study ID Number_____

Subject's Date of Birth_____

College Park, MD 20742 Today's Date_____
301.405.8546

Appendix C: Baseline Peers as Family Online Questionnaire

This survey will ask you about alcohol-related behaviors and should take about 20 minutes of your time. This session will timeout in 45 minutes. Do not share your responses with others. If you have any questions or concerns, call Melinda Griffin at 301-405-2551. Your responses will be kept confidential as described in the consent form that you just accepted.

Section A. True or False			
A1	A 150 pound person is not affected by alcohol until after he/she consumes at least 2 drinks per hour.	☐ TRUE	☐ FALSE
A2	Drinking carbonated beverages slows down the absorption rate of alcohol into the blood stream.	☐ TRUE	☐ FALSE
A3	One shot of liquor will affect a person's blood alcohol concentration in the same way as a bottle of beer.	☐ TRUE	☐ FALSE
A4	Passing out unconscious is NOT a life-threatening condition.	☐ TRUE	☐ FALSE
A5	If you are found in possession of a fake ID, you can be suspended from the University.	☐ TRUE	☐ FALSE
A6	You can count the number of times a person breathes in a minute as a way to determine if he/she has alcohol poisoning.	☐ TRUE	☐ FALSE
A7	Keg parties are allowed in residence halls if hosted by someone at least 21 years of age.	☐ TRUE	☐ FALSE

A8	Once a person passes out, his/her BAC cannot increase.	TRUE	FALSE
A9	Residents who are under 21 can consume alcohol in the privacy of their residence hall room.	TRUE	FALSE
A10	Getting a person drunk to have sex with him/her is a crime.	TRUE	FALSE
A11	A typical 12 once beer, 5 ounce glass of wine, and 1.5 ounce shot of liquor all contain roughly the same amount of alcohol.	TRUE	FALSE
A12	To prevent getting a hangover, one should sip one's drink slowly, drink and eat at the same time, space drinks over a period of time, and not drink over one's limit.	TRUE	FALSE
A13	A blood alcohol concentration of .02% causes a person to lose muscle control.	TRUE	FALSE
A14	Eating while drinking will have no effect on slowing down the absorption of alcohol in the body.	TRUE	FALSE
A15	Drinking coffee or taking a cold shower can be an effective way of sobering up.	TRUE	FALSE
A16	The average body can metabolize two drinks per hour.	TRUE	FALSE
A17	A 120-proof liquor contains 40% alcohol by volume.	TRUE	FALSE
A18	Over 1,500 college students die each year in the United States due to alcohol-related injuries.	TRUE	FALSE

Next Reset

Section B:

Please keep in mind that a *drink* is:

- a 12 oz bottle or can of beer
- a 5 oz glass of wine or a wine cooler
- a 1.5 oz shot of hard liquor such as rum, gin, vodka or whiskey straight or in a mixed drink, or similar portion of alcohol.

Use your best estimate of drinks based on this definition.

During a typical week in the past 30 days, how many drinks did you consume on each day of the week? (0 = no drinks 1 = one drink 2 = two drinks 3 = three drinks 4 = four drinks 5 = 5 drinks or more)								
B1		Sunday	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5+
B2		Monday	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5+
B3		Tuesday	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5+
B4		Wednesday	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5+
B5		Thursday	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5+
B6		Friday	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5+
B7		Saturday	☐	☐	☐	☐	☐	☐

During the past 30 days, on how many days did you have 5 or more drinks in a row (male) or 4 or more drinks in a row (female), that is within a couple of hours.		
B8	5 or more drinks in one sitting **(MALES ONLY)**	
B9	4 or more drinks in one sitting **(FEMALES ONLY)**	

Section B: How many days did you use the following substances **over the past 30 days?**		
B10	Beer	
B11	Wine or wine coolers	
B12	Liquor or Spirits (straight or mixed in a drink)	
B13	Prescription medication without a prescription (Vicodin, Percoset, OxyContin, Ritalin, Adderol)	
B14	Other non-prescription drugs (Marijuana, Cocaine, Amphetamines, Hallucinogens, etc.)	
B15	Combine drinking alcohol with taking drugs	
B16	Alcohol of any type.	

If **"None"** for B16, click here to skip to C48

Section C: How often did you experience any of the following as a result of **your own alcohol use during the past 30 days?** 0 = none 1 = 1 time 2 = 2 times 3 = 3 or more times					
C1	I missed or performed poorly in class	0	1	2	3
C2	I had a hangover	0	1	2	3
C3	I became sick or vomited	0	1	2	3
C4	I passed out	0	1	2	3

C5	I had memory loss or blackouts	☐ 0	☐ 1	☐ 2	☐ 3
C6	I physically harmed myself or another person	☐ 0	☐ 1	☐ 2	☐ 3
C7	I caused a disturbance (was noisy)	☐ 0	☐ 1	☐ 2	☐ 3
C8	I damaged property	☐ 0	☐ 1	☐ 2	☐ 3
C9	I had unprotected sex	☐ 0	☐ 1	☐ 2	☐ 3
C10	I received a citation or was arrested	☐ 0	☐ 1	☐ 2	☐ 3
C11	I regretted getting sexually involved with someone	☐ 0	☐ 1	☐ 2	☐ 3
C12	I coerced another person into being sexual with me	☐ 0	☐ 1	☐ 2	☐ 3
C13	I was ashamed by my behavior	☐ 0	☐ 1	☐ 2	☐ 3
C14	I had a conflict with my roommate or another person	☐ 0	☐ 1	☐ 2	☐ 3
C15	I fell behind in my studies	☐ 0	☐ 1	☐ 2	☐ 3
C16	I regretted losing control of my senses	☐ 0	☐ 1	☐ 2	☐ 3
C17	I was late for work or school	☐ 0	☐ 1	☐ 2	☐ 3

During the past 30 days, when you socialized with others where there was alcohol present, how often did you:							
C18		Alternate non-alcoholic beverages and alcoholic beverages	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C19		Determine, in advance, not to exceed a set number of drinks	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C20		Eat before and/or during drinking	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C21		Have a friend let you know when you'd had enough	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C22		Keep track of how many drinks you were having	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C23		Pace your drinks to 1 or fewer per hour	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C24		Avoid drinking games	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C25		Stop drinking at least 1-2 hours before going home	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C26		Limit money spent on alcohol	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C27		Only drink in safe environments	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C28		Make your own drinks	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C29		Avoid hard liquor or spirits	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C30		Refused a drink from a stranger	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
C31		Never leave your drink unattended	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always

Think back over the past 30 days. How often did you drink alcohol (beer, wine, wine coolers, and liquor):					
C32	At a bar or club	Never	Seldom	Occasionally	Frequently
C33	At a party with friends	Never	Seldom	Occasionally	Frequently
C34	To get drunk	Never	Seldom	Occasionally	Frequently
C35	To have a good time	Never	Seldom	Occasionally	Frequently
C36	With a small group of friends	Never	Seldom	Occasionally	Frequently
C37	With a large group of friends	Never	Seldom	Occasionally	Frequently
C38	On a college campus (e.g. at parties, in dormitories, at fraternities of sororities)	Never	Seldom	Occasionally	Frequently
C39	As part of a drinking game	Never	Seldom	Occasionally	Frequently
C40	On weekend nights	Never	Seldom	Occasionally	Frequently
C41	When bars have drink specials	Never	Seldom	Occasionally	Frequently
C42	When you have no classes or other obligations the next morning	Never	Seldom	Occasionally	Frequently
C43	Before "going out" (i.e. to a party or bar)	Never	Seldom	Occasionally	Frequently
C44	To make it easier to go to bed with someone	Never	Seldom	Occasionally	Frequently
C45	To build up courage to talk to someone to whom you are attracted	Never	Seldom	Occasionally	Frequently
C46	To reduce inhibitions	Never	Seldom	Occasionally	Frequently
C47	When a friend from home visits for the weekend	Never	Seldom	Occasionally	Frequently

How often did you experience any of the following as a result of **others' alcohol use during the past 30 days**? 0 = none 1 = 1 time 2 = 2 times 3 = 3 or more times						
C48	I was harassed, insulted, or humiliated	☐ 0	☐ 1	☐ 2	☐ 3
C49	I had a serious argument or quarrel	☐ 0	☐ 1	☐ 2	☐ 3
C50	I was pushed, hit, or assaulted	☐ 0	☐ 1	☐ 2	☐ 3
C51	I had my property damaged	☐ 0	☐ 1	☐ 2	☐ 3
C52	I had to "baby-sit" or take care of another student	☐ 0	☐ 1	☐ 2	☐ 3
C53	I had my studying or sleep interrupted	☐ 0	☐ 1	☐ 2	☐ 3
C54	I experienced an unwanted sexual advance	☐ 0	☐ 1	☐ 2	☐ 3
C55	I was the victim of sexual assault or date rape	☐ 0	☐ 1	☐ 2	☐ 3
C56	I was inconvenienced from vomit in the hallway or bathroom	☐ 0	☐ 1	☐ 2	☐ 3
C57	I was affected by the behavior of guests who were drinking	☐ 0	☐ 1	☐ 2	☐ 3

Next Reset

Section D: How confident are you that you could do the following?		
D1	Avoid drinking too much	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D2	Resist pressure from someone else to drink too much	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D3	Avoid being in situations where you would be encouraged to drink too much	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D4	Avoid drinking games	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D5	Drink an alcohol look-alike (non-alcoholic beer, etc)	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D6	Carry around a cup but did not drink any alcohol	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident

D7	Alternate non-alcoholic beverages and alcoholic beverages	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D8	Determine in advance not to exceed a set number of drinks	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D9	Pace your drinks to 1 or fewer per hour	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D10	Keep track of how many drinks you were having	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D11	Socialize with my **WING-MATES** (persons living on your side of your residence hall floor) in a manner that does not include alcohol	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident

How confident are you that you could do the following?			
D12		Prevent a wing-mate from drinking too much	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D13		Take a drink away from someone	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D14		Make someone leave a bar/party	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D15		Drive or walk someone home	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D16		Help a wing-mate who has had too much to drink	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D17		Confront a wing-mate with a problem	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident

D18		Avoid driving after you have been drinking	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident
D19		Avoid riding with someone who has been drinking	☐ **Un**confident ☐ Somewhat **un**confident ☐ Somewhat confident ☐ Confident

How sure are you that you could resist drinking?			
D20		When I am out at dinner	
D21		When someone offers me a drink	
D22		When my boy/girl friend or partner is drinking	
D23		When my friends are drinking	
D24		When I am at a party or club	

Next Reset

Section E:

For the following the questions, base your responses on your expectations rather than your experience given that you have not yet lived with students on your **WING** (your side of your residence hall floor).

Indicate how much **you think** students on your wing agree with the statements below.

E1	Students here admire non-drinkers.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Neither Agree nor disagree ☐ Somewhat agree ☐ Agree
E2	It's important to show how much you can drink and still hold your liquor.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Neither Agree nor disagree ☐ Somewhat agree ☐ Agree
E3	You **can't** make it socially at this school without drinking.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Neither Agree nor disagree ☐ Somewhat agree ☐ Agree
E4	Drinking is an important part of the college experience.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Neither Agree nor disagree ☐ Somewhat agree ☐ Agree

E5		School rules about drinking are almost never enforced.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Neither Agree nor disagree ☐ Somewhat agree ☐ Agree
E6		I feel that there is pressure for me to drink.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Neither Agree nor disagree ☐ Somewhat agree ☐ Agree

On your wing of your residence hall floor, how acceptable would it be for **you** to do the following as a result of your alcohol use?			
E7		Come home drunk	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E8		Throw up in the bathroom, hallway, or other common area	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E9		Be loud and obnoxious	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E10		Vandalize or destroy property	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable

E11	Pass out (in a common area)	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E12	Get help **for** someone else who has had too much to drink	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E13	Get help **from** someone else because you had too much to drink	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E14	Interrupt someone else's sleep	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E15	Interrupt someone else's studying	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable
E16	Use being drunk as an excuse for my behavior	☐ **Un**acceptable ☐ Somewhat **un**acceptable ☐ Somewhat acceptable ☐ Acceptable

For the following the questions, base your responses on your expectations rather than your experience given that you have not yet lived with students on your wing.

E17. **During the past 30 days**, what percent of students on your **wing** used alcohol?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

E18. **During the past 30 days**, what percent of students on your **wing of your residence hall** consumed 5 or more drink on one occasion?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Next Reset

Section F:

F1. **During the past 30 days,** how often were you in situations where there was alcohol?

If **"Never"** for F1, click here to skip to F10

During the past 30 days, when you socialized with others, how often did you:							
F2		Choose not to drink alcohol	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F3		Use a designated driver	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F4		Drink an alcohol look-alike (non-alcoholic beer, etc)	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F5		Hang out with trusted friends	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F6		Carry around a cup but did not drink any alcohol	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F7		Use public or campus transportation services	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F8		Avoided situations where there was alcohol	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always
F9		Participate in activities that did not include alcohol	☐ Never	☐ Rarely	☐ Sometimes	☐ Usually	☐ Always

During the past 30 days, how often did you do the following things for someone who had too much to drink?		
F10	Took a drink away from someone	
F11	Made someone leave a bar/party	
F12	Drove or walked someone home	
F13	Helped someone use public transportation	
F14	Took someone to the bathroom	
F15	Gave someone water	
F16	Gave someone food	
F17	Kept someone from passing out	
F18	Stayed with someone to take care of them	
F19	Called 911 or got emergency medical assistance	

Next Reset

Section G:
Answer the following questions based on whether or not you would expect the effect to happen to you **if you were under the influence of alcohol**

If I were under the influence of alcohol...

G1	My senses would be dulled.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G2	My writing would be impaired.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G3	I would have difficulty thinking.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G4	I would neglect my obligations.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree

G5	I would feel dominant.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G6	My head would feel fuzzy.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G7	I would feel dizzy.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G8	I would be clumsy.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G9	I would be loud, boisterous, or noisy.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G10	I would feel shaky or jittery the next day.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree

G11		I would act aggressively.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G12		My responses would be slow.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G13		I would act tough.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G14		I would take more risks	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree

Answer the following questions based on whether or not you would expect the effect to happen to you **<u>if you REFRAINED from drinking alcohol in social situations.</u>** If I **ABSTAINED** from alcohol:		
G15	I would be outgoing.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G16	I would be humorous.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G17	It would be easy to express my feelings.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G18	I would be friendly.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
G19	I would feel energetic.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree

G20		It would be easy to talk to people.	**Dis**agree Somewhat **dis**agree Somewhat agree Agree
G21		I would be talkative.	**Dis**agree Somewhat **dis**agree Somewhat agree Agree
G22		I would act sociable.	**Dis**agree Somewhat **dis**agree Somewhat agree Agree

Next Reset

Section H:		
H1	Is Fall 2006 going to be your first and only full-time semester on campus?	☐ Yes ☐ No
H2	What is your gender?	☐ Male ☐ Female ☐ Transgender
H3	How old are you?	
H4	In which hall do you reside?	

H5	What is your class standing?
☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior ☐ Other (Please Indicate):	

H6	Do you consider yourself to be Hispanic or Latino? (Select **one**)
☐ Hispanic or Latino ☐ Not Hispanic or Latino	
H6a	What race do you consider yourself to be? (Select **all** that apply.)
☐ American Indian or Alaska Native ☐ Asian ☐ Black or African American ☐ Native Hawaiian or Other Pacific Islander ☐ White ☐ Other	

H7	Are you a member of a Fraternity or Sorority here at UM?	☐ Yes	☐ No
H7a	If no, do you intend to pledge or join a Fraternity or Sorority at UM?	☐ Yes	☐ No
H8	Are you a member of a varsity athletic team here at UM?	☐ Yes	☐ No
H9	Do you belong to a Living-learning program here at UM?	☐ Yes	☐ No
H9a	If yes, which one?		
H10	Did you complete AlcoholEdu?	☐ Yes	☐ No
H11	Did you pass AlcoholEdu?	☐ Yes	☐ No

How much do you agree with the following statements?			
H12		I carefully read every question and response in this survey.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
H13		I completed this survey in private, without someone looking at my responses.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
H14		I discussed my responses to this survey with other people.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree
H15		I was very honest in my responses to the questions about my alcohol use.	☐ **Dis**agree ☐ Somewhat **dis**agree ☐ Somewhat agree ☐ Agree

Do you have any feedback for the researchers?
Type your questions, comments, suggestions, etc. in the box below:

Please be sure this survey is complete and accurate. Thank you!

Next Reset

PAF
Peers As Family

Hooray! You have completed the Survey! The Peers as Family staff would like to thank you for your participation. We remind you that your responses will be kept confidential, and serve to help us understand the college student population.

*This page serves as confirmation that you completed the survey and at **#currenttime#** on **#todaydate#**. This entitles you to a $10 University Book Store Coupon.*

To receive your $10 University Book Store Coupon:
Our staff will be at the University of Maryland, at three tables near your residence hall during move-in weekend. You can pick up your coupon from us at the following locations from 1pm - 8pm on Saturday, August 26th and from 12:30-7:30pm on Sunday, August 27th:

If you live in **CUMBERLAND,** please visit the Peers as Family table in front of Cumberland Hall, on the side facing La Plata Beach (volleyball courts) and the Campus Recreation Center.

If you live in **ELLICOTT,** please visit the Peers as Family table in the basement lobby of your hall, near the Gemstone offices.

If you live in **DENTON** or **EASTON,** please visit the Peers as Family table in "**the woods.**" This is the wooded area between your residence hall and North Campus Dining Hall.

We will post signs so you will not be able to miss us! **PLEASE BRING YOUR STUDENT ID WITH YOU TO CLAIM YOUR COUPON.**

In the instance that you can not stop by or are unable locate us, your $10 coupon will be mailed to your campus mailing address.

You do not *need* this page to receive your coupon. However, if you would like, you may print this page for your reference by clicking the link below.

Thank you very much for completing the Peers as Family survey. Your responses are critical to our research.

Now that you have responded to the survey items and have thought about possible problems that can result from alcohol use, we want to provide you with some campus information. This information will be given to all students who have responded to the survey, so **do not feel as though this information is reflective of your individual responses.**
If you feel that you or a friend has problems with alcohol use or there are any physical or emotional concerns, we urge you to seek assistance from the following resources. Please know that University Health and Counseling Center resources are ***confidential***.

- University Health Center 301-314-8106
- Counseling Center 301-314-7651
- Victim Advocate Office 301-314-2222

Your honesty in completing this survey is appreciated. Your answers are completely confidential. Individual information will not be shared with campus authorities. However, we would like to reinforce that certain behaviors are illegal and may result in arrest, citation or documentation. Those behaviors include:

- Having sex with someone who is intoxicated
- Rape
- Possession of alcohol (anywhere) if you are under 21
- Drinking or possessing alcohol or other controlled substance on campus property
- Driving with any alcohol in the body if you are under 21
- Driving while under the influence or driving while impaired due to use of any controlled substance at any age
- Public intoxication
- Manufacturing, selling, or possessing a fake ID
- Having sex with a minor (under the age of 18)
- Assaulting or abusing others

Thank you again for your contribution to the Peers as Family Project!
Print this page for your reference: Send to printer

Appendix D: PROC TRAJ Syntax

Unconditional Respondent Model Syntax

```
TITLE "Unconditional (Alcohol Use Only) Model with All Respondents" ;

LIBNAME test5 SPSS 'c:\test5.por' ;

DATA ETOH ;
     SET  test5.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/


TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR dkweekly dkweek_1 dkweek_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
     NGROUPS 3 ;
     ORDER  1 2 2 ;
       IORDER 2 ;
     START       -2.0  0.025  2.6  0.04  -0.0267   1.8  0.104  -0.03
-2.5  -0.39  0.157
33.0   33.0  34.0;


RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time', 'Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Unconditional Repeater Model Syntax

```
TITLE "Unconditional (Alcohol Use Only) Model with Completers" ;

LIBNAME test6 SPSS 'c:\test6.por' ;

DATA ETOH ;
     SET  test6.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/


TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR dubiesal dubies_1 dubies_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
     NGROUPS 4 ;
     ORDER  2 0 1 2 ;
       IORDER 2 ;
    START     2.4  0.13  -0.06  -2.8  1.19  0.107  2.8  0.06  -0.02
-2.4   -0.3   0.16
25.0  25.0  25.0  25.0;



RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Conditional Respondent DRSE Model Syntax

```
TITLE "Conditional (DRSE Only) Model with All Respondents" ;

LIBNAME DRSEbase SPSS 'c:\DRSEbase.por' ;

DATA ETOH ;
     SET  DRSEbase.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/


TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR dkweekly dkweek_1 dkweek_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
       RISK baseline ;
     NGROUPS 3 ;
     ORDER  0 2 2 ;
       IORDER 2 ;
     START         -1.802899    /* 0.02770    -0.142744 */
                    2.72500     0.04668    -0.022578
    1.760316     0.110000     -0.0300000

-2.259667    -0.325862     0.136296
    7.0    -0.212458   5.0    -0.2
;

%TRAJTEST('baseline2=0, baseline3=0');
%TRAJTEST('baseline2=baseline3');

RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Conditional Repeater DRSE Model Syntax

```
TITLE "Completer Model (with DRSE only)" ;

LIBNAME DB_DRSE SPSS 'c:\DB_DRSE.por' ;

DATA ETOH ;
     SET  DB_DRSE.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/


TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR complete comple_1 comple_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
       RISK comple_3 ;
     NGROUPS 4 ;
     ORDER  2 0 1 2 ;
       IORDER 2 ;
     START
2.444     0.13879    -0.06851
-3.06760
1.18066     0.11311
2.8   0.06048   -0.0244

-2.32587   -0.34403    0.15785

-3.76759    0.17176   -1.16863   0.05420   -0.13099   -0.04025
;


%TRAJTEST ('comple_32=0, comple_33=0, comple_34=0');
%TRAJTEST('comple_32=comple_33');
%TRAJTEST ('comple_32=comple_34');
%TRAJTEST ('comple_33=comple_34');
```

```
RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Conditional Respondent All Risk Factor Model Syntax

```
TITLE "Conditional--All Respondent, All Risk Factor Model (with Dummy
Variables)" ;

LIBNAME allrisk2 SPSS 'c:\allrisk2.por' ;

DATA ETOH ;
     SET  allrisk2.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/


TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR dkweekly dkweek_1 dkweek_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
       RISK baseline /*DRSE*/ baseli_1 /*age*/ DG /*dummy gender*/ DLL
/*dummy living learning status*/
          DRother DRblack DRasian DRhispan /*dummy race variables*/
DCsingle DCmixed /*dummy condition variables*/;
     NGROUPS 3 ;
     ORDER  0 2 2 ;
       IORDER 2 ;
     START          -1.324643     /*0.035383    -0.039422*/     1.253839
0.039289    -0.022621
    2.864787     0.0100000     0.0100000    -2.508107    -0.395889
0.150099
    5.208910    -0.263878     0.084384    -0.054383    -0.565056
0.981810
    0.170807     0.327972     0.196503    -0.304606    -0.327482    -
0.030574
   -0.227290    -0.486935    -0.037631    -0.063175     0.038219    -
0.012192
```

```
   -0.018154    -0.011484    -0.034395    -0.018682 ;

%TRAJTEST ('baseline2=0, baseline3=0'); /* DRSE*/
%TRAJTEST ('baseli_12=0, baseli_13=0'); /* age*/
%TRAJTEST ('DG2=0, DG3=0'); /* dummy gender */
%TRAJTEST ('DLL2=0, DLL3=0'); /* dummy living learning status */
%TRAJTEST ('DRother2=0, DRother3=0, DRblack2=0, DRblack3=0, DRasian2=0,
DRasian3, DRhispan2=0, DRhispan3=0'); /*all races together*/
%TRAJTEST ('DCsingle2=0, DCsingle3=0, DCmixed2=0, DCmixed3=0'); /*
single and mixed gender together */

%TRAJTEST ('baseline2=baseline3');
%TRAJTEST ('DG2=DG3');

RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Conditional Repeater All Risk Factor Model Syntax

```
TITLE "Conditional--Completer All Risk Factor Model (with Dummy
Variables)" ;

LIBNAME dumcomp SPSS 'c:\dumcomp.por' ;

DATA ETOH ;
     SET  dumcomp.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/


TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR complete comple_1 comple_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
       RISK comple_3 comple_4 DRother DRblack DRasian DRhispan DCsingle
DCmixed DG DLL ;
     NGROUPS 4 ;
     ORDER  0 2 1 2;
       IORDER 2 ;
     START       -1.542718     /*0.017265    -0.030507  */  1.226228
0.079738    -0.032141
    1.306975    0.0200000  /*  0.0100000  */   2.346852    -0.0100000
-0.0100000
   -2.492895    -0.419609     0.156344     4.971001    -0.111579    -
0.103686
    0.958226     0.236019     0.545103     0.223355    -0.639127    -
0.665516
   -0.397944    -0.467989    -0.046385    -0.104764    -0.760587
0.037712
   -0.006581    -0.023330    -0.022755    -0.047594    -0.059666    -
0.082943
```

```
   -0.079560    -0.043261    -0.056555    -0.703214     0.039567    -
0.006540
   -0.022474    -0.022288    -0.046324    -0.058713    -0.080748    -
0.077522 ;

%TRAJTEST ('comple_32=0, comple_33=0, comple_34=0');
%TRAJTEST ('comple_42=0, comple_43=0, comple_44=0');
%TRAJTEST ('DRother2=0, DRother3=0, DRother4=0, DRblack2=0, DRblack3=0,
DRblack4=0, DRasian2=0, DRasian3=0,
DRasian4=0, DRhispan2=0, DRhispan3=0, DRhispan4=0');
%TRAJTEST ('DCsingle2=0, DCsingle3=0, DCsingle4=0, DCmixed2=0,
DCmixed3=0, DCmixed4=0');
%TRAJTEST ('DG2=0, DG3=0, DG4=0');
%TRAJTEST ('DLL2=0, DLL3=0, DLL4=0');



%TRAJTEST ('comple_32=comple_33');
%TRAJTEST ('comple_32=comple_34');
%TRAJTEST ('comple_33=comple_34');

RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Optimal Respondent Model Syntax

```
TITLE "Conditional--Optimal Model with All Respondents (and Dummy
Variables)" ;

LIBNAME allrisk2 SPSS 'c:\allrisk2.por' ;

DATA ETOH ;
     SET  allrisk2.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/
PROC FREQ DATA=OF;
      /*Tables GROUP*baseline;*/
      Tables GROUP*DG;
      RUN;

/*PROC GLM  DATA=OF ORDER=INTERNAL ;
CLASS GROUP ;
MODEL BASELINE = GROUP / SS3 ;
LSMEANS  GROUP  /  TDIFF ;
RUN ; */

PROC GLM  DATA=OF ORDER=INTERNAL ;
CLASS GROUP DG ;
MODEL BASELINE = GROUP DG GROUP*DG / SS3 ;
LSMEANS  GROUP  /  TDIFF  ;
LSMEANS GROUP / CL ;
LSMEANS GROUP / STDERR ;
RUN ;

PROC LOGISTIC DATA=OF ORDER=INTERNAL;
CLASS DG ;
MODEL GROUP = BASELINE DG ;
RUN;

TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
```

```
     VAR dkweekly dkweek_1 dkweek_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
       RISK baseline /*DRSE*/  DG /*dummy gender*/ ;
     NGROUPS 3 ;
     ORDER  0 2 2 ;
       IORDER 2 ;
     START            -1.558138     1.249373     0.039535    -0.022219
2.060316     0.003100000
    0.00300000    -2.529464    -0.407693     0.159534     2.840866    -
0.217660
   -0.235504    0.846618    0.491551    0.765179
 ;


%TRAJTEST ('baseline2=0, baseline3=0'); /* DRSE*/
%TRAJTEST ('DG2=0, DG3=0'); /* dummy gender */
%TRAJTEST ('baseline2=baseline3');
%TRAJTEST ('DG2=DG3');

RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

Optimal Repeater Model Syntax

```
TITLE "Conditional--Optimal Model with Completers (and Dummy
Variables)" ;

LIBNAME dumcomp SPSS 'c:\dumcomp.por' ;

DATA ETOH ;
     SET  dumcomp.por ;

       Tmean = (0 + 2 + 6) / 3 ;  /* Replace 0, 3, and 8 -- here and
below -- with the assessment month */

     Tetoh0 = 0 - Tmean ;
     Tetoh1 = 2 - Tmean ;
     Tetoh2 = 6 - Tmean ;

RUN ;

/*
PROC CONTENTS DATA=ETOH VARNUM ;
RUN ;
*/

/*PROC FREQ Data=OF;
      tables GROUP*comple_3;

RUN;*/

PROC GLM  DATA=OF ORDER=INTERNAL ;
CLASS GROUP ;
MODEL comple_3 = GROUP / SS3 ;
LSMEANS  GROUP  /  TDIFF ;
RUN ;

TITLE2 'Alcohol Use - Zero Inflated Poisson Model' ;


PROC TRAJ DATA=ETOH OUTPLOT=OP OUTSTAT=OS OUT=OF OUTEST=OE ;

     ID studyID ;
     VAR complete comple_1 comple_2 ;  /* Replace with the name of your
alcohol
measure at Time=0, 1, and 2 */
     INDEP Tetoh0 Tetoh1 Tetoh2 ;
     MODEL ZIP ;
       RISK comple_3  ;
     NGROUPS 4 ;
     ORDER  2 1 0 2;
       IORDER 2 ;
    START      1.573030     0.003146    -0.030160     1.225035
0.079309   /* -0.032173*/
      0.0306975  /*  -0.0100000    -0.0100000    */ 2.346852    -
0.0100000    -0.0100000
```

```
     -2.475577    -0.421848     0.154291     2.763457    -0.107779    -
0.743940
     -1.031060    -0.743940    -1.031060
 ;

%TRAJTEST ('comple_32=0, comple_33=0, comple_34=0');

%TRAJTEST ('comple_32=comple_33');
%TRAJTEST ('comple_32=comple_34');
%TRAJTEST ('comple_33=comple_34');

RUN ;
%TRAJPLOT(OP, OS, 'Alcohol Use v. Time','Zero Inflated Poisson
Model','Alcohol Use','Assessment Time Point in Deviation Form') ;
```

APPENDIX E: Freshmen Only PROC TRAJ Output

Conditional--Optimal Model with All Respondents (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Maximum Likelihood Estimates
Model: Zero Inflated Poisson (ZIP)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-2.03808	0.22468	-9.071	0.0000
2	Intercept	1.82004	0.07863	23.147	0.0000
	Linear	0.10448	0.01625	6.431	0.0000
	Quadratic	-0.03008	0.00843	-3.569	0.0004
3	Intercept	2.75508	0.04560	60.415	0.0000
	Linear	0.04734	0.01101	4.301	0.0000
	Quadratic	-0.02658	0.00596	-4.457	0.0000
	Alpha0	-2.33581	0.30896	-7.560	0.0000
	Alpha1	-0.37986	0.05904	-6.433	0.0000
	Alpha2	0.13712	0.03471	3.950	0.0001
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	4.90024	1.44756	3.385	0.0007
	BASELINE	-0.19134	0.05151	-3.715	0.0002
	DG	-0.05085	0.27736	-0.183	0.8546
3	Constant	6.74559	1.55034	4.351	0.0000
	BASELINE	-0.27174	0.05627	-4.829	0.0000
	DG	-1.01928	0.33281	-3.063	0.0022

BIC= -2146.01 (N=1077) BIC= -2139.74 (N=492) AIC= -2106.16 L= -2090.16

Conditional--Optimal Model with All Respondents (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Effect	X^2	df	p
	24.5047	2	.000004774

baseline2=0, baseline3=0

Conditional--Optimal Model with All Respondents (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Effect	X^2	df	p
DG2=0, DG3=0	11.5008	2	.003181578

Conditional--Optimal Model with All Respondents (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Effect	X^2	df	p
baseline2=baseline3	8.82246	1	.002975448

Conditional--Optimal Model with All Respondents (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Effect	X^2	df	p
DG2=DG3	9.42436	1	.002141220

Conditional--Optimal Model with Completers (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Maximum Likelihood Estimates
Model: Zero Inflated Poisson (ZIP)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	2.44201	0.06421	38.032	0.0000
	Linear	0.13867	0.02093	6.624	0.0000
	Quadratic	-0.06852	0.00977	-7.010	0.0000
2	Intercept	1.18086	0.09299	12.699	0.0000
	Linear	0.12416	0.02512	4.943	0.0000
3	Intercept	-2.85856	0.61920	-4.617	0.0000
4	Intercept	2.81064	0.07205	39.008	0.0000
	Linear	0.06127	0.01915	3.200	0.0014
	Quadratic	-0.02473	0.01001	-2.471	0.0137
	Alpha0	-2.28856	0.35211	-6.500	0.0000
	Alpha1	-0.35544	0.06392	-5.560	0.0000
	Alpha2	0.14106	0.04008	3.520	0.0005
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	-1.30747	0.97348	-1.343	0.1796
	COMPLE_3	0.05742	0.03952	1.453	0.1466
3	Constant	-3.13281	1.42254	-2.202	0.0279
	COMPLE_3	0.14786	0.05372	2.753	0.0060
4	Constant	0.08272	0.93684	0.088	0.9297
	COMPLE_3	-0.04523	0.03937	-1.149	0.2509

BIC= -1474.47 (N=795) BIC= -1464.59 (N=265) AIC= -1432.37 L= -1414.37

Conditional--Optimal Model with Completers (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

Effect	X^2	df	p
comple_32=0, comple_33=0, comple_34=0	11.9764	3	.007464441

Conditional--Optimal Model with Completers (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

	X^2	df	p	Effect
comple_32=comple_33	2.33875	1	0.12619	

Conditional--Optimal Model with Completers (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

	X^2	df	p	Effect
comple_32=comple_34	5.51555	1	0.018848	

Conditional--Optimal Model with Completers (Freshmen Only)
Alcohol Use - Zero Inflated Poisson Model

	X^2	df	p	Effect
comple_33=comple_34	9.37504	1	.002199605	

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