

IDENTIFYING AND PREDICTING TRAJECTORIES OF BINGE DRINKING FROM  
ADOLESCENCE TO YOUNG ADULTHOOD

by

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B.A., Kent State University, 2008  
M.S., Purdue University Calumet, 2011

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

School of Family Studies and Human Services  
College of Human Ecology

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

2014

## Abstract

Early binge drinking (i.e., five or more drinks on a single occasion) is associated with a greater risk of later substance abuse or dependence, and other non-alcohol related problems in adulthood, (e.g., adult civil or criminal convictions). Identifying alcohol use trajectories has mainly been limited to within single developmental periods (i.e., adolescence or emerging adulthood) or between developmental periods up until around the legal drinking age. Using  $N = 1,864$  adolescents from the National Longitudinal Study of Adolescent Health (Add Health) dataset, this paper sought to identify trajectories of binge drinking beginning in adolescence and into adulthood using growth mixture modeling. Family factors (e.g., parent-child communication, shared activities, connectedness, and parental control) were used to predict the various trajectories. Two class trajectories were identified, a low initial-escalating group (87%), and a high initial-deescalating group (13%). Being male and having more close friends using alcohol were predictive of a greater likelihood of being in the high initial-deescalating group. Results can inform therapeutic interventions in an effort to affect an adolescent's trajectory of use and reduce the risk of long-term heavy alcohol use.

*Keywords:* Adolescence, Alcohol use, Binge drinking, Family socialization theory, Growth mixture modeling, Individual and family studies, Trajectories

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## **Chapter 1 - Introduction**

My study will be focusing on family factors related to binge drinking trajectories from adolescence to emerging adulthood, and finally to young adulthood. I hope that by expanding our understanding of the family relationships and characteristics related to binge drinking trajectories, I will be able to inform and strengthen family intervention practices. Through the use of growth mixture modeling, I will identify various trajectories of binge drinking over three developmental periods (i.e., adolescence, emerging adulthood and young adulthood). I will consider how various family factors, related to family support and control, are related to these different trajectories. I will be using the National Longitudinal Study of Adolescent Health (Add Health), examining a sample of 1,864 nationally representative participants over three waves of data, and spanning 14 years. Through an expanded understanding of the differences between adolescents, family therapy practices may be better able to specialize intervention efforts. This specificity hopefully can lead to a reduction in the long-term risks from early binge drinking.

### **The Development of Binge Drinking**

Before reaching the legal drinking age, around 81.4% of people in the United States start to use alcohol (Substance Abuse and Mental Health Administration [SAMHSA], 2013). The rate of binge drinking fluctuates across various developmental periods. Adolescence, generally recognized as ages 10-18, is a period of development often associated with significant storm and stress (Arnett, 1999), and where a significant amount of biological, emotional, and social changes occur (Feldman & Welch, 2012). As adolescents begin asserting their independence, difficulties begin, and there is often a significant escalation in the amount of conflict with parents, mood disruptions, and risky behavior. For the majority, alcohol use begins during adolescence (SAMHSA, 2013), but this use is not confined to one-time experimentation. For many adolescents, alcohol use is frequent and consumed in large quantities. By as early as 15 years of age, around 50% of youth in the United States will have had at least one drink (U.S. Department of Health and Human Services, 2007). Heavy and problematic alcohol use can also begin during adolescence. For example, in the U.S., between the age of 12 and 20 an estimated 5.9 million adolescents, or 15.3%, in 2012 were engaging in binge drinking (i.e., five or more drinks on the same occasion; SAMHSA, 2013; Wechsler, Dowdall, Davenport, & Rimm, 1995),

whereas around 1.7 million or around 4.3%, were classified as heavy drinkers (i.e., binge drinking 5 or more days in a 30 day period; SAMHSA, 2013).

Whereas risky behavior tends to escalate in adolescence, risky behavior peaks during the developmental period defined as emerging adulthood (Arnett, 2000). Adolescents are generally still under closer adult supervision as they begin to explore their identity; however, as the identity exploration continues through the transition to emerging adulthood, when they begin to have much more freedom, risky behavior becomes logistically more possible (Arnett, 2000). After rates of binge drinking begin and increase throughout adolescence (15.3% of those age 12 to 20), they tend to peak during emerging adulthood (39.5% of those adults age 18 to 25; SAMHSA, 2013). Consequently, as people mature out of emerging adulthood and into young adulthood (late twenties and early thirties), where roles and obligations become more significant (Arnett, 2000), the risky behavior tends to decline again. About 37.7% of those age 26 to 29, and 33.7% of those age 30 to 34, report binge drinking in the past 30 days (SAMHSA, 2013).

The initiation into alcohol use, and binge drinking for many, coincides with adolescence, and peaks with emerging adulthood, and then declines into young adulthood. This is consistent with the need for the development of individuality, and the changing and altering of roles over the life span (Arnett, 2000). However, this progression of use is not curvilinear for all, and does not simply accompany and escalate with specific developmental periods. For some, it starts with specific developmental periods, initiating a trajectory of use that may persist throughout the rest of one's life (Viner & Taylor, 2007).

### **The Importance of Examining Binge Drinking**

Alcohol use during adolescence accompanies risk both during adolescence (U.S. Department of Health and Human Services, 2007), and risk that continues beyond adolescence. Simply beginning to use in adolescence coincides with a risk of problematic use that extends into adult life, and can translate into a life-long struggle with alcohol dependency. The risk of qualifying for a diagnosis of alcohol abuse or dependency, per the guidelines from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), increases along with the age of first use (Office of Applied Studies, 2004).

Drinking at all in adolescence increases the potential for future problems with alcohol. Binge drinking in adolescence often precedes both problems with alcohol, as well as non-alcohol

negative outcomes in adulthood (Viner & Taylor, 2007). Binge drinking during adolescence predicts not only the likelihood for alcohol abuse or dependency, but also precedes a history of exclusion from school, leaving school without qualifications, adult civil or criminal convictions, a history of significant accidents, and a lower adult social class by age 30 (Viner & Taylor, 2007). Using the British Cohort Study (BCS70), a longitudinal cohort study of infants born in England, Scotland, Wales, and Northern Ireland, Viner and Taylor (2007) examined how the drinking behaviors of adolescents (i.e., age 16) were related to adult (i.e., age 30) negative outcomes. Whereas binge drinking is connected with adult non-alcohol-related negative outcomes, frequent drinking among adolescents, once or twice a week over the course of a year, only carries a risk for later problems with alcohol but not the other adult problems (Viner & Taylor, 2007). Specifically targeting early binge drinking through interventions could prove to give the greatest benefits. These interventions can potentially reduce not only the likelihood of alcohol abuse or dependence, but also other negative outcomes that co-occur with early binge drinking. An understanding of the intricacies of the different patterns of change in binge drinking, along with understanding what can predict these differing rates of change, can inform the construction of interventions.

Although the probability for alcohol dependence or abuse problems through adulthood is more common for those who initiate use early in adolescence (Grant & Dawson, 2007) and for those who binge drink (Viner & Taylor, 2007), the risk is not absolute. A significant portion of persons are able to take a different path into their future. Although there is consistency in binge drinking from adolescence and into adulthood (McCarty, Ebel, Garrison, DiGiuseppe, Christakis, & Rivara, 2004), this consistency is not determinative for all. Although half of all males and one third of all females age 17 to 20 who binge drink, also binge drink when they are ages 30 to 31, this also means that half of males and two-thirds of females change this behavior. Further, some who are not binge drinkers in adolescence become binge drinkers in adulthood. Of those who do not engage in binge drinking during adolescence, 20% of those males and 8% of those females will binge drink in adulthood (McCarty et al., 2004). Using growth mixture modeling, I will examine whether some family factors are able to predict the different trajectories of binge drinking, potentially predicting lower trajectories of binge drinking.

## **The Purpose of Examining Binge Drinking**

In order to reduce the likelihood of developing substance abuse or dependence problems that persist into adulthood, it may first be necessary to identify the differences in how persons progress with their use of alcohol. Some persons develop problems with substance use while others do not, and some display continuity in use as they mature while others do not. Increased understanding about the different ways people change in alcohol use could lead to developing improved prevention and intervention efforts for alcohol treatment, and lower the risk for long-term problems related to the alcohol use, which is the focus of project

Reducing the long-term risk of alcohol use becomes even more critical when considering that when drinking continues into adulthood, this drinking may also impact future children. The alcohol use of a parent has the potential to influence the age of initiation into alcohol use for their child (Biederman, Faraone, Monuteaux, & Feighner, 2000; Thornberry, Krohn, & Freeman-Gallant, 2006), and thus inadvertently affect both the child's eventual trajectory of use and the risk for a lifetime of alcohol-related problems (Grant & Dawson, 1997; Office of Applied Studies, 2004). This study is focused on binge drinking that begins in adolescence, with the purpose of identifying factors that can be the target of family intervention practices, to the aim of reducing binge drinking trajectories for the individual and potentially future generations.

## **Family Socialization Theory**

In an effort to understand the development and progression of alcohol use, scholars have turned to understanding how the family system influences the development of alcohol use in adolescence. Social modeling served as the primary model for consideration (Barnes, Farrell, & Cairns, 1986), as it became clear that there is a link between parental alcohol use and early adolescent use (Ary, Tildesley, Hops, & Andrews, 1993; Biederman et al., 2000; Coffelt, Forehand, Olson, Jones, Gaffney, & Zens, 2006; Thornberry, Krohn, & Freeman-Gallant, 2006). This relationship was not definitive, however. Some mothers who abstained from alcohol use also had adolescents who abstained, but other mothers who abstained had children who engaged in heavy drinking (Barnes et al., 1986). These differences inspired a perspective that a unique socialization effect was occurring and reducing the adolescent alcohol use. The family socialization theory was then purported to explain this relationship.

Barnes and colleagues (1986) followed the work of Rollins and Thomas (1979) in formulating the family socialization theory. Parental support and control, as defined by Rollins and Thomas (1979), were identified by Barnes and colleagues (1986) as instrumental “for effective socialization into nonproblematic drinking behavior” (Barnes et al., 1986, p. 28). Parental support was defined as any behavior that indicated acceptance, approval or love (e.g., encouraging, praising, helping, or giving affection) for the child, whereas parental control was inclusive of any behavior that guided or directed child behavior (e.g., explanations for rules or physical punishment; Barnes et al., 1986; Rollins & Thomas, 1979). Although family socialization theory does not incorporate or explain individual (i.e., psychological or biological) or larger cultural influences (i.e., sociodemographic), it is the proposed link between the two, as parents provide ongoing socialization parallel to the exposure and influence of these other factors (Barnes, 1990; Barnes, Reifman, Farrell, & Dintcheff, 2000). Both parental control and support have been identified as providing unique contributions to the explanation of alcohol abuse in an adolescent population, and alcohol abuse is the lowest when levels of parental support are high and control is moderate (Barnes et al., 1986). These parenting factors are also related to long-term outcomes, as they predict both levels of drinking in adolescence, and also changes in drinking into emerging adulthood (Barnes et al., 2000). This theory initially explained alcohol use within the adolescent population, and has more recently evolved to also explain general changes in drinking into emerging adulthood. The next necessary expansion of this theory is to understand whether these factors (i.e., parental support and control) affect adolescents and alcohol use in different ways, potentially being related to various classes of adolescents with different trajectories of frequency in binge drinking over time. This study seeks to take this next step in expanding the family socialization theory to include how it can predict multiple trajectories of binge drinking.

### ***The Family as a Predictor of Binge Drinking***

Current therapeutic interventions have identified that incorporating the family unit provides superior outcomes (Baldwin, Christian, Berkeljon, Shadish, & Bean, 2012) and is much more cost-effective than individual therapy (Morgan, Crane, Moore, & Eggett, 2013). Given that there is substantial variation between people in terms of their current binge drinking and their frequency of binge drinking over time, understanding how to reduce binge drinking begins with

understanding the greatest risk factors for later problems. After this is understood, attention can then be given to understanding what risk and protective factors are in play with these problematic trajectories. Following the family socialization theory, parental support and control have been consistently identified as related to lesser problematic alcohol use outcomes (e.g., Barnes et al., 1986; Barnes et al., 2000).

***Parental Support.*** Parental support includes any behavior by a parent that relays feelings of acceptance, approval, or love of the child. This can include behavior that is encouraging, praising, helping, or giving affection (Barnes et al., 1986; Rollins & Thomas, 1979). Parent support that includes time spent with parents, communication about personal problems, and reliance on the parent, has been related to less problematic drinking in adolescence (Barnes et al., 1986). In the context of parenting styles, parental support has also been highlighted as a crucial aspect that contributes to child outcomes. Acceptance and involvement from parents, when combined with strictness and supervision, is related to a reduced likelihood of an adolescent using alcohol at an early age and drinking heavily (Adalbjarnardottir, & Hafsteinsson, 2001). Those parents who highlight both parental support along with control, have adolescents who are the least likely to experiment with alcohol compared to adolescents of parents with deficits in both of these characteristics. When it comes to long-term outcomes, however, parental support has only been indirectly associated with changes in alcohol use over time does not appear to be directly related to changes in alcohol use over time, but has been linked through the effect of parental control (Barnes et al., 2000). To examine parental support in this study, variables including parent-child communication, parent-child shared activities, and parent-child connectedness will be included in analyses, consistent with Barnes and colleagues (1986) initial definition of parental support.

***Parental Control.*** Parental control includes any behavior by a parent that guides or directs the child's behavior, including giving explanations for rules or even physical punishment (Barnes et al., 1986; Rollins & Thomas, 1979). In examining alcohol use, this aspect has been frequently examined and found to be a significant factor in the prediction of alcohol use. Parental control is related to a reduced likelihood of drinking heavily (Adalbjarnardottir, & Hafsteinsson, 2001) and generally engaging in alcohol use (van der Vorst, Engels, Meeus, Deković, Vermulst, 2006). In some studies, control itself was not examined, but instead how permissive parents were. Parental permissiveness has been related to an increased likelihood for a high frequency of



alcohol use over time (Bennett, McCrady, Johnson, & Pandina 1999; Li, Duncan, & Hops, 2001; Tucker et al., 2003). In examining how parenting affects an adolescent's trajectory of alcohol use over time, parental permissiveness has been one of the only factors indicated as significant in the long-term. To examine parental control in this study, a variable examining an adolescent's freedom to make decisions will be included to approximate the amount of guidance parents are giving their child, consistent with Barnes and colleagues' (1986) definition of parental control.

***Intergenerational transmission.*** Beyond family relationships, other factors within the family unit can affect whether an adolescent is likely to use. Specifically, if an adolescent's mother and father are using alcohol, and they are exposed to that, then there is an increase in their likelihood for them to also begin using alcohol (Biederman et al., 2000; Cranford, Zucker, Jester, Puttler, Fitzgerald, 2010; Kerr, Capaldi, Pears, & Owen, 2012; Thornberry et al., 2006). This exposure is an important risk factor to consider, especially given that some family contextual factors, including parental monitoring, have not been found to significantly mediate this association (Kerr et al., 2012). The direct exposure to this type of behavior is likely to be an important family socialization factor above and beyond other parent-child relationship variables. Especially since a parent's own alcohol use could create an overall level of permissiveness specifically to their child using alcohol; they may be more tolerant than of the adolescent's use (Kerr et al., 2012). To identify how much family socialization of alcohol use is occurring, the frequency of alcohol use by the mother and father figure in the home will be included to predict binge drinking trajectories beginning in adolescence.

***Family structure.*** The structure of adolescent families, whether they are in one-parent or two-parent homes, is related to delinquent behaviors (Hawkins, Catalano, & Miller, 1992), where having two-parent homes are considered optimal for supporting the socialization process (Demo & Acock, 1996). Some research suggests that single-parent homes are associated with greater delinquent behaviors (Hawkins et al., 1992). Other research, however, has not supported these differences. Research on alcohol use has found that when race is controlled for, there are no differences in adolescent drinking behaviors between one-parent and two-parent families (Barnes & Farrell, 1992). Furthermore, child well-being is not significantly different between one-parent and two-parent homes in terms of internalizing and externalizing behaviors, self-esteem and efficacy (Lansford, Ceballo, Abbey, & Stewart, 2001). With inconsistent findings on whether family structure contributes significantly to adolescent outcomes, it is important to continue to

consider family structure when predicting binge drinking as related to family processes. This study will control for whether there is one or two parents in the household.

### ***Additional Factors Related to Binge Drinking***

***Peer influences.*** Family socialization theory explains adolescent alcohol use through the lens of family relationships, and suggests a socialization process parallel to other influences (Barnes, 1990; Barnes et al., 2000). In this respect, family socialization theory would state that peers are only influential because the family relationships allowed them to be. However, peer substance use emerges as one of the strongest predictors of alcohol use within adolescence (Crosnoe & McNeely, 2008; Cruz, Emery, & Turkheimer, 2012; Dishion & Owen, 2002). A strong parent-child relationship, a strong attachment, can buffer the risk that having friends who use substances can provide, but peer alcohol use still remains a stronger predictor, and tends to more strongly predict changes in alcohol use over time (Duncan, Duncan, & Hops, 1994; Duncan, Tildesley, Duncan, & Hops, 1995). For this reason, I will also examine the number of close friends using alcohol as a predictor of trajectories of binge drinking.

***Gender.*** Males and females have differing rates of alcohol use. In adolescence, males and females generally have similar rates of current alcohol use, but over time, a greater percentage of males as compared to females will tend to drink, and will be binge drinkers (SAMHSA, 2013). There are differences in terms of outcomes from high levels of drinking for males and females, and specifically, females tend to have more negative outcomes after having fewer drinks than males (Wechsler et al., 1995). This has led to a different definition of the quantity of drinks required to be classified as binge drinking for males and females. The definition can be stated as four or more drinks on a single occasion for females, and five for males (Wechsler et al., 1995). The Add Health did not address this discrimination in their survey, and so I will not be using a different definition for binge drinking for males and females. In many large substance-related surveys, the general definition of five or more drinks on an occasion is used for both males and females (SAMHSA, 2013). I will include gender as a demographic control for this study.

***Race.*** Differences in the prevalence of alcohol use can be found across racial groups. Those who identify as White are more likely than other racial groups to report current alcohol use (SAMHSA, 2013). Fifty-seven percent of Whites report alcohol use in the past 30 days, whereas 51.9% of those who are multiracial, 43.2% of Blacks, 41.8% of Hispanics, 41.7% of

American Indian/Alaska Natives, and 36.9% of Asians do (SAMHSA, 2013). In terms of binge drinking, those who identify as White continue to be of the highest likelihood to drink five or more drinks on a single occasion. Those who are multiracial (25.1%) or American Indian/Alaska Natives (30.2%) are the only racial groups with a greater rate of binge drinking than those who are White (23.9%) (SAMHSA, 2013). Due to the high prevalence of alcohol use in the White population, and the unequal proportion of Whites in our sample, this study will include race as a control variable, with Whites serving as the reference group.

### **Trajectories of Alcohol Use Within Developmental Periods**

The examination of trajectories of alcohol use is not a new topic area. Many have examined trajectories over time in an attempt to identify heterogeneity. Many studies have examined trajectories of alcohol use within developmental periods, and some have examined trajectories across developmental periods. Only one study (i.e., Chassin, & Flora, King, 2004) examined alcohol use across adolescence, emerging adulthood, and young adulthood, but no studies have examined binge drinking across these three developmental periods. This study will fill this gap. I will review the current literature on the trajectories that have been identified both within and across developmental periods to determine the trends already identified, and to give an idea of what I may expect to find through my study.

#### ***Trajectories of Drinking in Adolescence***

Adolescence is a developmental period (ages 10-18) encompassing puberty, and significant physical, cognitive, and social changes (Arnett, 2000; Arnett, 2004). Adolescence is a period of time where many first use alcohol (Office of Applied Studies, 2004), and there is also significant variation in use during this period of time (Colder, Campbell, Ruel, Richardson, & Flay, 2002; Li et al., 2001). Li and colleagues (2001) followed a group of adolescents ( $N = 179$ ) yearly from grade 6 through grade 12 (i.e., 8 total time points), and identified two main trajectories of frequency of alcohol use during this time using piecewise growth mixture modeling. Growth mixture modeling is an analysis that is used to identify differences in growth trajectories for various subgroups (Jung & Wickrama, 2008). One class of adolescents began with an initial high level of alcohol use and increased throughout their high school years (32% of the total sample). A second class initially had a low status of alcohol use, and increased steadily

during middle school, with an escalation in use during high school (68%). During the middle school period, there were significant increases in the alcohol use trajectories, and steeper growth rates during high school years. Gender differences were also identified in this study, where the males were more likely to use alcohol earlier than the females and had greater levels of use during high school. This provides support for the examination of, but no explanation for, gender differences. The females did display a steeper developmental trajectory. Although the findings were significant, this study had a relatively small sample size, and therefore power may have limited the ability to detect more trajectories, if they existed.

The two class model for alcohol frequency across adolescence was supported by Li, Barrera, Hyman, and Fisher (2002) using the National Youth Survey (NYS). Using latent growth mixture modeling with adolescents from age 14 through 18 (i.e., 5 total time points); Li and colleagues (2002) identified two overall trajectories for the frequency of alcohol use each year. One class of users on average had low use (65% of the total sample), while the second class had a high average use of alcohol (35%).

Colder and colleagues (2002), on the other hand, examined trajectories using a much larger sample of adolescents in grade 7 ( $N = 1,918$ ), from the Television, School, and Family Smoking Prevention and Cessation Project. These adolescents were assessed at grades 7, 8, 9, and 12 for their frequency and quantity of alcohol use within the previous month. From the latent growth mixture modeling, adolescents could be categorized into five different groups (i.e., classes), based on the changes over time in how much they were drinking (i.e., quantity) and how often they were drinking (i.e., frequency). Most adolescents could be placed in two categories: occasional and very light drinkers who increased modestly in both frequency and quantity, or as escalators (36% of the total sample) who had much greater increases in both quantity and frequency over time. Other classes identified were occasional heavy drinkers, rapid escalators, and heavy drinkers that had declining frequency.

One final study was identified that examined different classes of alcohol use trajectories (Hix-Small, Duncan, Duncan & Okut, 2004). This study did not solely examine the trajectories for frequency of alcohol use in the past year, but also included marijuana use in the growth mixture model analysis. The NYS was also used for this sample, but included adolescents that were between 11 and 17 years of age at the initial time point, and assessed them at two additional time points a year apart ( $N = 1,725$ ). Seven classes were identified when examining the

comorbidity of alcohol and marijuana use. In terms of alcohol, the following patterns emerge: 1. Low initial use and low to moderate growth in the frequency over time (53% of total sample), 2. Low initial frequency of use with a significant increase in frequency over time (13.6%), 3.,4. and 5. Moderate to high initial frequency of alcohol use that continues over time (6.3%, 4.5%, and 3.2% respectively), 6. High initial alcohol use with sustained use over time (7.7%), and 7. Low initial use of alcohol with substantial use over time (11.7%). Within the classes, some gender differences were also detected in this study, with a tendency for the males the use more frequently and increase in frequency at steeper level over time. The increased power in this study might have more allowed for the detection of additional classes.

Overall, it is clear that adolescents' use changes and varies even within the short period of adolescence. Multiple groups emerge, where some will begin with a low frequency of use, but increase over time, others will start high and maintain at a high level. However, in some cases, some adolescents will even decrease in their use in this developmental period, but a decrease during this period is uncommon and has only been detected in large samples. As a whole, increases from an initial low level are common, but the initial starting point, and the amount of increase varies across groups and across studies. At this point, there is not a clear pattern or number of trajectories emerging in adolescence, likely due to the variety of ways that alcohol use has been measured, the varying number of time points that have been examined, and the low number of adolescents examined in most studies. Whereas trajectories of frequency of drinking have been examined extensively within adolescence, frequency of binge drinking has not. Studies examining alcohol use patterns across emerging adulthood and young adulthood, on the other hand, have incorporated binge drinking.

### ***Trajectories of Drinking in Emerging Adulthood***

With significant variation in adolescence, the question becomes how does change continue through emerging adulthood? In adolescence, most trends indicate an increase in alcohol use occurring over time (Colder et al., 2002; Hix-Small et al., 2004; Li et al., 2001). Emerging adulthood is defined as a unique period of development from the ages 18 to 25 that is distinct from both adolescence and adulthood (Arnett, 2000). "Having left the dependency of childhood and adolescence, and having not yet entered the enduring responsibilities that are normative in adulthood, emerging adults often explore a variety of possible life directions in

love, work, and worldviews” (Arnett, 2000, p. 469). It is notable that this period of time might be especially relevant to patterns of alcohol use, as the age of legal alcohol use begins during the middle of this time period.

Only one study employed GMM procedures to examine trajectories of alcohol use within the emerging adulthood period. Muthén and Shedden (1999) used finite mixture modeling with the National Longitudinal Survey of Youth (NLSY) dataset, and identified three trajectories of heavy alcohol use (6 or more drinks in the past 30 days) during emerging adulthood. These three groups could be classified as a “high” group (12% of the total sample) that drank heavily early on, but steadily decreased until the age of 24, an “up” (6.3%) group that started off low but steadily increased in use from age 18 to 24 and became the most frequent heavy drinking group, and finally a “norm” group (81.7%) that had low frequency of heavy drinking over time resembling the normal expectation. In these groups, the males were more likely to be members of the “high” and “up” groups.

These trajectories, however, are only identified through a period of time where alcohol use has recently become legal, and thus cannot give an indication of whether the trajectory will remain on this path continuing past emerging adulthood and years after the novelty of legal drinking has diminished. It is possible that some groups who declined beginning in emerging adulthood increased afterwards, or that some of those who were at a high level in emerging adulthood decrease significantly after the novelty of legal drinking has worn off. Gaps in understanding how problematic alcohol use develops and continues throughout adulthood still remain. Further, it is difficult to understand what use during adolescence preceded these developmental changes, and potentially set the individual on this course of alcohol use.

## **Trajectories of Alcohol Use Across Developmental Periods**

### ***Trajectories of Drinking from Adolescence through Emerging Adulthood***

In an effort to understand how alcohol use extended past adolescence, several studies looked at the continuity of use from adolescence through emerging adulthood (Chassin, Pitts, & Prost, 2002; Flory, Lynam, Milich, Leukefeld, & Clayton, 2004; Tucker, Ellickson, Orlando, Martino, & Klein, 2005; Tucker, Orlando, & Ellickson, 2003). Chassin and colleagues (2002) identified four trajectories of binge drinking across these two developmental periods using

mixture modeling. Participants ( $N = 454$ ) were followed across three assessments in adolescence, and a fourth assessment 5-7 years later in emerging adulthood. Most of the sample (39.5%) fell into the non-binge drinking group, having not had any episodes of binge drinking. The second most common group was the late-moderate group (30%), which had a late onset of use that gradually, but moderately, increased over time. Next were the early-heavy group (20.9%) that started drinking heavily early on, and only slightly decreased over time. Finally, there was the infrequent group (9.6%), that had a relatively early onset of bingeing, but did not escalate in frequency over time. In this sample, similar to earlier studies, the males were the most likely to be in the more frequent binge drinking groups, while females were more likely to abstain from bingeing or binge drink infrequently. Parent factors were examined, but parent discipline, family conflict, and social support were not significant predictors of these trajectories.

In a study by Flory and Colleagues (2004), examining the amount of lifetime alcohol use across 6 time points from ages 11-12 to 19- 21 ( $N = 481$ ), both males and females had three classes of trajectories. Trajectories were classified as early-onset (16.9% males, 25.2% females), late-onset (63.6% males, 56.8% females), and non-users (19.5% males, 17.9% females). Besides the group that persisted as non-users, the other groups generally increased as they entered emerging adulthood. The only exception was the early-onset men, who displayed a slight decrease by ages 19-21 from the amount of use during ages 15-16. The male and female trajectories were compared, and the only differences emerged at age 13-14 in the early-onset groups and at 15-16 in the early- and late-onset groups. At these time points the males had significantly greater use, but at all other time points across males and females in their respective groups, there were no differences. The quality of family relations was not a significant predictor of the trajectories.

Tucker and colleagues (2003) and Tucker and et al. (2005) followed adolescents ( $N = 5,694$ ) across six time points beginning at age 13 through emerging adulthood at age 23. In addition to the adolescents who abstained from binge drinking (32% of the sample), four classes of trajectories of binge drinking were identified in this large sample of participants. Binge drinking was defined in this study as having three or more drinks when between the ages of 13 and 16, and was defined as having five or more drinks between the ages of 18 and 23, which is slightly discrepant from previous definitions (SAMHSA, 2013; Wechsler et al., 1995). Patterns of binge drinking during adolescence were similar to previous studies focusing on quantity of use

(e.g., Colder et al., 2002). When examining how the alcohol use persisted into adulthood, three of the four trajectories decreased in the amount of binge drinking through emerging adulthood, while one class increased dramatically. This group that increased steadily in use from an initial low amount of use (23.8% of binge drinkers) displayed the greatest amount of risk, and potentially would be a group in the most need of early intervention. The groups that decreased in use over time were classified as moderate stables (54.2%), early highs (8.8%) and adolescent bingers (13.3%). In this sample, the steady increasers were more likely to be male, and females were most likely to be in the moderate stable group (Tucker et al., 2003). Again, males displayed a pattern of greater use than their female counterparts. Parental approval of alcohol use was related to a greater potential for being classified in one of the higher risk binge drinking trajectories.

The groups first identified in adolescence and emerging adulthood separately seem to blend together. During adolescence, most increase in use (Colder et al., 2002; Hix-Small et al., 2004; Li et al., 2001; Li et al., 2002), whereas in emerging adulthood some increase and some decrease (Muthén & Shedden, 1999). For the most part, the increase during adolescence remains, and a pattern of decreasing alcohol use in emerging adulthood presents itself (Chassin et al., 2002; Flory et al., 2004). When specifically examining trajectories of binge drinking as compared to progressions in frequency of alcohol use, different patterns seem to emerge. Whereas frequency of use generally displays an increasing trajectory from adolescence into emerging adulthood (Flory et al., 2004), frequency of binge drinking seems to peak during adolescence, and slowly decline over time (Chassin et al., 2002; Tucker et al., 2003). This is consistent with research stating that adolescents more often binge drink, when they do drink, as compared to their counterparts who have reached young adulthood (National Institutes of Health, 2007).

During the period from adolescence through emerging adulthood, where family variables were examined as protective factors, no significant factors emerged (Chassin et al., 2002; Flory et al., 2004). Parents approving of alcohol use (Tucker et al., 2003) and parental alcoholism did emerge as factors related to higher use trajectories (Chassin et al., 2002), but in no studies did parents prove to be a significant predictive factor of the class trajectory of alcohol use. It is notable that each of these studies examined family factors as predictors of these trajectories only after trajectories had been classified, rather than how the family factors influence trajectories.



### ***Trajectories of Drinking from Emerging Adulthood to Young Adulthood***

Transitioning into emerging adulthood coincides with the transition into the legal drinking age at 21 years old. It is likely that the alcohol consumption levels during this period of time are not consistent with previous patterns of use, and will not be an accurate representation of later patterns of use, but instead are a representation of temporary experimentation by many. Young adulthood, the period of development following emerging adulthood, is one in which most settle into more stability, wherein most persons agree that they have reached adulthood, and of which most have completed a variety of role transitions (i.e., marriage, parenthood, stable employment; Arnett, 2000). In an effort to identify whether problem drinking during emerging adulthood would continue through young adulthood, Bennett and colleagues (1999) used data from the Health and Human Development Project to follow young adults ( $N = 1,073$ ) through this transition. Three age cohorts (ages 18-25, 21-28, and 24-31) were assessed in their frequency and quantity of use during the past year, at two time points seven years apart. Cluster analyses identified four different groups: youth-limited problem drinkers (9.1% of total sample), stable moderate drinkers (38.2%), stable low drinkers (29.5%), and developmentally persistent problem drinkers (23.2%). Most of the participants were found to correspond with the stable moderate group. Between the clusters, it was found that those who were in the older groups were less likely to be classified in the developmentally-persistent problem drinking group, indicating that a maturing out process may occur for some adults well into adulthood. Other differences emerged, including that men were more likely to be classified in the developmentally-persistent group, supporting a greater consistency of their use across time. Some family variables were also indicated as related to trajectories of use. Parental permissiveness was related to drinking that was limited to adolescence. Overall, there was continuity in patterns of drinking over time, and although some matured out of drinking as they aged, most did not.

### ***Trajectories of Drinking Across Adolescence, Emerging Adulthood, and Young Adulthood***

While connecting trajectories from emerging adulthood to young adulthood can provide a view on the continuity and change in alcohol use as one matures (Bennett et al., 1999), also examining how adolescence is related to the trajectory can give a full developmental understanding of changes in use. When examining the various courses of alcohol use that a

person can take, most studies examined these changes within a single developmental period (i.e., adolescence or emerging adulthood), or changes across two developmental periods (e.g., adolescence through emerging adulthood). Only one study has examined changes across these three developmental periods: adolescence, emerging adulthood, and young adulthood (Chassin, Flora, & King, 2004). Assessments of frequency and quantity of use were given to participants ( $N = 454$ ) at three time points in adolescence, one in emerging adulthood, and a final one during young adulthood. Additionally, participants were assessed on their frequency of drug use in the past. Across these developmental periods, using growth mixture modeling (GMM), four groups of trajectories combining alcohol and drug use emerged: abstainers (11.2% of sample), light drinking/rare drug use (24.1%), moderate drinking/experimental drug use (44.6%), and heavy drinking/heavy drug use (20%). The most common group was the moderate group that increased rapidly in alcohol consumption during high school and stabilized in use around the age 23, with the least common group being those who abstained throughout. This is consistent with those studies that began to see a decrease in frequency of binge drinking during emerging adulthood (Chassin et al., 2002; Tucker et al., 2003). Although drinking in adolescence increases the risk that alcohol use will consistently increase over time (e.g., Colder et al., 2002; Hix-Small et al., 2004), including later developmental periods (i.e., emerging adulthood and young adulthood) can shed further light on the process of change in drinking behaviors (Bennett et al., 1999; Chassin et al., 2004).

### ***The Present Study***

The present study expands upon the current literature in two main ways. The first goal of this study was to examine trajectories of binge drinking across three developmental periods: adolescence, emerging adulthood, and early adulthood. Whereas frequency of alcohol use has been examined across these three periods (Chassin et al., 2004), binge drinking has not been. As binge drinking carries a greater risk for both problems in adolescence and in adulthood (Viner & Taylor, 2007), it is important that this gap is filled so that interventions can be informed by understanding trajectories of this higher risk behavior. Differences emerged between trajectories of frequency of use (Flory et al., 2004) as compared to binge drinking (Chassin et al., 2002; Tucker et al., 2003) from adolescence to emerging adulthood. So, although trajectories from adolescence to young adulthood have been identified for frequency of alcohol use (Chassin et al.,

2004), it is likely that the trajectories that arise from this study's examination of binge drinking will be different. Additionally, this study improves upon Chassin and colleagues' (2004) study by employing a large national sample when connecting these developmental periods. The classes of trajectories were determined with the covariates as part of the model to avoid model misspecification (Huang, Brecht, Hara, & Hser, 2010; Jung & Wickrama, 2008; Muthén, 2003; Muthén, 2004). Information from this study identifies what groups of adolescents may be in most need for early interventions, as compared to those who are likely to mature out of problem use. Focusing intervention efforts on those adolescents with the greatest long-term risk may provide the most ability to prevent long-term alcohol use problems.

The second goal of this study, and contribution to the literature was the examination of specific family socialization factors related to a reduced trajectory of use over time, in an effort to inform intervention practices as to what areas are most important to target. In examining the heterogeneity of alcohol use trajectories, as a whole, most studies either did not take into account the influence of the family unit (Colder et al., 2002; Li et al., 2002; Muthén & Shedden, 1999), or primarily examined family risk factors (Hix-Small et al., 2004; Li et al., 2001). Familial alcoholism (Chassin et al., 2002; Hix-Small et al., 2004) and parental permissiveness (Bennett et al., 1999; Li et al., 2001; Tucker et al., 2003) were the risk factors examined, and were both related to an increased likelihood of a high frequency of alcohol use over time. Where family support factors were examined, none were significantly related to trajectories (Chassin et al., 2002; Flory et al., 2004). Chassin and colleagues (2002) suggest that effects of the family are only significant as mediated through peer influences; however, they did not include covariates in the identification of classes, and so their models may have been misspecified by not accounting for these factors. Other covarying factors on the trajectories of alcohol use included peer use (Chassin et al., 2002; Hix-Small et al., 2004) or deviancy (Li et al., 2002), peer pressure resistance (Flory et al., 2004), depression, externalizing behaviors, positive alcohol expectancies (Chassin et al., 2002), self-esteem, church involvement, sensation seeking, and school performance and commitment (Flory et al., 2004). Presently, risk factors as related to alcohol use trajectories are primarily the focus, and protective factors (especially as related to the family unit) are being largely ignored. Because of this, a more complete understanding of the etiology and development of alcohol use trajectories is lacking. Because the lens of this study is to inform

family intervention practices, this study specifically focused on various family factors that could be the target of therapeutic intervention as they are related to trajectories of binge drinking.

### *Hypotheses*

1. Unconditional latent basis growth curve - On average adolescents will have an increasing slope for frequency of binge drinking into young adulthood, and there will be significant variation around the initial frequency, and the rate of change in frequency of binge drinking over time.
2. Conditional GMM – Being older, male, White, from a one-parent family, having more friends who use alcohol, a parent with a greater frequency of alcohol use, having low parent-child communication, few parent-child shared activities, low parent-child connectedness and less parental control will increase the likelihood of being in a trajectory with a higher initial rate of binge drinking, and a greater increase in binge drinking across time.

## **Chapter 2 - Method**

### **Sampling Procedure**

The National Longitudinal Study of Adolescent Health (Add Health) began in 1994-1995 by collecting a sample of adolescents enrolled in grades 7 to 12 from various schools across the United States (U.S.; Harris et al., 2009). An initial list of 26,666 U.S. high schools was sorted based on enrollment size, school type, region, location, and percent White. After being sorted, these schools were divided into groups for systematic sampling, which then targeted 80 schools and gave greater probability of being selected to those with greater enrollment size. For those high schools that did not include 7<sup>th</sup> and 8<sup>th</sup> grades, feeder schools supplying enrollment to that high school were identified and selected, again greater probability of being sampled was given to those schools that supplied a larger percentage of students to the entering class each year. A total of 52 feeder schools were added to the sample of 80 high schools, for a final total of 132 schools. After being contacted to be part of the study, only 52 of the high schools were both eligible and agreed to participate. In order to maintain the sample number, twenty-eight similar schools were selected based on the sorting frame to replace those that did not participate. Parental consent was required and obtained using passive consent forms, meaning that unless a form with a signature was returned to the school by the parent, parental permission was assumed (Harris et al., 2009). For some schools, however, active consent was required, and a form with a signature giving permission was necessary for participation.

Multiple panels of data were collected on the adolescents through different surveys and over the waves of data collection. Being a longitudinal study, three additional waves of data were collected after the initial administration of assessments. Wave II was collected one to two years later in 1996, followed by Wave III five to six years later in 2001-2002, and the final wave, Wave IV, was collected six to seven years later in 2007-2008. At Wave I, data were collected in-school through surveys given to the students and the school administrators, and also in-home with the adolescents and their parents. Waves II through IV also collected information through the in-home surveys, with an additional interview collecting information from the young adults' partners at Wave III. These surveys collected information on demographics, general health, academics and education, relations with parents, personality and the family, the use of tobacco,

alcohol, and drugs, as well as other categories related to relationships, mental health, and other risk and protective factors.

The sampling strategies used for this study targeted schools based on specific criteria, yielding an unequal probability for being selected to participate in the Add Health study, and because of this strategy, biases can be present in analysis estimates (Chantala, 2006; Harris et al., 2009). In order for analyses to be generalized to the overall population, and to prevent Type I errors, sampling weights and clusters have been constructed for use with this data. In regards to sampling, some populations were oversampled in this study, and therefore disproportionately represent their population. The sampling weights correct for any disproportionate sampling related to race, socioeconomic status, etc. so that any population parameters and the standard errors are estimated without bias, and allow for the generalization of findings to the national population. The sampling weights specific to longitudinal analysis, also correct for missing data if a participant was not interviewed at a specific time point. The respective weights that have been calculated and designed for analyses using multiple waves, including Wave IV, will be employed in this longitudinal study. Further, schools were selected after being grouped based on a variety of criteria, and so analyses should consider the clustering of the data. By accounting for the clustering of students, the overestimate of variance that would have occurred otherwise and biased the data can be controlled for. In order to maintain generalizability, only those adolescents with sampling weights available should be used in the analyses (Chantala, 2006; Tourangeau Shin, & National Longitudinal Study of Adolescent Health, 1999); otherwise, results cannot be said to represent a population outside of the sample. For this study, only those adolescents with weights constructed correcting for the sampling method and longitudinal analysis, including the fourth wave, will be included within my sample.

## **Participants**

The public use data for the Add Health was used for the current research. This sample was limited from the full dataset ( $N = 12,105$ ) and made available to the public after about half of the core sample and half of the oversample of African-American adolescents that had a parent with a college degree from Waves I and II ( $N = 6,504$ ) were randomly selected. At Wave III,  $N = 4,882$  of the respondents from the Wave I public use sample were re-interviewed. Finally, at Wave IV, 92.5% of the respondents from the core sample were located, and 80.3% were eligible

and interviewed, or  $N = 5,114$  respondents of the public use dataset. According to Harris and colleagues (2009), only those participants who were interviewed at all four waves of data collection, and for whom a sampling weight was constructed, should be included in longitudinal analyses. This limited the larger sample to only those that had sampling weights, leaving a sample size of 3,342 respondents, 51.4% of original public use sample.

This study used data from Wave I, III, and IV to examine binge drinking trajectories across adolescence, emerging adulthood, and young adulthood. The sample was reduced so that the age range of participants at each wave was limited to a single developmental period. In Wave I, adolescents ranged from age 11 to 21 ( $M = 15.06$ ,  $SD = 1.62$ ). Those adolescents that had already matured into the emerging adulthood stage (i.e., those 18 years and older) at Wave I were eliminated from the study ( $n = 200$ ). In order to also limit Wave III to the emerging adulthood period, those participants at the lower end of the age range also needed to be removed. The sample was then limited to those between grade 9 and 12, the traditional high school range. This eliminated  $n = 1,277$  participants, limiting the sample used in this study to  $N = 1,864$  adolescents between grades 9 and 12 and ages 14 and 17. This final sample represented 28.66% of the original Add Health dataset.

The final sample for use with the current study was diverse. In this sample at Wave I, adolescents ranged from age 13 to 17 ( $M = 15.77$ ,  $SD = .96$ ), from 19 to 26 ( $M = 22.16$ ,  $SD = .98$ ) at Wave III, and from 26 to 31 ( $M = 28.66$ ,  $SD = 1.02$ ) at Wave IV. Again, only Waves I, III and IV will be used for this study, as the interest is in differences across three developmental periods (i.e., adolescence, emerging adulthood, and young adulthood) that coincide with the age ranges at each wave. The sample was relatively evenly split between males and females with 44.5% of the sample being male and 55.5% being female. In terms of family structure, 29.7% of the adolescents came from a one-parent home, while 69.5% came from a two-parent home. Finally, the distribution amongst races for the sample was 1.7% Native American, 3.3% Asian, 4.7% Hispanic, 20.4% Black, and 69.2% White. For the purposes of this study, the race variable served as a control. In order to maintain power, the race variable was dummy coded with Whites serving as the comparison group. White was employed as the reference group due to the unequal proportion of Whites in the sample, and the elevated use of alcohol in the White population (SAMHSA, 2013). The final race categorization was 69.2% White and 30.0% all other races. Only 0.8% of responses for race were missing.

I examined whether there were significant differences in the variables of interest for this study between those who were included in the final sample as compared to those who were eliminated from the final sample. Participants were either removed from of the final sample because of missing sampling weights, or because they were outside of our age range. I compared these two groups on the variables using a t-test. The final sample had a lower frequency of binge drinking in emerging adulthood ( $t = -5.49$ ), less parent-child communication reported ( $t = -5.73$ ), but more parent-child connectedness ( $t = 5.24$ ), and more parental control ( $t = 4.88$ ). They also had a younger age ( $t = -9.02$ ), were more likely to be from a one-parent family ( $t = -3.17$ ), and had less friends using alcohol ( $t = -5.97, p < .05$ ). These differences should be noted when considering how the data can generalize to the population.

## **Measures**

Primarily, this study was interested in identifying multiple trajectories of binge drinking starting in adolescence and through adulthood. Secondly, this study was interested in predicting the various trajectories of use with protective factors and risk factors. Measures quantified binge drinking behaviors for use in the growth mixture model, and also identified various family socialization variables predictors of binge drinking trajectories.

### ***Binge Drinking***

Substance use in the sample was assessed at all three waves of data. Binge drinking, was assessed through a single item, asking participants, “Over the past 12 months, on how many days did you drink five or more drinks in a row?” Binge drinking was measured the same way across all waves, and responses had the same scale, but Wave I responses were originally coded so that a lesser value indicated greater frequency of binge drinking. The Wave I item was reverse coded to be consistent with the additional two waves so that a greater number represented a higher level of drinking. Responses were on a likert-type scale from 0 = *never*, 1 = *1 or 2 days in the past 12 months*, 2 = *once a month or less*, 3 = *2 or 3 days a month*, 4 = *1 or 2 days a week*, 5 = *3 to 5 days a week*, to 6 = *every day or almost every day*.

### ***Family Socialization Measures***

Family support and control variables were assessed on a variety of dimensions at the first wave of the Add Health study: parent-child communication, shared activities, connectedness, and



parental control. The measures used were adapted from the measures identified in the research conducted by Resnick et al. (1997), Beuhring et al. (1998), and Crosnoe and Elder (2004) who used the Add Health dataset.

**Communication.** Adolescents reported the amount of communication with their parents through eight items on the *Relations with Parents* scale, four regarding the communication with the mother, and four with the father (Crosnoe & Elder, 2004). Adolescents were asked to report (0 = *no* or 1 = *yes*) on whether they had talked to their parents about different topics in the previous four week period. For example, whether they had “talked about someone (s/he was) dating, or a party (s/he went to).” Other topics included personal problems, school work or grades, or other things s/he was doing in school. An average score for the amount of communication reported with a mother and a father figure was calculated separately, and then the average of the two parents’ scores was taken, similar to Crosnoe and Elder’s (2004) construction of the variables. In this way, if scores for either the mother or father were missing, then the magnitude of the adolescent’s score would not be negatively impacted. There was a significant correlation between the adolescent’s report of communication with their mother and father ( $r = .54, p < .001$ ). Internal consistency for the items was acceptable (Cronbach’s  $\alpha = .68$ ) per the guidelines dictated by George and Mallery (2003), and was similar to the internal consistency reported by Crosnoe and Elder (2004) (i.e.,  $\alpha = .70$ ).

**Shared activities.** The amount of parent-adolescent shared activities was reported through ten questions on the *Relations with Parents* scale, again with half of the questions regarding the mother-adolescent and half regarding the father-adolescent interactions (Beuhring et al., 1998; Crosnoe & Elder, 2004). Adolescents were asked to report 0 = *no* or 1 = *yes* as to whether they had done several activities with their parent in the previous four week period. An example question includes whether the adolescent had “gone shopping” with his/her parent. Other suggested activities included playing a sport, going to a religious service or church-related event, going to a movie/play/museum/concert/sports event, or worked on a school project. The adolescent-rated score for the amount of shared activities with his/her mother and father was calculated by taking the average, and then the average of the two parents’ scores was taken. This procedure was suggested by Crosnoe and Elder (2004). There was a significant positive correlation between the reported shared activities with the mother and the father ( $r = .52, p <$

.001). The internal consistency for the items was modest (Cronbach's  $\alpha = .60$ ), but consistent with the reliability that Crosnoe and Elder (2004) reported (i.e.,  $\alpha = .64$ ).

**Connectedness.** The degree of connectedness between the parent and child was assessed through self-report from the adolescent (Crosnoe & Elder, 2004). Parent-child connectedness was assessed through eight questions, with four about the relationship with the mother and four with the father (Crosnoe & Elder, 2004). On a scale from 1 = *not at all* to 5 = *very much*, adolescents were asked "How close do you feel to your (mother/father's name)." The other three questions reporting parent bond were reverse coded so that a higher number indicated greater parent-adolescent bond (1 = *strongly disagree* to 5 = *strongly agree*). An example question includes: "Most of the time, your mother is warm and loving toward you." The other two questions on each mother and father scale asked whether the adolescent was satisfied with the way they communicate with their parent and whether they are satisfied overall with their relationship with their parent. The adolescent-rated score for his/her bond with his/her mother and father was calculated by taking the average for each parent, and then the average of the two parents' scores was taken (Crosnoe & Elder, 2004). There was a significant positive correlation between the connectedness an adolescent reported with their mother and father ( $r = .48, p < .001$ ). The internal consistency for the adolescent-reported bond was good (Cronbach's  $\alpha = .85$ ), and again, similar to the consistency Crosnoe and Elder (2004) reported (i.e.,  $\alpha = .88$ ).

**Parental control.** Adolescents answered seven questions regarding their freedom to make decisions on their own on the *Relation with Parents* scale (Beuhring et al., 1998). Adolescents were asked (0 = *no*, 1 = *yes*) if his/her parents let him/her make decisions about the time they must be home on weekend nights, the people he/she hangs around with, what s/he wears, how much television s/he watches, which television programs s/he watches, what time s/he goes to bed on week nights, about what s/he eats. The average of the items was taken to create the overall adolescent decision making ability construct. The internal consistency for adolescent decision making ability was modest (Cronbach's  $\alpha = .59$ ).

### ***Control Variables: Demographics and Alcohol Exposure Items***

A number of variables were controlled for in my analyses. Multiple demographics served as control variables in this study. Age and gender were controlled for, with 0 = *male* and 1 = *female*. Race also served as a control. In order to obtain the categorization of race, the series of

multiple response items for racial identification had to be recoded. This was done in a hierarchical way, as suggested by Harris and colleagues (2009), where participants were classified within only one race category. This process began with participants who identified as Hispanic or Latino, as they were given a racial designation of “Hispanic” and were removed from further classification. Next, those who identified as Black or African American were coded as “Black or African American”, and then removed from any further categorization processes. This process continued for the remaining categories of race, and was conducted in the following order: Asian, Native American, Other, and White. This variable was then dummy coded by combining all racial groups other than White and assigning them as 1 = *Other* and placing those participants in the White category as the reference group 0 = *White*. Family structure will be controlled for, with 1 = *one-parent family* and 2 = *two-parent family*.

With exposure to alcohol from both parents and peers being an important factor in the development of alcohol use behaviors (Cranford et al., 2010; Cruz et al., 2012), three exposure to alcohol variables served as controls. Substance use of the parents in the home was assessed from the parent in-home interviews. One parent, generally the biological mother (81%) or other maternal figure (5.5%), was asked how much she drank alcohol from 1 = *never* to 6 = *nearly every day*. That same parent was asked, “How often did your current (spouse/partner) drink alcohol?” in the past 12 months, on the same 6-point scale. Peer alcohol use was assessed by asking the adolescent at Wave I, “Of your three best friends, how many drink alcohol at least once a month?” from 0 = *no friends* to 3 = *three friends*.

## **Data Analysis Plan**

### ***Unconditional Latent Basis Growth Curve***

Prior to examining multiple trajectories of binge drinking, an unconditional latent growth curve (LGC) was conducted to examine the general trajectory of binge drinking. Analyses were completed using *Mplus* version 7.0 (Muthén & Muthén, 1998-2012). LGC uses the observed indicators at each time point, to estimate an initial level (i.e., the intercept), and an average rate of change over time (i.e., the slope) for a variable (Byrne, 2012; Duncan, Duncan, & Strycker, 2006). The observed frequency of binge drinking at each time point was used as the factor loadings for two latent constructs, one representing the intercept and the other the slope. Each of

the parameters from the intercept to the observed frequencies of binge drinking over time was constrained to a value of 1, to indicate that the intercept remains constant over time. The parameters from the slope to the observed frequencies of binge drinking specify what the shape of the growth over time is. Constraining one of the indicators to 0 labels the intercept, in this study this will be the first wave of data. With three or more observed time points, it is possible to test for nonlinear trends in the data, known as a latent basis growth curve model (Duncan et al., 2006; Grimm, Ram, & Hamagami, 2011; Ram & Grimm, 2007). This is done by simply not specifying one of the loadings from the slope to an observed time point (Duncan et al., 2006; Grimm et al., 2011; Jung & Wickrama, 2008; Ram & Grimm, 2007). For this study, I freely estimated the loading to the second time point, Wave III, and constrain the loading to Wave IV at 1. Results give information about the average initial frequency of binge drinking, the average rate of change in binge drinking over time, and how the initial frequency of binge drinking is related to changes over time. In this latent basis growth curve, the mean slope value indicates the total amount of growth in frequency of binge drinking from adolescence to young adulthood. The estimated loading for Wave III on the slope, can be interpreted as the proportion, or percentage, of change that occurred up to that point (Ram & Grimm, 2007). The average frequency of binge drinking in emerging adulthood can be calculated the following equation: [Mean Intercept + (Estimated Factor Loading\*Mean Growth Value)] (Ram & Grimm, 2007). Although this method provides flexibility in estimating nonlinear growth over time, the drawback becomes the inability to then predict behavior outside of the observed period (Grimm et al., 2011). I did not use this data to make predictions of what change in the frequency of binge drinking may occur beyond young adulthood.

### ***Conditional Growth Mixture Model***

For the examination of multiple trajectories of binge drinking, growth mixture modeling (GMM) was employed. Whereas latent growth curves seek to identify an average rate of change over time, growth mixture modeling allows researchers to capitalize on “interindividual differences in intraindividual change [while] taking into account unobserved heterogeneity (different groups) within a larger population” (Jung & Wickrama, 2008, p. 303). Growth mixture modeling allows for there to be differences between individuals in the intercept and slope;

groups of individuals will vary collectively around different means for both the intercept and slope.

In a growth mixture model analysis, conducting an unconditional latent class model, without including the covariates, can lead to a misspecification of class membership for participants (Huang et al., 2010; Jung & Wickrama, 2008; Muthén, 2003; Muthén, 2004). For this reason, it is recommended that any, and all relevant, covariates should be included in model specification throughout the process of identifying the number of class trajectories. Even covariates that are not correlated with the growth factors should be included, as they will provide much additional information in the group classification process (Huang et al., 2010). The controls, alcohol exposure, and family socialization variables served as covariates in this model. The intercept, slope, and trajectory class membership were regressed on all the covariates in this model. Regressing the growth factors (i.e., the intercept and slope) directly on the covariates allows for the estimation of group membership after controlling for the direct effects of the covariates on the growth factors and class membership (Huang et al., 2010; Jung & Wickrama, 2008).

In identifying the best number of classes of trajectories to fit the data, an iterative process was used to add classes to the model, and compare several fit indices to determine which model is the best fit to the data (Jung & Wickrama, 2008). If adding a class to the model serves to improve model fit, then the class should be retained. This process was continued until adding additional classes no longer served to improve model fit, the model no longer converged and estimated, or adding additional classes violated parsimony and no longer made sense. Jung and Wickrama (2008) suggest several steps and model fit indices to be examined, while also emphasizing the importance that model parsimony, interpretability, and theory should play in the deciding upon the appropriate number of classes. The first step to model estimation was identifying whether the model converged, meaning that the values for each class were able to be estimated. If the log likelihood value repeats in the output, then the model had converged; a smaller log likelihood value, as compared to the previous model, indicates better fit. If the model does not converge, the number of random sets and start values can be increased. Next, entropy was examined. Entropy reflects the ability of the model to classify people into distinct classes. The more distinct the classes are, the less likelihood there is for a person being classified in more than one group. An entropy value greater than .8 is acceptable. The Bayesian Information

Criteria (BIC) was next examined, and a smaller value indicates better fit. Finally, the Lo, Mendell, and Rubin (2001) likelihood ratio test (LMR-LRT) was examined. A significant LMR-LRT and BLRT indicate that the model with more classes ( $k$ ) is significantly better than the model with fewer classes ( $k-1$ ). The Bootstrap LRT was not be examined in this model since it is not available when using sampling weights (Muthén & Muthén, 1998-2012). Again, determining the final number of classes to be retained included an evaluation of the fit indices, as well as consideration of parsimony, and how previous research studies inform the present hypotheses.

The growth mixture modeling procedure is a person-centered type of analysis that attempts to identify distinct groups of individuals based on their response patterns (Jung & Wickrama, 2008). There are different assumptions about the variability amongst the groups, and even within the groups that can be held with this modeling procedure. The primary assumption of growth mixture modeling, that differentiates it from simple growth modeling, is that there are “different groups of individual growth trajectories (that) vary around different means” (p. 304). In terms of longitudinal change on a variable, this means that there are groups of individuals that started at different levels, and that changed at different rates over time. Additional assumptions in this model, include whether there is within group variance around the intercept and slope, whether that variance is different between groups, whether the covariance of the slope and intercept differs within group, and whether the covariance differs between groups. Latent class growth analysis (LCGA) assumes that individuals within classes are homogeneous, and so fixes the variance and covariance around the growth trajectories to be zero (Jung & Wickrama, 2008). This was the starting point for our process of identifying the various class trajectories.

Because there is much variance in the literature on the trajectories of alcohol use (e.g., Colder et al., 2002; Hix-Small et al., 2004; Li et al., 2001; Li et al., 2002), it seemed more probable that trajectories were not entirely distinct, and that within class differences would still exist. Further, much of the alcohol research that has examined various drinking trajectories has utilized GMM in their estimation (Chassin et al., 2002; Chassin et al., 2004; Hix-Small et al., 2004; Li et al., 2001; Tucker et al., 2005). Therefore, after estimating the LCGA model, four models were estimated and class membership examined: a.) the class-invariant, diagonal, b.) the class-varying, diagonal, c.) the class-invariant, non-diagonal, and d.) the class-varying, non-diagonal (Masyn, 2013). The class-invariant, diagonal model allows for variance around the

intercept and slope to exist within groups, but not between groups. The class-varying, diagonal frees the variance around the intercept and slope to be different across the groups. The class-invariant, non-diagonal holds the between group variance on the growth factors to be equal, but also allows for there to be covariance of the intercept and slope. The final model, the class-varying, non-diagonal allows for both within-group and between-group variance and covariance of the growth factors.

Throughout all of the analyses, I also allowed for the shape of the trajectory to be non-linear and vary across classes, by allowing for the Wave III parameter to be freely estimated across classes (Grimm, Ram, & Estabrook, 2010; Li et al., 2001; Muthén, 2005, July 2). In estimating this type of model, errors can occasionally occur during computation, including the emergence of Heywood cases, or negative residual variance estimated. A negative residual variance on the slope or intercept can indicate that there is no individual variation, and so the variance can be constrained to 0 in this case (Muthén, 2005, August 28). Model fit indices were examined across all of the estimated models, and considered in addition to model parsimony, and interpretability, to determine the correct number of classes of trajectories of binge drinking.

### ***Missing Data***

Missing data can present a problem within data analyses, as biases can present themselves within results (Acock, 2005; Allison, 2003). With the use of the Add Health sampling weights, an estimator that can handle the complex data, as well as missing data, is necessary. Maximum likelihood with robust standard errors (MLR) will be utilized for the estimation of missing data, and all parameter estimates in the models (Yuan & Bentler, 2008). MLR is a robust estimator that can manage non-normality and missing data, whereas other estimators that can handle non-normality cannot also estimate for missing data (Muthén, 2011). MLR employs a sandwich estimator for the estimation of standard errors and a chi-square test statistic in the context of maximum likelihood parameter estimation. MLR estimates are robust to both non-normality and also to non-independence when used along with a complex modeling technique in *Mplus* version 7.0 (Muthén & Muthén, 1998-2012). Again, this allows for parameter estimates to be computed when there is missing data, non-normality, and complex data techniques being incorporated.

## Chapter 3 - Results

Both descriptive statistics and bivariate analyses were examined initially. For full frequencies of binge drinking during adolescence, emerging adulthood, and young adulthood see Table 1. In examining the frequency of binge drinking for adolescents, I identified whether there were any adolescents who did not binge drink at all over the course of the three waves. Around 29% of the sample ( $n = 535$ ) remained as non-binge drinkers throughout the three waves of data. For full descriptive statistics on adolescent binge drinking, the family socialization, alcohol exposure and demographics variables see Table 2. Generally, the frequency of binge drinking increased over time, with an overall sample peak in the frequency of binge drinking in emerging adulthood (i.e., at Wave III).

**Table 1. Descriptive Statistics for Binge Drinking Behaviors from Adolescence, Emerging Adulthood, and Young Adulthood (N = 1,864)**

	Wave I		Wave III		Wave IV	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
<b>Binge Drinking</b>						
Never	1339	71.8	859	46.1	953	51.1
1 or 2 days in the past 12 months	195	10.5	312	16.7	316	17.0
Once a month or less	130	7.0	205	11.0	207	11.1
2 or 3 days a month	90	4.8	207	11.1	173	9.3
1 or 2 days a week	61	3.3	192	10.3	135	7.2
3 to 5 days a week	32	1.7	61	3.3	48	2.6
Every day or almost every day	15	.8	19	1.0	26	1.4



**Table 2. Adolescent Binge Drinking and Family Socialization Variables: Descriptive Statistics (N = 1,864)**

Variables	<i>M or %</i>	<i>SD</i>	Range	$\alpha$
Binge Drinking W1 <sup>a</sup>	.65	1.28	0 – 6	
Binge Drinking W3	1.36	1.61	0 – 6	
Binge Drinking W4	1.18	1.54	0 – 6	
Parent-Child Communication	.49	.29	0 – 1	.68
Parent-Child Shared Activities	.29	.20	0 – 1	.60
Parent-Child Connectedness	4.29	.65	1.20 – 5.00	.85
Parental Control	.24	.21	0 – 1	.59
Parent Alcohol Use	2.00	1.21	1 – 6	
Partner Alcohol Use <sup>b</sup>	2.59	1.60	1 – 6	
Number of Friends Using Alcohol	1.24	1.17	0 – 3	
Age	15.77	.96	13 – 17	
Gender <sup>c</sup>	.56	.50	0 – 1	
Race <sup>d</sup>	.30	.46	0 – 1	
Family Structure <sup>e</sup>	1.70	.46	1 – 2	

<sup>a</sup>W = Wave. <sup>b</sup>Partner Alcohol Use refers to the frequency of alcohol use by the partner of the parent who was interviewed through the parent in-home survey at Wave I. <sup>c</sup>Gender: 0 = *male*, 1 = *female*. <sup>d</sup>Race: 0 = *White*, 1 = *Non-White*. <sup>e</sup>Family Structure: 1 = *one-parent home*, 2 = *two-parent home*.

Bivariate analyses indicated significant correlations between binge drinking and the family socialization variables (see Table 3 for all bivariate correlations). Binge drinking in adolescence (i.e., Wave I) was negatively related to parent-child shared activities ( $r = -.13, p < .001$ ), parent-child connectedness ( $r = -.09, p < .001$ ), and parental control ( $r = -.09, p < .001$ ), but was not related to parent-child communication. Only parental control was related to binge drinking in emerging adulthood ( $r = -.07, p < .01$ ), and no parental control or support variables were related to binge drinking in young adulthood. Being exposed to others who use alcohol was related to a greater frequency of adolescent alcohol use. The more frequent a parent and their partner used alcohol was related to a greater frequency of adolescent binge drinking ( $r = .12, p < .001$ ;  $r = .09, p < .001$  respectively), as were the number of three closest friends using alcohol ( $r = .45, p < .001$ ). Each of these exposure variables remained significant predictors of frequency of binge drinking in emerging adulthood and young adulthood. On average, males generally had a greater frequency of binge drinking across all three developmental periods, as did those who were White (see Table 3). Age was only related to the frequency of binge drinking during adolescence ( $r = .13, p < .001$ ) and the number of parents in the household was only related to binge drinking in emerging adulthood (Wave II) ( $r = .06, p < .05$ ).

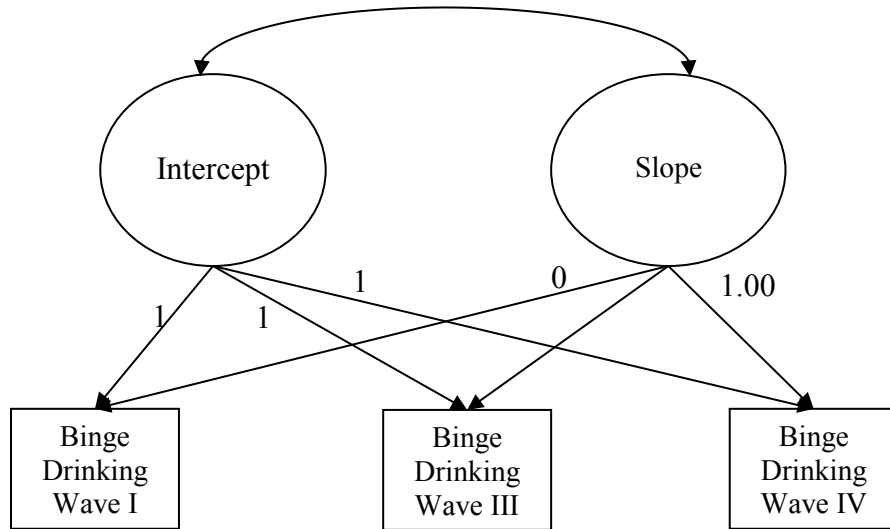
**Table 3. Adolescent Binge Drinking and Family Socialization Variables: Bivariate Correlations (N = 1,864)**

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Binge W1 <sup>a</sup>	--												
2. Binge W3	.24***	--											
3. Binge W4	.19***	.47***	--										
4. Parent-Child Communication	-.03	-.02	-.00	--									
5. Parent-Child Shared Activities	-.13***	-.01	-.04	.27***	--								
6. Parent-Child Connectedness	-.09***	-.01	-.01	.27***	.28***	--							
7. Parental Control	-.09***	-.07**	-.04	-.11***	.05	.07**	--						
8. Parent Alcohol Use	.12***	.22***	.20***	.09***	-.06**	-.05	.09***	--					
9. Partner Alcohol Use <sup>b</sup>	.09**	.18***	.18***	.10**	-.11***	-.11***	.11***	.50***	--				
10. Friends Using Alcohol	.45***	.21***	.17***	.03	-.13***	-.10***	.11***	.11***	.09**	--			
11. Age	.13***	.01	-.01	.07**	-.13***	.00	-.18***	.02	.03	.13***	--		
12. Gender <sup>c</sup>	-.11***	-.29***	-.20***	.12***	.04	-.13***	-.01	-.05*	-.01	-.04	-.06**	--	
13. Race <sup>c</sup>	-.09***	-.19***	-.13***	-.02	-.00	-.01	.12***	-.14***	-.09**	-.10***	-.02	.07**	--
14. Family Structure <sup>d</sup>	-.04	.06*	.00	-.19***	-.04	.02	.04	-.05*	-.04	-.04	.00	-.01	-.17***

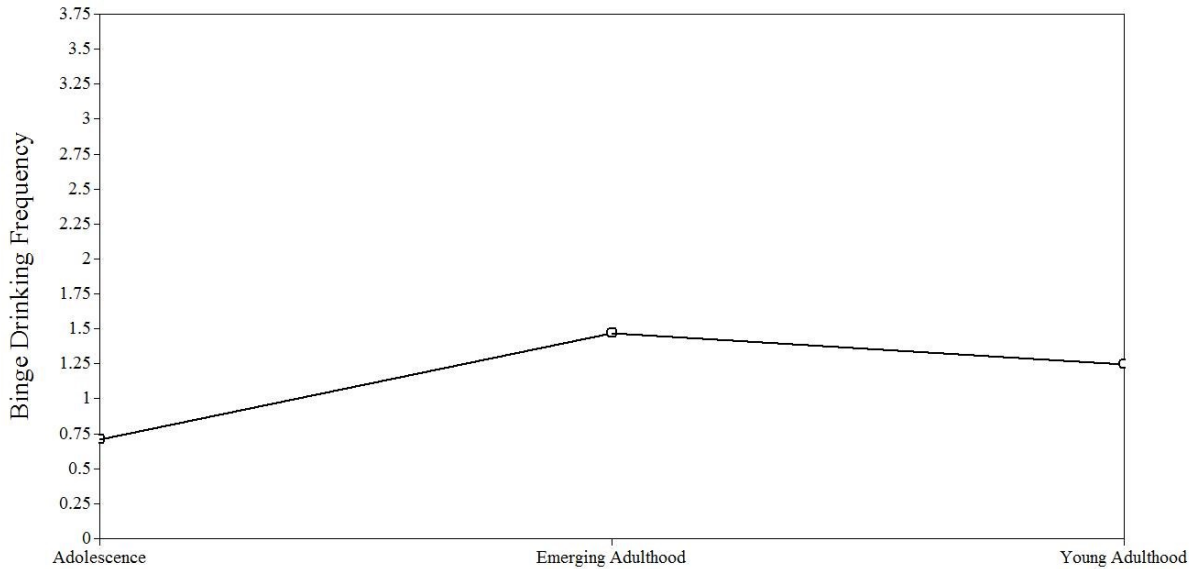
*Note.* <sup>a</sup>W = Wave. <sup>b</sup>Partner Alcohol Use refers to the frequency of alcohol use by the partner of the parent who was interviewed through the parent in-home survey at Wave I. <sup>c</sup>Gender: 0 = *male*, 1 = *female*. <sup>d</sup>Race: 0 = *White*, 1 = *Non-White*. <sup>e</sup>Family Structure: 1 = *one-parent home*, 2 = *two-parent home*. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

## Unconditional Latent Basis Growth Curve

Initially running the unconditional latent basis growth curve with the freely estimated slope loading for Wave III binge drinking, the model was just identified, and had a Heywood case for the estimated correlation between the slope and the intercept values. I then constrained the correlation between the slope and intercept to be equal to zero (Muthén, 2005, August). This model was a good fit to the data,  $\chi^2(1) = 2.60, p > .05$ , RMSEA = .03 (90% C.I. = .00 to .08), CFI = .99, TLI = .98, SRMR = .01 (see Figure 1 and 2). The average intercept value, or in other words the initial level of binge drinking in adolescence while correcting for measurement error, was .71 on the scale from 0 – 6. The slope was estimated at an average rate of change from adolescence to young adulthood being .53 units, representing an average of a 75% increase in the frequency of binge drinking over the 14 year period. The freely estimated parameter for Wave III was estimated at 1.42, indicating that the change between adolescence and emerging adulthood was 1.42 times the overall change between adolescence and young adulthood. This equated to a 106% increase in the frequency of binge drinking from adolescence to emerging adulthood. Both the intercept ( $b = .42, p < .001$ ) and the slope ( $b = .53, p < .001$ ) values were significant, indicating that they were different than 0. In this model, the slope and the intercept were not significantly related.



**Figure 1. Unconditional Latent Basis Growth Curve Predicting Binge Drinking Frequency from Adolescence into Young Adulthood (N = 1,864)**



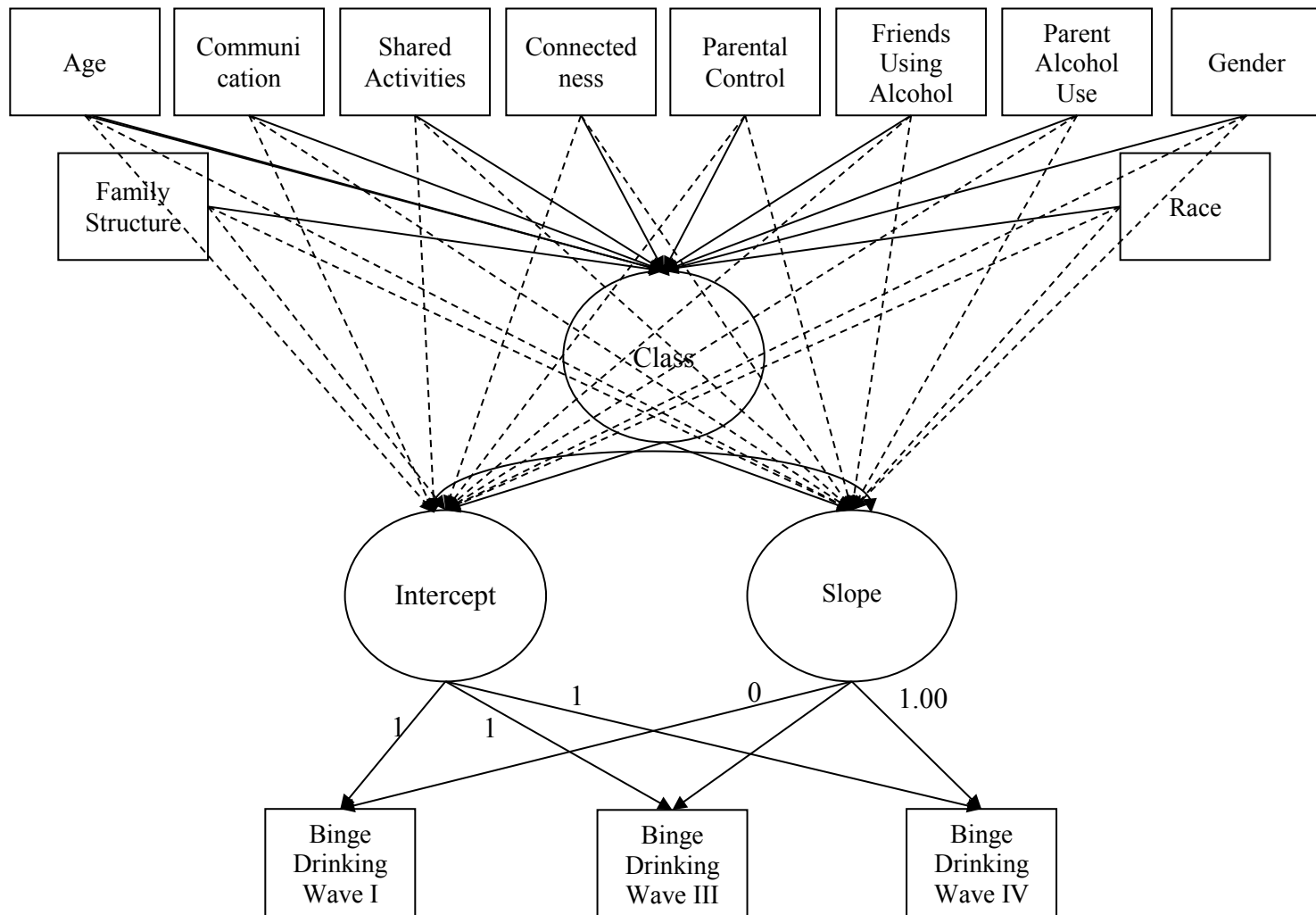
**Figure 2. Average Trajectory of Binge Drinking Frequency from Adolescence to Young Adulthood (N = 1,864)**

### **Conditional Growth Mixture Model**

The conditional growth mixture model was the next step in the analyses. The covariates were set to be predictive of both the class membership, and the variance around both of the growth parameters (see Figure 3). Due to missing values on the covariates, *Mplus* dropped  $n = 650$  participants from analyses, any participants with missing values on all the covariates are dropped in growth mixture model estimates (Huang et al., 2010). It was identified that a majority of the missing values came from the parent’s report of their partner’s alcohol use. Those parents without a partner ( $n = 619$ ) had values that were missing. This led to  $n = 400$ , or 72%, of the adolescents from a single parent home being dropped from the analyses. It was decided that this variable would be dropped from subsequent analyses. The adolescents within the sample that were identified as not having binge drank at all throughout the study were not removed from analyses in the conditional GMM because it was expected if they were a distinct class that they were emerge as such in the identification of trajectories. Removal of them from the overall sample could have led to model misspecification in the identification of trajectories.

The process suggested by Masyn (2013) was followed in identifying the number of classes of trajectories. Initially, no within-class variance was allowed for the intercepts and slopes. Allowing within-class variance can be more computationally burdensome, and so it is

recommended to initially start with the most parsimonious model when estimating the class trajectories (Jung & Wickrama, 2008). From there, within class variance was allowed to be estimated, then between class variance. Finally, the covariance was allowed to be estimated. Theory guided this process. I expected there to be both within-group and between-group variance around the trajectories, consistent with previous studies (e.g., Hix-Small et al., 2004; Li et al., 2001; Tucker et al., 2005).



**Figure 3. Conditional Latent Based Growth Curve Predicting Binge Drinking Frequency from Adolescence into Young Adulthood (N = 1,864)**



After iteratively relaxing constraints on the variance around the slope and intercept, the covariance between the group, and the between-group variance, and then iteratively adding classes, one model emerged that was of the best fit to the data: the two-class class-invariant non-diagonal GMM, LL = -7776.67, BIC = 15856.52, Entropy = .96, LMR = 1138.77,  $p < .001$  (see Table 4). As compared to the other models, this was the only model that successfully converged, that had the lowest BIC value, and had a significant LMR value indicating better fit than the previous model (see Table 4 for model fit indices for all models estimated). Theoretically, this model also made sense. There was an initial higher frequency group and an initially lower frequency group, similar to other examinations of binge drinking starting in adolescence (Li et al., 2001).

In this model, there was initially allowed to be within-class variance around the slope and intercept, and they were set to covary. However, the residual variance for the intercept was estimated to be negative in the model, and so was constrained to be equal to 0, as was done in the unconditional latent growth model reported on previously. This also meant that the correlation between the intercept and slope residual variance then could not be calculated. The variance around the slope was the only within-group variance that was estimated when fitting the classes of trajectories. Again, two class trajectories were identified, class one being a low initial-escalating group (87.34%,  $n = 1420$ ), and class two being a high initial-deescalating group (12.66%,  $n = 205$ ) (see Figure 4). The average initial frequency of binge drinking for the low initial-escalating group was -.45 units with an average increase from adolescence into young adulthood estimated to be at 2.66 units ( $p < .01$ ) on the scale from 0 – 6, and was significantly different from no change at all. The Wave III loading was estimated at 1.18 for class 1, indicating that between adolescence and emerging adulthood, there was a 3.15 unit increase in the frequency of binge drinking. For the second class, the average initial frequency of binge drinking was estimated at 2.77 units, with an average decrease into young adulthood of .02 units ( $p > .05$ ), which was not estimated to be greater than no change at all. The Wave III loading was estimated at 1.01, indicating an average decrease from adolescence to emerging adulthood of .02 units. Visually, the shape of change could be described as curvilinear for both of the classes. Again, the residual variance around the intercept was constrained to be 0 due to negative residual variance, and so there was not significant within-group variance for the intercept, but the slope was estimated at having significant within group variance ( $p < .001$ ).

**Table 4. Model Fit Indices for Conditional Growth Mixture Models Determining the Number of Class Trajectories for Binge Drinking from Adolescence into Young Adulthood**

	Convergence	Warning	LL	BIC	Entropy	LMR	<i>p</i> -value	Class1	Class2	Class3
$\Psi = 0$										
1 Class	Y	N	-8474.27	17140.78				1.00		
2 Classes	N	Y	-7884.97	16058.30	0.96	1166.46	<.001	.87	.13	
3 Classes	N	Y	-7445.99	15291.25	0.99	867.67	0.66	.81	.06	.13
4 Classes	N	Y	-7295.64	15086.67	0.90	342.42	0.76	.20	.13	.61
$\Psi$ class-invariant, diagonal										
1 Class	Y	N	-8336.38					1.00		
2 Classes	Y	N	-7769.29	15841.74	0.96	1123.31	0.54	.12	.88	
3 Classes	Y	N	-7328.26	15063.19	0.99	873.62	0.53	.13	.06	.81
4 Classes	N	N	-7080.79	14664.37	0.99	507.45	0.85	.71	.18	.09
$\Psi$ class-varying, diagonal										
1 Class	Y	N	-8336.38	16872.39				1.00		
2 Classes	N	Y	-19681.61		0.00					
3 Classes	N	Y	-19681.61		0.00					
$\Psi$ class-invariant, non-diagonal										
1 Class	Y	N	-8336.14	16879.30				1.00		
2 Classes	Y	N	-7776.69	15635.37	0.96	1138.77	<.001	.87	.13	
3 Classes	Y	N	-7327.44	15061.55	0.99	879.96	0.76	.06	.81	.13
4 Classes	Y	Y	-7101.66	14720.89	0.99	446.91	0.76	.11	.13	.71
$\Psi$ class-varying, non-diagonal										
1 Class	Y	N	-8336.14	16879.30				1.00		
2 Classes	N	Y	-19681.61		0.00					
3 Classes	N	Y	-19681.61		0.00					

*Note.* LL = Loglikelihood value. BIC = Bayesian Information Criteria. LMR = Lo-Mendell-Ruben LRT Test. The Class columns indicate the proportion of the sample that was identified as part of that class trajectory.

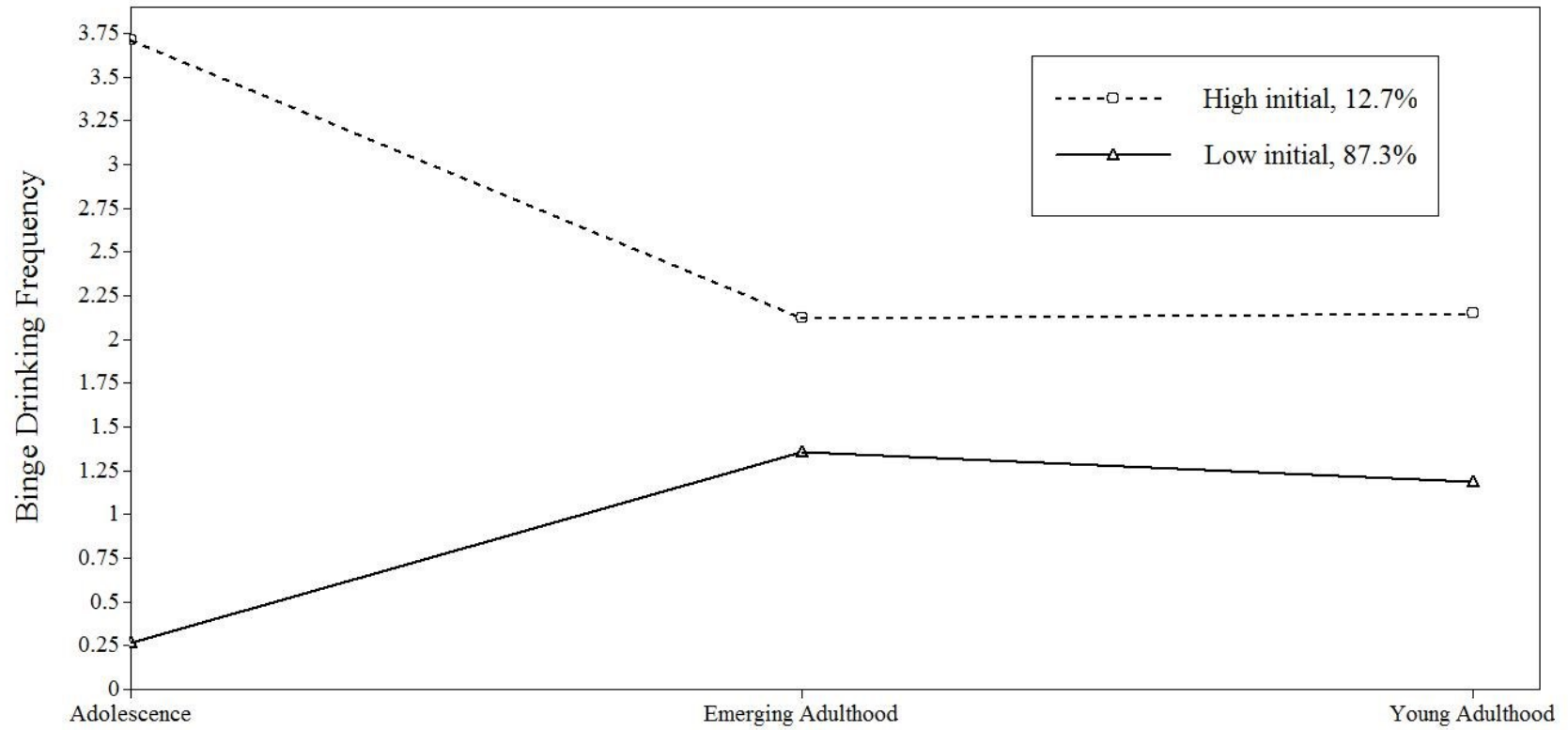
Several covariates in the model significantly predicted the variance around the slope and the intercept (see Table 5). Those adolescents who were older ( $b = .07, p < .001$ ), White ( $b = -.08, p < .05$ ), from a one-parent home ( $b = -.11, p < .10$ ), and had more friends using alcohol ( $b = .14, p < .001$ ) had a higher frequency of binge drinking in adolescence. Of the family socialization variables, none of them could account for variance around the intercept. Only demographics and alcohol exposure variables predicted variance around the slope. Those who were older ( $b = -.14, p < .01$ ), non-White ( $b = -.28, p < .001$ ), female ( $b = -.67, p < .001$ ), and from a one-parent home ( $b = .30, p < .001$ ) had a lower average trajectory of binge drinking into young adulthood. Parent alcohol use was also related to the variance in the slope ( $b = .16, p < .001$ ); those adolescents with a parent who reported a one unit greater frequency of alcohol use had a slope that increased .16 units more over the 14 year period.

In predicting the class membership of the trajectories for binge drinking into young adulthood, few variables were significant predictors, and contrary to hypotheses, none of the family socialization variables distinguished between classes of trajectories. The high initial-deescalating group was set as the reference group. A male's odds of being in the high initial-deescalating group was increased by a factor of .53 or 47% ( $b = -.64, p < .05$ , odds ratio =  $e^{-.64} = .53$ ). In other words, males were more likely to be in the higher-risk class that initially starts very high in their frequency of binge drinking, and remains higher over time. The number of close friends that an adolescent reported were using alcohol was also related with class membership. With a one unit increase in the number of friend's using alcohol the odds of being in the high initial-deescalating group increased by a factor of 2.87, or 287% ( $b = 1.05, p < .001$ , odds ratio =  $e^{1.05} = 2.87$ ). In sum, having one more friend drinking alcohol increases your odds of being in the high-risk trajectory of binge drinking from adolescence into young adulthood almost three times.

**Table 5. Conditional Growth Mixture Model Predicting Binge Drinking Trajectories from Adolescence in Young Adulthood: Standardized Results (N =1,626)**

Predictor Variables	Class 1				Class 2			
	Intercept		Slope		Intercept		Slope	
	$\beta(SE)$	$b(SE)$	$\beta(SE)$	$b(SE)$	$\beta(SE)$	$b(SE)$	$\beta(SE)$	$b(SE)$
Intercept	-2.19	-.45			15.74	2.77		
Slope			2.78	2.66			.02	.02
Age	.31(.15)*	.07(.03)	-.14(.04)**	-.14(.04)	.35(.17)*	.07(.03)	-.14(.04)**	-.14(.04)
Gender <sup>a</sup>	.02(.13)	.01(.06)	-.35(.04)***	-.67(.08)	-.02(.15)	.01(.06)	-.34(.04)***	-.67(.08)
Race <sup>b</sup>	-.16(.08)*	-.08(.04)	-.12(.03)***	-.28(.08)	-.18(.08)*	-.08(.04)	-.11(.03)***	-.28(.08)
Family Structure <sup>c</sup>	-.24(.13)‡	-.11(.06)	.14(.04)***	.30(.08)	-.28(.15)‡	-.11(.06)	.15(.04)***	.30(.08)
Friends Using Alcohol	.75(.10)***	.14(.03)	.04(.04)	.03(.04)	.73(.12)***	.14(.03)	.03(.03)	.03(.04)
Parent Alcohol Use	.11(.13)	.02(.02)	.20(.04)***	.16(.03)	.14(.15)	.02(.02)	.21(.05)***	.16(.03)
Parent-Child Communication	.04(.11)	.03(.09)	.03(.04)	.09(.14)	.06(.14)	.03(.09)	.03(.05)	.09(.14)
Parent-Child Shared Activities	-.13(.11)	-.13(.11)	.05(.04)	.25(.19)	-.15(.12)	-.13(.11)	.05(.04)	.25(.19)
Parent-Child Connectedness	-.22(.14)	-.07(.05)	-.01(.05)	-.02(.07)	-.28(.18)	-.07(.05)	-.01(.05)	-.02(.07)
Parental Control	.02(.10)	.02(.10)	-.03(.04)	-.15(.18)	.02(.12)	.02(.10)	-.03(.04)	-.15(.18)

<sup>a</sup>Gender: 0 = *male*, 1 = *female*. <sup>b</sup>Race: 0 = *White*, 1 = *Non-White*. <sup>c</sup>Family Structure: 1 = *one-parent home*, 2 = *two-parent home*. ‡ $p < .10$ . \* $p < .05$ , \*\* $p < .01$ . \*\*\* $p < .001$ .



**Figure 4. Estimated Means for Class Trajectories of Binge Drinking from Adolescence into Young Adulthood**

## Chapter 4 - Discussion

When binge drinking (i.e., 5 or more drinks on a single occasion) begins during adolescence, there is an elevated risk of having poor school performance and engaging in a variety of other risky health behaviors, including being sexually active, smoking, being a victim of dating violence, attempting suicide, and using other illicit drugs (Miller, Naimi, Brewer, & Jones, 2007). Adolescents that choose to drink most often do not drink moderately. Most adolescents who report drinking at all report that they are binge drinking (Miller et al., 2007). When this behavior begins in adolescence, there is a risk of a struggle with alcohol abuse or dependence, as well as non-alcohol related outcomes that continue into adulthood, which is above and beyond the risk of more mild alcohol use (Viner & Taylor, 2007). This study was focused on understanding the trajectory of binge drinking from adolescence to emerging adulthood and then to young adulthood, and on understanding how family factors are related to this trajectory. The goal was to identify specific family socialization factors that are related to a lower trajectory of binge drinking into young adulthood in an effort to inform family therapy interventions.

This study used the National Longitudinal Study of Adolescent Health (Add Health) data to examine the binge drinking behaviors from adolescence (Wave I) to young adulthood (Wave IV). The average trajectory of binge drinking was first examined to identify a baseline for comparison. Then multiple classes of trajectories of binge drinking were identified as related to the family socialization variables. This study was the first to examine binge drinking trajectories across three developmental periods (i.e., adolescence, emerging adulthood, and young adulthood). This study was also the first to examine binge drinking behaviors in a large nationally representative population, and also was the first to identify trajectories while allowing for the estimation of non-linear trends using a latent basis growth mixture modeling analysis. Results of this study were largely confirmatory of previous studies identifying two trajectories of binge drinking (Li et al., 2002), and peer alcohol use being the primary risk factor for a higher trajectory of use (Chassin et al., 2002). Implications are made to help provide more depth to clinical interventions.

## **Trajectory of Binge Drinking from Adolescence into Young Adulthood**

Prior to being able to predict binge drinking behaviors, and prior to examining heterogeneity of trajectories in this sample, this study sought to simply examine the average trajectory of binge drinking from adolescence through young adulthood. In examining the average trajectory, I was looking to identify the general rate of change in the frequency of binge drinking, while also looking to determine whether there was significant variation in the trajectory to rationalize including covariates, and considering multiple trajectories in the sample. My first hypothesis was supported. A nonlinear trajectory of binge drinking was identified with a peak in emerging adulthood. As a whole, adolescents were not binge drinking frequently in adolescence, in fact, on average adolescents were reporting binge drinking less than one or two days in the past 12 months. The frequency of binge drinking peaked in emerging adulthood, and then lessened into young adulthood. In young adulthood, on average adolescents were drinking more than twice a year, but less than once a month. This trend was consistent with the rates of binge drinking reported in the average population where they are the greatest during emerging adulthood, right around the legal drinking age (SAMHSA, 2013). Emerging adults not only logistically have more freedom than their adolescent counterparts (Arnett, 2000), but also gain the legal right to consume alcohol. It is common for emerging adults to engage in risky behavior as they explore their identity without much adult supervision (Arnett, 2000). As expected, as the sample matured into young adulthood, their frequency of binge drinking dropped, likely due to the increased obligations associated with this period of the life cycle (Arnett, 2000). Analyses identified significant variation in the starting frequency of binge drinking and the rate of binge drinking over time, allowing for the addition of covariates and potentially additional classes of trajectories.

## **Identifying Classes of Trajectories from Adolescence into Young Adulthood**

Past studies have identified the importance of examining heterogeneity in the trajectories of substance use behaviors (e.g., Chassin et al., 2002; Chassin et al., 2004; Colder et al., 2002; Li et al., 2001; Tucker et al., 2003). This study sought to examine differences in trajectories of binge drinking while also considering how family socialization factors could predict different trajectories of binge drinking into young adulthood. This study identified two distinct trajectories of binge drinking from adolescence into young adulthood, and that were similar to those

previously identified (e.g., Li et al., 2002). A majority of the sample (87.5%) could be described as in a low initial-escalating group where their trajectory started with a low frequency of binge drinking, being almost never, and then increased somewhat over time. They would peak in emerging adulthood, and then slightly decrease into young adulthood. The other 12.5% of the sample could be classified in a high-initial deescalating group. They initially started with a relatively high frequency of binge drinking in adolescence, between two or three days a month to once or twice a week, then decreased as they entered emerging adulthood and leveled off in their use through young adulthood. Although they experienced a decrease in their use over time, those who were in the high initial-deescalating group remained at a higher frequency of binge drinking in young adulthood as compared to their low-initial escalating counterparts.

Studies examining the heterogeneity in alcohol use behaviors over time have identified a variety of different trajectories over time, anywhere from 2 trajectories (Li et al., 2001; Li et al., 2002) all the way up to 5 different trajectories (Tucker et al., 2003). Chassin and colleagues (2004) had the only study that examined alcohol use behaviors spanning adolescence through young adulthood, and they identified four groups of trajectories. The difference between the number of classes Chassin and colleagues (2004) and this study identified is likely due to the difference in the alcohol use variable that was examined. In comparison, this study was examining the heterogeneity within an already high rate drinking, and so the identification of fewer trajectories is not surprising.

Family socialization theory (Barnes et al., 1986) guided the second goal and hypothesis of this study, as I was interested in how family support and control were related to trajectories of binge drinking. Family socialization theory indicates that both support and control from parents is part of the crucial socialization process that can reduce an adolescent's likelihood for problematic alcohol use (Barnes et al., 1986). While this theory has been supported in relation to adolescent behaviors (Barnes et al., 1986), the long-term importance of both parental support and control has not been corroborated (Barnes et al., 2000). Parental control seemed to be more important in the long-term as compared to support (Barnes et al., 2000; Bennett et al., 1999; Li et al., 2001; Tucker et al., 2003). In identifying the trajectories of binge drinking, I hypothesized that the family socialization variables would account for variation around the frequency of binge drinking in adolescence, the rate of change into young adulthood, and would also predict class membership in the trajectories. Consistent with family socialization theory (Barnes et al., 1986;



Barnes et al., 2000), I expected that family support and control would be linked with lower amounts of adolescent reported binge drinking. However, this was not the case. In fact, none of the family socialization variables accounted for any variance in the frequency of binge drinking in adolescence, the rate of change into young adulthood, nor could any of the family socialization variables predict the likelihood to be on either trajectory of binge drinking. Other studies corroborate this lack of a relationship between family relationship factors and trajectories of alcohol use over time (Chassin et al., 2004). I expected that including these family socialization factors in the process of specifying trajectories within the model would result in different results as compared to previous studies (e.g., Chassin et al., 2002), and potentially allow for the variables to emerge as significant predictors. However, this was not the case. However, where the family socialization processes failed to directly predict a trajectory of binge drinking, having close friends using alcohol did, along with gender.

The nonsignificant finding of parental control predicting binge drinking behaviors could be related to a couple different factors. The first being that previous studies examined parental control as meaning coercive control (Barnes et al., 1996) or the amount of monitoring parents had (Barnes et al., 2000). This could lead to different associations with alcohol use as compared to this study's measure that examined primarily decision making ability of the adolescent. Further, the previous studies generally used a likert-type scale to measure parental control (Barnes et al., 1986), which might have provided the variance needed to detect results. This study's parental control items only allowed for a yes or no response to whether parents restricted their decision making ability in several areas, and the scale did not have strong internal reliability. This might not have been robust enough of a scale to appropriately capture variation in parental control, or that might not have measured necessary aspects of parental control.

On the other hand, where the lack of findings could be related to measurement in this study, it could also be because this study included additional variables as controls in the analyses that previous studies did not. It could be because this study was also accounting for other factors that are significant in the prediction of binge drinking behaviors. For example, this study included the number of friends using alcohol as a covariate, while previous examinations of the family socialization theory did not account for peer influences (Barnes et al., 1986; Barnes et al., 2000). The number of friends using alcohol was the strongest predictor of binge drinking in adolescence, and had a large effect size (Class 1  $\beta = .73$ ; Class 2  $\beta = .75$ ). With every additional

friend using alcohol, there was a .14 unit increase in the frequency of binge drinking in adolescence. This is consistent with the implication in the literature that peer influences are the strongest predictor of substance use in adolescence (Crosnoe & McNeely, 2008; Cruz et al., 2012; Dishion & Owen, 2002). Family socialization theory would have suggested that peers only have an influence because of the family socialization variables (Barnes et al., 1986). This study found significant bivariate relationships between the family socialization variables and the number of friends using alcohol. Less shared activities, less connectedness, and less parental control were associated with having more friends who use alcohol in adolescence. Other studies have suggested that family relationships have a direct relationship with peer use, but then only an indirect relationship with adolescent alcohol use through peer use (Chassin et al., 2002). A mediation analysis was outside of the scope of this study, but regardless of how it happens, these findings suggest that the peers predict binge drinking in adolescence above and beyond the family socialization factors.

Peers consistently emerge in the literature as a prominent influence on adolescent alcohol use (Crosnoe & McNeely, 2008; Cruz et al., 2012; Dishion & Owen, 2002), with close friends being even more influential (Cruz et al., 2012). In this study, the number of best friends using alcohol was related to a greater initial frequency of binge drinking, but was not significantly related to the rate of change over time. Having close friends using alcohol also was associated with a greater likelihood of being in the high-risk trajectory of binge drinking. Adolescents with friends who were using alcohol had an increased likelihood of being in the high-initial escalating trajectory of binge drinking. This trajectory not only started off with a greater frequency, but continued to maintain a higher frequency of binge drinking into young adulthood. Some suggest that adolescents select peers with alcohol use similar to their own (Urberg, Luo, Pilgrim, & Değirmencioğlu, 2003; Cruz et al., 2012), and that peers mediate the influence between family socialization factors and alcohol use behaviors (Chassin et al., 2002). Others suggest that there's still an exposure effect beyond the selection effects (Cruz et al., 2012; Li et al., 2002). The debate of exposure or selection effects is an important one, as it can lead to different clinical implications.

Regardless of how it happens, those adolescents with more close friends using alcohol had not only a greater frequency of binge drinking in adolescence, but as a whole were at a greater likelihood of being on an entirely different trajectory of binge drinking into young

adulthood. Li and colleagues (2002) suggest that it is likely to be a selection effect for those adolescents in the higher risk trajectory group, but exposure effects for those in a lower trajectory group. This study's findings could support both of these alternatives, as having friends using alcohol was predictive of a higher risk trajectory of binge drinking, as well as within class variance for both trajectories. It would be important for a clinician to consider each of these potential alternatives. Although participants experienced reductions in their binge drinking over time, adolescents in the high initial-deescalating group still remained at a higher frequency of binge drinking in young adulthood. Besides being male, only a greater number of friends using alcohol could significantly predict a likelihood of being in this higher risk group.

Where family socialization factors did not account for much of the variance around the initial frequency and rate of change in binge drinking over time, demographics and exposure to alcohol provided significant insight. The demographics' relationships with initial levels and the rate of change into young adulthood were largely consistent with the hypothesis. A younger age at Wave I was related to a lower frequency of binge drinking in adolescence, and a greater rate of change into young adulthood. On average, rates of binge drinking increase with age (SAMHSA, 2013). It seems that in this sample, those who were younger in adolescence in turn had to "catch up" to their peers who were older at the first wave. There were no sex differences in binge drinking in adolescence, but males increased with a rate of change that was greater than their female counterparts (McCarty et al., 2004; SAMHSA, 2013). Racial differences emerged for both the adolescent rate of binge drinking and the rate of change over time. Those who were White started off with a higher frequency of binge drinking, and had a great rate of change into young adulthood than those who were non-White (SAMHSA, 2013). Consistent with expectations, the structure of the family was related to initial frequency of binge drinking and the rate of change into young adulthood. Those from a one-parent home had a greater initial frequency, consistent with previous findings (Hawkins et al., 1992), but those from a two-parent home saw a greater rate of change over time. It could be that although binge drinking increased in adolescence, the effects of being in a single parent home diminished over time, approximately equalizing the two groups' binge drinking behaviors. Parent alcohol use did not have a significant relationship with adolescent binge drinking behaviors, but those who had a parent reporting more frequent alcohol use did have a greater rate of change into young adulthood. This supports both the socialization into problem alcohol use (Barnes et al., 1986) as well as an

intergenerational transmission process when adolescents are exposed to parent alcohol use (Biederman et al., 2000; Cranford et al., 2010; Kerr et al., 2012; Thornberry et al., 2006).

### **Strengths and Limitations**

This study had a number of strengths and limitations that should be considered. The primary strength was that this study was the first to specifically examine binge drinking trajectories across three periods of development (i.e., adolescence, emerging adulthood, and young adulthood) using a large nationally representative sample. Binge drinking is likely to peak during emerging adulthood, and present studies examining binge drinking generally did not go beyond that stage (Chassin et al., 2002; Tucker et al., 2003).

Another strength of this study was the estimation of binge drinking trajectories with the family factors as covariates in the conditional growth mixture model. Most present studies (e.g., Chassin et al., 2004) identified class trajectories first, and then considered how variables were related to those trajectories. In growth mixture modeling procedures, it has been suggested that method can lead to model misspecification (Huang et al., 2010; Jung & Wickrama, 2008; Muthén, 2003; Muthén, 2004). When allowing relevant variables to account for variance while approximating classes of trajectories, a different set of trajectories may emerge than if they are not included in the estimation process.

There were some limitations for the study as well. Although it was a strength to have a large nationally representative sample with longitudinal data spanning three developmental periods, it was a limitation that I only had information about binge drinking behaviors at one measurement point during each developmental period. There are known fluctuations in alcohol use behaviors within adolescence (e.g., Colder et al., 2002; Li et al., 2002) and within emerging adulthood (e.g., Muthén & Shedden, 1999), and so having only one data point as a representation for an entire developmental period may not be an accurate representation of actual behavior. I also only had information regarding the parent-child relationship during adolescence. This relationship is likely to change over time, and the influence on binge drinking behaviors could become different as they enter different developmental periods. Future studies could expand upon these limitations by examining these trajectories with information at multiple time points over each developmental period.

It is also a limitation that I could not account for how drinking of both parents was related with the trajectories into young adulthood. Exposure to alcohol use by both maternal and paternal figures is a known predictor of adolescent substance use (Biederman et al., 2000; Cranford et al., 2010; Kerr et al., 2012; Thornberry et al., 2006). This sample was limited to only using the frequency of one parents' use, and primarily the mother's use. Due to missing data, this study had to choose between maintaining a sample of adolescents from one-parent homes, and keeping in the parent's report of their partner's alcohol use. I decided that in this study it was more important to maintain a high sample of adolescents, and adolescents from various demographics. Additionally, some studies have identified that exposure to maternal alcohol use is more influential on adolescent drinking behaviors than is paternal use (Brook, Whiteman, Gordon, & Cohen, 1986; Thornberry et al., 2006).

Internal consistency of most of the family socialization variables (i.e., parent-child communication, shared activities and parental control) was modest, and could potentially be responsible for the lack of significance found in these analyses. The variables I chose for this study have been established and used in earlier studies (Beuhring et al., 1998; Crosnoe & Elder, 2004; George & Mallery, 2003; Resnick et al., 1997). The large sample size used helped to increase power somewhat, despite lower internal consistency in the measurement than would have been desired. These variables also assessed whether there was communication on a variety of topics, and whether there were shared activities, but did not assess the quality of these interactions. The quality of interactions may provide different information as compared to simply the presence of communication and shared time.

Another limitation of this study was the definition of binge drinking that was used. Studies have identified gender differences in the definition for binge drinking for males as compared to females (Wechsler et al., 1995). Binge drinking in a female population is considered four or more drinks on a single occasion, while for males it is considered five or more drinks on an occasion. Females generally experience negative consequences for their drinking after fewer drinks than their male counterparts (Wechsler et al., 1995). In this study, the definition was held to 5 or more drinks for both males and females. This could lead to some underestimating of the binge drinking frequency for females in this sample. Future studies should consider the gender difference in this definition when tracking trajectories of use.

Finally, this study relied on self-report on behavior. Self-reporting of alcohol use may be biased, but most studies indicate that a small proportion of adolescents will have extreme response biases (Winters, Stinchfield, Henly, & Schwartz, 1990). The correlational design of the study also limits this study's ability to make causal inferences from the between covariates and binge drinking behavior. While a limitation, it is hopeful that this study can lend information to potential intervention research in the future, that then could allow for the inference of how family relationships do change binge drinking behaviors.

### **Clinical Implications**

Current evidence-based family therapy treatments for adolescent substance abuse and other delinquent behavior include Brief Strategic Family Therapy, Functional Family Therapy (FFT), Multidimensional Family Therapy (MDFT) and Multisystemic Therapy (MST; Baldwin et al., 2012). These approaches are associated with better outcomes as compared to individual treatment (Baldwin et al., 2012) and considered to be more cost-effective than individual treatment (Morgan et al., 2013). These therapies each approach the family socialization factors differently, with some placing greater emphasis on parental control and others emphasizing parental support. For example, Brief Strategic Family Therapy uses primarily structural and strategic therapies in an effort to change family structure (Szapocznik, Hervis, & Schwartz, 2003), which in many cases will support greater boundaries by the parents and create more parental control. Multidimensional Family Therapy engages family support through a focus on emotional involvement of the parents (Liddle & Hogue, 2001). Each approach incorporates interventions that can be related to increasing parental support and control in one way or another.

This study found some support for family socialization factors in their relation with binge drinking in adolescence and the trajectories of binge drinking into young adulthood. Specifically, a feeling of connectedness with one's parents and a greater amount of time spent sharing activities together were related with a lower frequency of binge drinking in adolescence. These can both be areas that clinicians target in family treatment. However, with peer alcohol use emerging as one of the most discriminating factors in terms of how likely an adolescent is to engage in a high level of binge drinking, this factor should be emphasized in treatment. Multisystemic Therapy directly addresses key social-ecology factors, including the peer network, through its intervention efforts (Borduin, Mann, Cone, Henggeler, Fucci, Blaske, & Williams,

1995; Henggeler, Schoenwald, Borduin, Rowland, & Cunningham, 1998). In some cases, though, where they did see a reduction in delinquent behavior through treatment, they did not necessarily see a change in peer associations (Borduin et al., 1995). This brings back into question the exact role that peers are playing in the development of risky substance use. Is it due to selection effects or exposure effects?

Clinicians should consider the role that peers are playing in the adolescent's alcohol use. Adolescents may select peers with substance use similar to their own, or may see an increase in their substance use due to an exposure to peers who use alcohol (Li et al., 2002). Borduin and colleagues (1995) saw a reduction in delinquent behavior after treatment, despite a lack of change in exposure to the deviant peers. This could speak to a selection effect rather than an exposure effect. Exposure and selection effects could potentially speak to different interventions, but both speak to a need for supporting both parental control and support. If exposure to deviant peers is the primary issue, then creating more boundaries and parental control to minimize access to the peers seems to be the primary need. However, that is not to minimize the need for parental support. Adolescents with parents with high levels of control and low levels of support, authoritarian parents, are more likely to experiment with alcohol than their peers with parents who are high on both control and support, authoritative parents (Adalbjarnardottir & Hafsteinsson, 2001). If selection is the issue, the goal becomes identifying what need that the peers are fulfilling. Is there a need that the family could be fulfilling instead? Perhaps the only support the adolescent is receiving is from their peers, and increasing family support could reduce this need.

Incorporating the family unit in treatment for adolescent substance use has already been identified as beneficial (Baldwin et al., 2012). This study suggests that clinicians first consider the peer network's role in the binge drinking, identifying whether there's an exposure or selection effect happening. Being more intentional in effecting peer use can strengthen our interventions. Both parental support and control could address this issue, with connectedness and shared activities potentially being especially relevant. Clinicians should also note that male adolescents are at a much greater risk for a higher trajectory of binge drinking into young adulthood, and interventions for them are especially crucial.

## **Future Directions**

In considering the contributions of this study, as well as the inherent strengths and limitations, there are future studies that could strengthen our understanding of the etiology and development of binge drinking behaviors. Specifically, a mediational analysis could contribute to our understanding of the role peer selection or exposure effects have on drinking behaviors in relation to family socialization factors. Examining family factors before the child begins to drink, and before exposure to alcohol, can help us understand if adolescents are choosing peers who drink, or simply being exposed to them. A mediational analysis can also help us understand the role that family factors have on this process. A network analysis could also potentially help us understand this complex relationship between peer relationships and alcohol use.

With the current analyses focusing on the development and progression of binge drinking, future analyses can extend these by focusing on parallel processes and distal outcomes. Distal outcome analyses can allow us to understand the potential results of being in a specific binge drinking trajectory. Potential distal outcomes to be examined can include parent-child relationships, job outcomes, or relationship outcomes. Where I examined family socialization factors in adolescence in relation to initial frequencies of binge drinking, there is likely to be an ongoing socialization process related to binge drinking behaviors. For example, it has been identified that in some cases, changes in drinking behaviors precede changes in the parent-child relationship (van der Vorst et al., 2006). Including time-varying covariates in the identification of trajectories can provide insight of an ongoing process.

Finally, intervention work should be conducted that specifically targets parental control and support, while examining changes in the peer network. The peer network continues to emerge as significantly related to trajectories of substance use, while family factors have not; however, family treatment continues to emerge as an effective approach to reducing adolescent substance use (Baldwin et al., 2012). Reconciling these two seemingly contradictory findings can help clarify how peer exposure and selection effects should contribute to the design of our evidence-based practices.

## **Conclusion**

The overall frequency of binge drinking is likely to increase from adolescence into young adulthood. Two classes of adolescents emerged, those who have a low initial frequency of binge



drinking, but who escalate over time, and those who start off with a relatively high rate of binge drinking, but who experience a moderate decline over time. Where parental support is related to lower frequency of binge drinking in adolescence, this positive impact diminishes over time. In this study, no family socialization factors directly predicted a lower trajectory of binge drinking into young adulthood. Being a male and having more close friends who use alcohol were the best predictors of being in the high initial-deescalating trajectory. When working with an adolescent and their family clinically, the role of the peer network should not be underestimated, and interventions targeting family support and control should be implemented with the intent to affect peer influences. Although family factors are not emerging as direct predictors of the trajectory of binge drinking, their role is not to be diminished. The family can still make an impact on the factors that do emerge as significant predictors of behavior, and has already been shown to do so (Baldwin et al., 2012). By targeting family interventions on the peer network, and exposure and selection influences on alcohol use behaviors, outcomes will likely be improved.

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## Appendix A - Add Health Variables

Variable	Item Description	Scale
<b>Name</b>		
<b>BINGE DRINKING</b>		
H1TO17	Over the past 12 months, on how many days	0 – none
H2TO21	did you drink five or more drinks in a row?	1 – 1 or 2 days in the past 12
H3TO40		months
H4TO37		2 – once a month or less (3-12
		times in the past 12 months)
		3 – 2 or 3 days a month
		4 – 1 or 2 days a week
		5 – 3 to 5 days a week
		6 – every day or almost every day
<b>PARENT-CHILD COMMUNICATION</b>		
<b>Mother Figure Communication</b>		
<i>Which of these things have you done with your {MOTHER/ADOPTIVE</i>		
<i>MOTHER/STEPMOTHER/FOSTER MOTHER/etc.} in the past 4 weeks?</i>		
H1WP17D	talked about someone you're dating, or a party	0 – no
	you went to	1 – yes
H1WP17F	had a talk about a personal problem you were	0 – no
	having	1 – yes
H1WP17H	talked about your school work or grades	0 – no

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		1 – <i>yes</i>
H1WP17J	talked about other things you're doing in	0 – <i>no</i>
	school	1 – <i>yes</i>

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**Father Figure Communication**

*Which of these things have you done with your {FATHER/ADOPTIVE FATHER/  
STEPFATHER/FOSTER FATHER/etc.} in the past 4 weeks?*

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H1WP18D	talked about someone you're dating, or a party	0 – <i>no</i>
	you went to	1 – <i>yes</i>
H1WP18F	had a talk about a personal problem you were	0 – <i>no</i>
	having	1 – <i>yes</i>
H1WP18H	talked about your school work or grades	0 – <i>no</i>
		1 – <i>yes</i>
H1WP18J	talked about other things you're doing in	0 – <i>no</i>
	school	1 – <i>yes</i>

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**PARENT-CHILD SHARED ACTIVITIES**

**Mother-Child Shared Activities**

*Which of these things have you done with your {MOTHER/ADOPTIVE  
MOTHER/STEPMOTHER/FOSTER MOTHER/etc.} in the past 4 weeks?*

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H1WP17A	gone shopping	0 – <i>no</i>
		1 – <i>yes</i>
H1WP17B	played a sport	0 – <i>no</i>
		1 – <i>yes</i>
H1WP17C	gone to a religious service or church-related	0 – <i>no</i>

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	event	1 – <i>yes</i>
H1WP17E	gone to a movie, play, museum, concert, or sports event	0 – <i>no</i> 1 – <i>yes</i>
H1WP17I	worked on a project for school	0 – <i>no</i> 1 – <i>yes</i>

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**Father-Child Shared Activities**

*Which of these things have you done with your {FATHER/ADOPTIVE FATHER/  
STEPFATHER/FOSTER FATHER/etc.} in the past 4 weeks?*

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H1WP18A	gone shopping	0 – <i>no</i> 1 – <i>yes</i>
H1WP18B	played a sport	0 – <i>no</i> 1 – <i>yes</i>
H1WP18C	gone to a religious service or church-related event	0 – <i>no</i> 1 – <i>yes</i>
H1WP18E	gone to a movie, play, museum, concert, or sports event	0 – <i>no</i> 1 – <i>yes</i>
H1WP18I	worked on a project for school	0 – <i>no</i> 1 – <i>yes</i>

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**PARENT-CHILD CONNECTEDNESS**

**Mother-Child Connectedness**

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H1WP9	How close do you feel to your {MOTHER/ADOPTIVE MOTHER/STEPMOTHER/ FOSTER	1 – <i>not at all</i> 2 – <i>very little</i> 3 – <i>somewhat</i>
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	MOTHER/etc.}?*	4 – <i>quite a bit</i>
		5 – <i>very much</i>
H1WP10	How much do you think she cares about you?	1 – <i>not at all</i>
		2 – <i>very little</i>
		3 – <i>somewhat</i>
		4 – <i>quite a bit</i>
		5 – <i>very much</i>
H1PF1	Most of the time, your mother is warm and loving toward you.	1 – <i>strongly disagree</i>
		2 – <i>disagree</i>
		3 – <i>neither agree or disagree</i>
		4 – <i>agree</i>
		5 – <i>strongly agree</i>
H1PF4	You are satisfied with the way your mother and you communicate with each other.	1 – <i>strongly disagree</i>
		2 – <i>disagree</i>
		3 – <i>neither agree or disagree</i>
		4 – <i>agree</i>
		5 – <i>strongly agree</i>
H1PF5	Overall, you are satisfied with your relationship with your mother.	1 – <i>strongly disagree</i>
		2 – <i>disagree</i>
		3 – <i>neither agree or disagree</i>
		4 – <i>agree</i>
		5 – <i>strongly agree</i>

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**Father-Child Connectedness**

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H1WP13	How close do you feel to your  {FATHER/ADOPTIVE  FATHER/STEPFATHER/FOSTER  FATHER/etc.}?*	1 – <i>not at all</i>  2 – <i>very little</i>  3 – <i>somewhat</i>  4 – <i>quite a bit</i>  5 – <i>very much</i>
H1WP14	How much do you think he cares about you?	1 – <i>not at all</i>  2 – <i>very little</i>  3 – <i>somewhat</i>  4 – <i>quite a bit</i>  5 – <i>very much</i>
H1PF24	You are satisfied with the way your father and  you communicate with each other.	1 – <i>strongly disagree</i>  2 – <i>disagree</i>  3 – <i>neither agree or disagree</i>  4 – <i>agree</i>  5 – <i>strongly agree</i>
H1PF23	Most of the time, your father is warm and  loving toward you.	1 – <i>strongly disagree</i>  2 – <i>disagree</i>  3 – <i>neither agree or disagree</i>  4 – <i>agree</i>  5 – <i>strongly agree</i>
H1PF25	Overall, you are satisfied with your  relationship with your father.	1 – <i>strongly disagree</i>  2 – <i>disagree</i>  3 – <i>neither agree or disagree</i>

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4 – *agree*

5 – *strongly agree*

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**PARENTAL CONTROL**

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	Do your parents let you make your own	0 – <i>yes</i>
	decisions about the time you must be home on	1 – <i>no</i>
H1WP1	weekend nights?	
	Do your parents let you make your own	0 – <i>yes</i>
	decisions about the people you hang around	1 – <i>no</i>
H1WP2	with?	
	Do your parents let you make your own	0 – <i>yes</i>
H1WP3	decisions about what you wear?	1 – <i>no</i>
	Do your parents let you make your own	0 – <i>yes</i>
	decisions about how much television you	1 – <i>no</i>
H1WP4	watch?	
	Do your parents let you make your own	0 – <i>yes</i>
	decisions about which television programs you	1 – <i>no</i>
H1WP5	watch?	
	Do your parents let you make your own	0 – <i>yes</i>
	decisions about what time you go to bed on	1 – <i>no</i>
H1WP6	week nights?	
	Do your parents let you make your own	0 – <i>yes</i>
H1WP7	decisions about what you eat?	1 – <i>no</i>

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**ALCOHOL EXPOSURE**

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PA61	Parent Report – How often do you drink alcohol?	1 – <i>never</i> 2 – <i>once a month or less</i> 3 – <i>two or three days a month</i> 4 – <i>once or twice a week</i> 6 – <i>nearly every day</i>
PB22	Parent Report – During the past 12 months, about how often did your current (spouse/partner) drink alcohol?	1 – <i>never</i> 2 – <i>once a month or less</i> 3 – <i>two or three days a month</i> 4 – <i>once or twice a week</i> 6 – <i>nearly every day</i>
H1TO29	Of your three best friends, how many drink alcohol at least once a month?	0 – <i>no friends</i> 1 – <i>one friend</i> 2 – <i>two friends</i> 3 – <i>three friends</i>

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