ABSTRACT

Title of Dissertation: AN EXAMINATION OF PATHWAYS OF DEPRESSIVE SYMPTOMS AND HEAVY DRINKING FROM ADOLESCENCE TO ADULTHOOD

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This study examined the dynamic interaction of heavy alcohol use and depressive symptoms at three points over a time period of 11 years from adolescence to adulthood using a subset of data from the nationally representative, multi-year, longitudinal data source, the National Longitudinal Study of Adolescent Health (Add Health). Results revealed that, in general, those that drink heavily with greater frequency are more likely to have a greater number of depressive symptoms. Conversely, those with more early depressive symptoms are more likely to be early heavy drinkers, but less likely to be heavy drinkers six years down the road. Additionally, early depressive symptoms affect later trajectories in binge drinking. Gender, racial/ethnic group, and college attendance all affected the relationship over time for heavy drinking and were generally related to the average but not the change over time of depressive symptoms. Results are discussed in the context of Elder's life course theory that views developmental trajectories in relation to social pathways.

AN EXAMINATION OF THE PATHWAYS OF DEPRESSIVE SYMPTOMS AND HEAVY DRINKINGFROM ADOLESCENCE TO ADULTHOOD

by

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Chapter I: Introduction

Background and Significance

Alcohol Use. By adolescence, both heavy alcohol use or abuse and depression can be significant problems, often persisting into adulthood. Adolescents and young adults experiment with use and abuse alcohol more than any other substance (Palmer et al., 2009). Studies show that between 72 and 88 percent of students have consumed alcohol by the end of high school (Johnston, O'Malley, Bachman, & Schulenberg, 2009; Kandel, 2002) and 55 percent have been intoxicated at least once (Johnston et al., 2009). Forty-two percent of young adults aged 18 to 25 report binge drinking which is generally defined as having five or more drinks on the same occasion, on at least 1 day in the past 30 days. Among middle and high school students rates of binge drinking are somewhat lower but still represent substantial amounts (1.5 percent of 12-13 year olds, 7.8 percent of 14-15 year olds, and 19.4 percent of 16-17 year olds) (SAMHSA, 2007).

Cross-sectional and longitudinal studies have found that increased consumption of alcohol is correlated with risk in many areas including psychological, physical, school, social, and legal harm and is recognized as one of the most significant public health problems among adolescents (Dawson et al., 2008; Maney, Higham-Gardill, & Mahoney, 2002). Adolescent drinking is likely to be excessive and lead to accidents or disrupt adjustment (Crosnoe & Riegle-Crumb, 2007). Adolescent drinking is associated with both immediate and long-term consequences, including adult Substance Use Disorders

(SUDs) (Kandel et al., 1997; SAMHSA, 2007). Problematic drinking is influenced by development and tends to increase with age. Experimentation, repeated use, and prevalence of SUDs increase linearly with age until young adulthood (Palmer et al., 2009). An earlier onset of drinking is associated with increased problems, such as depression and conduct problems, throughout adolescence as well as increased prevalence of life-long drinking and problems with dependency (Chou & Pickering, 1992; Grant & Dawson, 1997; Kandel, 1978). Depression is a correlate to alcohol use and is the other main factor examined in this study. Educational variables are also related to both alcohol use and depression and will also be included as a variable in this study.

Depression. Depression, the most prevalent mental illness in the United States, is also a significant public health concern, often emerging during adolescence. Depression affects roughly 34 million Americans over the age of 12 during the course of their lifetimes (SAMSHA, 2007). Results from the National Comorbidity Survey (NCS) (Kessler & Walters, 1998), show that a quarter of Americans experience a major or minor depressive episode before they reach adulthood. Approximately 15 percent of 15 to 24 year-olds had lifetime prevalence for major depression, and approximately 10 percent had lifetime prevalence for minor depression. These adolescent rates are comparable to adult rates. Results of the National Comorbidity Survey Replication (NCS-R) (Kessler, Chiu, Demler, & Walters, 2005) indicate that, over 30 percent of those with major depression in the past year will have experienced negative consequences such as a suicide attempt, work disability, or other substantial limitation due to their depression. Depression puts adolescents at risk for a variety of current and potential future difficulties, including substance abuse (Birmaher et al., 1996). The Youth Risk Behavioral Surveillance Survey

(YRBSS) found that 28 percent of adolescents had disruptions of their normal activities because of depressive symptoms in the last year (Grunbaum et al., 2004).

Alcohol Use and Depression. Over the last several decades, evidence has emerged that there is a clear link between depression and alcohol use, with heavier alcohol use and Substance Abuse Disorders (SUDs) associated with higher levels of depression. Co-occurring psychiatric disorders tend to be more chronic than non-comorbid psychiatric disorders (Kessler et al., 1996) and amongst comorbid conditions, the comorbidity of depression and alcohol use is particularly common. A literature review on the comorbidity between substance abuse and other psychiatric disorders found that about 60 percent of youth who are using or abusing drugs or alcohol have a comorbid psychiatric condition, and that depression is the second most common comorbid condition (after conduct disorder comorbidity). Twenty to thirty percent of those with SUDs also were depressed (Armstrong & Costello, 2002). Studies have consistently found that those drinking at heavier levels have higher rates of depression (Dawson, Stinson, Chou, & Grant, 2008; Diego, Field, & Sanders, 2003; Flemming, Mason, Mazza, Abbott, & Catalano, 2008; McCarty et al., 2009; Meririnee et al., 2010; Needham, 2007; Owens & Shippee, 2009; Paschall, Freisthler, & Lipton, 2005; Sihvola et al., 2008; Strandheim, Holmen, Coombes, & Bentzen, 2009; Waller et al., 2006). For example, Kandel et al. (1997) demonstrated that the prevalence of depression increased from approximately 5 percent in abstaining youths to 23.8 percent in youth who used alcohol at least weekly. Of those drinking weekly, two-thirds of boys and girls had a comorbid psychiatric condition. However, questions remain about the causal direction between alcohol use and depression, or if there are other variables contributing to both. The

longitudinal nature of the current study may shed light on how these constructs affect each other. The causal relationships will be discussed in greater depth below.

A Developmental Trajectory. While the relationship between depression and substance use is well established, the nature of the interaction between them over time is less clear. Studies have found that child psychopathology, such as conduct disorder and depression, predicted earlier use of alcohol in adolescence as well as later substance abuse. Conversely, there was also evidence that adolescent substance use predicts adult depression (Armstrong & Costello, 2002). The directionality between substance use and depression is less clear than between substance use and other co-occuring disorders, although evidence points to the mental disorder generally emerging first (Kessler et al., 1996). Others studies suggest a bi-directional relation between the two (Hallfors, Waller, Bauer, Ford, & Halpern, 2005). Finally, other researchers view the relation as the result of a third underlying risk factor rather than a causal relationship (King & Chassin, 2006). An *Addiction* commentary (2008) of longitudinal studies on substance abuse concluded that such studies have found inconclusive results about the causal direction between internalizing difficulties, such as depression, and SUDs over time. Some have found relationships, often with gender differences, but differences in the measurement of drinking levels or SUDs have made overall conclusions difficult, creating a need for further research in this area.

Examining the relation between substance use or abuse and depression through a developmental framework and tracking their pathway of interaction longitudinally is still somewhat limited in the literature. Future studies of this nature will be able to contribute to the understanding of the interaction and directional relationship between depression

and substance use. Further complicating the matter, there may be a difference between episodic interactions of alcohol and depression and long-term trajectories. Interactions between comorbid factors are not necessarily constant over the course of development, and are likely impacted by factors such as major life events, stressors, social contexts, or underlying traits that emerge inconsistently over time and in relationship to changing life circumstances (Flemming et al., 2008; Hussong, Hicks, Levy & Curran, 2001; Jackson & Sher, 2003; Jackson, Sher, & Wood, 2000).

As adolescents make the journey to adulthood, they pass through many developmental stages, which are likely to influence their behavior, choices, and affect. Furthermore, the transition from adolescence to young adulthood and again from young adulthood to adulthood is often marked by significant transitions and changing contexts. These changes can often magnify one's existing strengths or weaknesses (Needham, 2007). Three contexts that many Americans pass through during the transition from adolescence to adulthood include high school, college, and the working world or graduate school.

For example, there is an association between drinking and academic status and the nature of this association changes over time. Crosnoe and Riegle-Crumb (2007) found that during high school, those of higher academic status are likely to drink less than their lower-achieving peers. However, upon completion of high school, this association reverses, with high-achieving students increasing their drinking as compared to lower-achieving peers. This effect is partially mediated by college but holds even for those high-achieving high school students who do not attend college. The authors predict another reversal after completion of college since drinking tends to gradually decline

throughout one's twenties and into the thirties (Crosnoe, & Riegle-Crumb, 2007). For males, heavy drinking in adolescence is also associated with lower educational attainment (Staff, Patrick, Loken, & Maggs, 2008, Johnston et al., 2009).

The transition from high school to college is accompanied by a significant increase in alcohol use across the board (Fromme, Corbin, & Kruse, 2008; Shulenberg and Maggs, 2002). College drinking can be predicted by pre-college predictors such as heavy drinking prior to college (Sher & Rutledge, 2006). Studies have also found a changing association between depressive symptoms and alcohol use over time. During the transition to young adulthood, those with higher initial depressive symptoms and higher rates of drinking were less likely to have an increase in their drinking use compared to non-depressed peers (Bryant, 2010; Needham, 2007). This finding may be explained by the general increase in drinking associated with entering young adulthood and college. These findings do not necessarily mean that those with depressive symptoms have decreased their drinking but that their peers have increased their drinking in comparison, serving to close the gap in levels of drinking between the two groups.

The above findings do not necessarily mean that the association between depression and drinking disappears, as there are likely still differences in the contexts in which depressed and non-depressed college students drink and in their motivations for drinking (Gonzalez, Collins, & Bradizza, 2009). Drug use, including alcohol use, outcomes are more problematic when associated with self-medication in order to relieve psychological distress or avoid challenges. More socially oriented drug use is not as problematic (Newcomb & Bentler, 1988). Solitary heavy drinking is more associated with depression in college than heavy social drinking. Solitary drinking is also associated

with coping and increased suicidal ideation (Gonzalez, Collins, & Bradizza, 2009). Once beyond the collegiate environment, and the normative heavy drinking associated with this context, the previous association between depressive symptoms and higher rates of drinking is likely to re-emerge.

Depressive symptoms, apart from alcohol use, are also related to educational success and attainment and, later on in the developmental trajectory, work success. Depressive symptoms during high school are associated with increased odds of high school failure among girls (Fletcher, 2008; Needham, 2009). For both males and females, there is an association between depressive symptoms and failure to enter college (Needham, 2009). Lower educational attainment is associated with higher levels of depression (Miech & Shanahan, 2000; Bjelland et al., 2008; Fletcher, 2008; Ross & Mirowsky, 2006) and has an accumulative relationship over time (Bjelland et al., 2008). Greater educational attainment decreases depression at a greater rate for women than men. As a result, education helps level the gender gap between depression for men and women (Ross & Mirowsky, 2006).

Gender. Some studies suggest different pathways for males and females for both substance use and depressive symptoms. Studies have consistently shown higher levels of alcohol consumption, higher trajectories, and greater prevalence of abuse/dependency among men than women (Dawson, et al., 2008; Palmer et al., 2009). However, these distinctions do differ at various ages (Johnston, et al., 2009). There are also gender differences in levels of depression between males and females, with females generally displaying higher levels of depression, as well as differences in the timing and trajectory of this depression. The correlation between depressive symptoms and alcohol use has

often been different across genders as well (Flemming et al., 2008; Needham, 2007). How alcohol use and depressive symptoms interact over time and across context would, therefore, also have potentially different relation for males and females (Needham, 2007; Dawson, et al., 2008; Palmer et al., 2009; Owens & Shippee, 2009; Strandheim, Holmen, Coombes & Bentzen, 2009).

Rationale and Purpose

The purpose of this study was to examine the pathways of depression and substance use from adolescence to adulthood. The relation between these two factors has been well established. However, there is a need for longitudinal research that looks at the relation between depression and alcohol across development. More information is still needed to fully understand the timing and predictive direction of these relations ranging from adolescence to adulthood. For example, there is evidence that trajectories of the relation between substance use and depression differ depending on factors such as gender, initial levels of use or depression, and educational context.

The questions were examined through the lens of Elder's (1998) life course theory, a theory of development that views developmental trajectories in relation to social pathways. While this study examined broad trajectories, it also examined how developmental contexts, college in particular, are related to drinking and depression. While heavy college drinking is considered to be normative, it is still associated with increased negative consequences (Shulenberg & Maggs, 2002) and could lead to larger problems of abuse and dependency in the future. As Shulenberg and Maggs (2002) conclude in their literature review on alcohol use, "in a few short years, the excessive drinking and concomitant negative consequences experienced by many students that

would likely reflect diagnosable alcohol misuse (and often alcohol dependence) at other points in the life span simply run their course and stop. For other students, heavy drinking becomes troublesome and tragic. By understanding how alcohol and other drug use fits in young people's lives, and specifically how it is embedded in their numerous developmental transitions, we can have a stronger foundation for understanding etiology and for effecting positive change" (p. 66-67). Looking at the relationship between alcohol use and depression in the context of college and across the developmental trajectory helps shed some light on this issue.

Furthermore, while studies have examined educational attainment in relation to both depression and alcohol use, with results suggesting that each of these individually is related to educational attainment, there is a notable lack of research on how all three of these variables interact. This project extends previous research by examining the dynamic interaction of alcohol use and depressive symptoms at three points over a time period of 11 years, a significantly lengthy time period compared to most studies examining this interaction, using data from the nationally representative, multi-year, longitudinal data source, the National Longitudinal Study of Adolescent Health (Add Health). During this time frame, the participants start in early adolescence and grow into adulthood, making their way through significant life markers, such as college. For purposes of this study, college attendance is defined as current (at the second data collection point of this study) college enrollment in a 4 year college. This study contributes to current research by further exploring the pathways of depression and substance abuse across these time periods and as it is affected by one's gender and race/ethnicity.

This line of research has important implications for mental health professionals. The interaction of alcohol use and depression during high school and the residual effects over time will help determine treatment direction by high school personnel, such as school psychologists and counselors and may help justify early intervention. Understanding how depression and alcohol interact in a college context and what implications this holds for future outcomes will have important implications for mental health workers on college campus', a context in which heavy drinking is normative.

While alcohol misuse and depression have been shown individually to progress over time, often necessitating long term treatment or follow up, how these two difficulties interact over time remains less clear. For example, understanding if depression predicts heavy drinking concurrently or over time and vice versa has important implications for treatment focus and direction. Additionally, a fuller understanding of the possible risks and protective factors that college attendance may afford may have treatment implications based on academic trajectory.

Research Questions

The study used a longitudinal design with data from participant interviews at three time points, instead of having to rely on cross-sectional data. The first interview (T1) was collected when participants were adolescents. This wave of data was collected in 1996 when the participants were in either 9^{th} or 10^{th} grade. The second interview (T2) was collected when participants were young adults. Data for this wave was collected in 2002 when the participants were potentially juniors or seniors in college if they attend a four-year school directly after high school. The final interview (T3) was conducted when participants were entering adulthood. Data were collected in 2007-2008 when

participants are in late 20s to early 30s. Using these three data points, the study seeks to answer the following research questions:

Research Questions with Depressive Symptoms as Dependent Variable

1. Is there a change over time for depressive symptoms at adolescence (T1), young adulthood (T2), and adulthood (T3)?

1a-c.) Is there an interaction between change-over-time and each of the variables listed below?

1a. Gender

1b. Race/Ethnicity

1c. College enrollment at Time 2

2.) What is the effect of adolescent (T1) depressive symptoms on change over time of depressive symptoms as measured at young adulthood (T2) and adulthood (T3)?

3.) What is the effect of adolescent (T1) binge drinking on depressive symptoms over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

3a-c.) Is there an additional interaction effect for each of the variables listed below?

3a. Gender

3b. Race/Ethnicity

3c. College enrollment at Time 2

4.) What is the effect of adolescent (T1) drunkenness on depressive symptoms over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

4a-c.) Is there an additional interaction effect for each of the variables listed below?

4a. Gender

4b. Race/Ethnicity

4c. College enrollment at Time 2

Research Questions with Binge Drinking as Dependent Variable

5.) Is there a change over time for binge drinking at adolescence (T1), young adulthood (T2), and adulthood (T3)?

5a-c.) Is there an interaction between change-over-time and each of the variables listed below?

5a. Gender

5b. Race/Ethnicity

5c. College enrollment at Time 2

6.) What is the effect of the frequency of adolescent (T1) binge drinking on change over time of binge drinking as measured at young adulthood (T2) and adulthood (T3)?

7.) What is the effect of adolescent (T1) depressive symptoms on binge drinking over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

7a-c.) Is there an additional interaction effect for each of the variables listed below?

7a. Gender

7b. Race/Ethnicity

7c. College enrollment at Time 2

Research Questions with Drunkenness as Dependent Variable

8.) Is there a change over time for drunkenness at adolescence (T1), young adulthood (T2), and adulthood (T3)?

8a-c.) Is there an interaction between change-over-time and each of the variables listed below?

8a. Gender

8b. Race/Ethnicity

8c. College enrollment at Time 2

9.) What is the effect of the frequency of adolescent (T1) drunkenness on change over time of drunkenness as measured at young adulthood (T2) and adulthood (T3)?

10.) What is the effect of adolescent (T1) depressive symptoms on drunkenness over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

10a-c.) Is there an additional interaction effect for each of the variables listed below?

10a. Gender

10b. Race/Ethnicity

10c. College enrollment at Time 2

Chapter II: Overview of the Literature

Life Course Theory

The present research is grounded within Elder's (1998) life course theory, a general theory of development. This theory was selected for this study because it is the primary theory used to frame and contextualize research in the substance abuse literature. Furthermore, the theory views developmental trajectories in relationship to social pathways, a frame which mirrors the nature of the research questions asked in this study. The theory emphasizes the importance of changes in social and environmental contexts in the development of an individual (Elder, 1998). Individual outcomes are shaped by developmental trajectories, which are, in turn, shaped by societal structures, institutions, and culture (Elder, Johnson, & Crosnoe, 2003). A person's behaviors, and therefore life trajectories, are also impacted by his or her place within these societal structures and institutions, such as positions influenced by his or her age or grade level (Crosnoe & Riegle-Crumb, 2007). As a person moves through their life course, it will be marked by transitions and events which often influence his or her setting, role, or stage, all of which will likely impact his or her personal identity, as well as his or her status within society (Crosnoe & Riegle-Crumb, 2007; Elder, 1998).

The transitions from adolescence to young adulthood, and again from young adulthood to adulthood, are usually marked by major changes in norms, context, responsibility, and social relationships (Arnett, 2000). These transition points can either strengthen or change behaviors. Binge drinking and the experience of depressive symptoms are two areas which are potentially influenced by changes in contextual

variables associated with life stage transitions. Furthermore, binge drinking and depression can both shape an individual's experiences at any given period in their life course, affecting their levels of responsibility and coping strategies, disrupting adjustment, changing their patterns of social interaction, and their later experiences in life (Crosnoe & Riegle-Crumb, 2007; Warner et al., 1995). For example, depressive symptoms are associated with an increased chance of high school failure, and a decreased chance of attending college (Fletcher, 2008; Needham, 2009).

Increases in alcohol use and binge drinking are particularly associated with the transition from adolescence to young adulthood, as many move into a collegiate setting where heavy drinking is more normative (Fromme, Corbin, & Kruse, 2008; Shulenberg & Maggs, 2002). However, even this relationship is related to other influences within one's life course. Those with higher academic achievement orientations tend to have a greater increase in drinking once they get to college since, for this population, heavy drinking in high school is not normative while it is in college. Conversely, heavy drinking is more likely to be normative in high school for low achievers, who are also less likely to enter a college context in their transition to young adulthood. Since they are not entering a context with normative heavy drinking they may be less likely to increase their drinking (Crosnoe & Riegle-Crumb, 2007).

Major changes over the life course, such as college attendance, also potentially change the association between depression and alcohol use since those drinking more heavily due to depression may be drinking at similar levels to their non-depressed peers once college is entered and heavy drinking is more normative (Bryant, 2010; Needham, 2007). However, since drinking tends to decrease as individuals move into their late 20s

and 30s, this association may reappear later in one's life course. As Gonzalez, Bradizza, & Collins (2009) note, "the college years, because they occur (for the traditional student) at a time of transition from adolescence to adulthood, are viewed as a critical developmental time period. If an individual does not develop more adaptive coping skills, problematic behaviors that are established during this important period may become habitual and have deep and lasting consequences… In college students, drinking to cope with negative affect has been implicated in problematic drinking and in failing to mature out of problematic drinking patterns" (p. 450)

This study examines how heavy drinking and depressive symptoms at various stages in the life course are related to later heavy drinking and depressive symptoms. Additionally, the potential influence to these relationships of a major transitional event, college attendance, is examined.

Alcohol Use and Depression

A search of the literature for previous studies investigating the associations between alcohol use and depression/depressive symptoms, both cross-sectional and longitudinal in nature, was conducted. Twenty-one articles were reviewed, including seven cross-sectional studies, 12 longitudinal studies with time spans ranging from 1 month to 11 years, one previous narrative literature review, and one meta analysis. Cross-sectional and longitudinal findings categorized by age group, as well as any gender differences found across the studies, are discussed below. See Table 1 in Appendix A for a summary of the relevant findings and limitations articles reviewed. Several limitations were noted across most articles, including a failure to report effect sizes and a failure to investigate or report on the longitudinal measurement invariance of both established and constructed

measures.

Summary Articles. Both a literature review of 22 studies by Armstrong and Costello (2002) and a meta analysis by Connor, Pinquart, and Gamble (2009) concluded that depression is associated with concurrent alcohol use and impairment. Armstrong and Costello (2002) reported that eight of the studies had similar findings: the prevalence of depression increased from approximately 5 percent among abstaining youth to approximately 24 percent in youth with at least weekly alcohol use. They also reported that, overall, the studies found concurrent comorbidity between substance use disorders (SUDS) and depression with rates ranging from 11 percent to 32 percent (median 18.8 percent). Across the studies, depression was found to be the second most common comorbid condition (following conduct disorder).

Conner, Pinquart, and Gamble's (2009) meta analysis of depression and substance use among those with Alcohol Use Disorders (AUDs) used 74 studies with a mean sample age of 21 years old. Fifty-eight of the studies used subjects from clinical settings, 10 used subjects from community settings, and 6 used subjects from both settings. They did not include studies that used a dichotomous cut off of symptoms into depressed versus non-depressed. In additional to finding a concurrent relationship between depression and alcohol use and impairment (60.5% with above average depressive symptoms compared to 39.5% without), they also found that depression is related to future alcohol use and impairment. Depression was also associated with earlier age of onset of an alcohol use disorder, and higher treatment participation. They did, however, find that those with AUD had a modest decline in depressive symptoms over time, with a stronger effect for older participants.

Cross-sectional studies. Several studies looked at the association between depression and substance use (although this was not necessarily the only focus of these studies). Two studies sampled a wide range of ages (12 and older and 15-54 year olds) using large national samples (Kandel, Huang, & Davies, 2001; Kessler et al., 1996) and found that higher levels of drinking are associated with depression. Kandel, Huang, and Davies (2001) (N=1285), using descriptive and multivariate regression analyses with data from the National Household Survey on Drug Use (NHSDA), found that rates of major depression increases with recent use and dependence status. According to Adjusted odds ratios, rates of depression were twice as high for dependent alcohol users than for former users or non-dependent users, and even higher compared to those who had never used. Kessler et al. (1996) (N=8098), focusing only on substance abuse disorders instead of use, found that 11 percent of those with alcohol abuse had a major depressive episode by using a simple cross-tabular method, comparing percentages. They also found that for the vast majority of people with co-occuring addictive and mental health disorders, a mental health disorder was present before the addictive disorder, although these findings were based on retrospective recall and simple correlational analysis.

The majority of the studies on the concurrent association between alcohol use and depression focused on a narrower age range. The bulk of these studies focused on population groups under the age of 18, and tended to be drawn from relatively large samples. Frequency of alcohol use is associated with increased risk for mood disorders, and in particular depression (Diego, Field, & Sanders, 2003; Kandel et al., 1997; Strandheim, Holmen, Coombes, & Bentzen, 2009; Waller et al., 2006). This association strengthened with increases in frequency of alcohol use from occasional to more regular

use according to the odds ratio from the logistic regression analysis of a study by Kandel et al. (1997) (N=1285). Higher levels of drinking strongly associated with SUD diagnosis even at these younger ages, pointing to the importance of examining levels of alcohol consumption. For adolescents who drank weekly, 30.8% and 41.7% were diagnosed with an SUD. However, the authors note that the power of the analysis was adversely affected by the low rates of drug use and SUDs in their sample. Strandheim et al. (2009) (N=8983), using logistic regression models to study associations, found that those who abstained from alcohol use were two and a half times less likely to have depressive symptoms than their peers who drank. Depressive symptoms were also highly associated with number of alcohol intoxications, indicating that the amount of alcohol consumed is also an important factor.

There were fewer studies on the concurrent association between alcohol use and depression that focused specifically on young adult populations over the age of 18. Only one study, with a very small sample size (N=91), was found. However, this study found similar results to those previously listed. Gonzalez, Bradizza, and Collins (2009) studied 18-20 year old college students from one university and, using multiple regression analysis, found that greater severity of depressive symptoms, based on a self-report scale, was associated with drinking problems and a tendency to drink to cope, as opposed drinking to socialize. However, while they found significant associations, the authors fail to report effect sizes of their analysis so the size of this impact remains unknown. Drinking to cope is associated with heavy episodic drinking, alcohol consumption, and alcohol problems.

Longitudinal Studies. A number of studies examining the relationship between

depression and alcohol use over time were also found, ranging in time span from a one month follow up (Hussong, Hicks, Levy, & Curran, 2001) to fifteen years (Shankman, Lewinsohn, Klein, Small, Seeley, & Altman, 2009). The largest number of studies examined a population during a middle and high school or high school only time period. While the majority of these studies used fairly large sample sizes, they were all based on specific populations, such as all students sampled from a single school district.

All studies found some sort of positive association between depression and alcohol use. The directionality of these findings, however, varied somewhat. Flemming et al. (2008) (N=951), Sihvola et al. (2008) (N=1545), and Kumpulainen (2000) (N=1267) all found that depression tended to predict later increases in alcohol use. Sihvola et al. (2008), using multinomial logistic regression, found that early onset depressive disorders (at age 14) predicted frequent alcohol use and recurrent drunkenness 3 years later. This predictive association emerged when controlling for shared familial influences, data about which was accessible because this was a twin study. However, the authors do note that the sample leading to this conclusion was limited and therefore results should be viewed as suggestive rather than definitive. Furthermore, Flemming et al. (2008) found, in a population of 8^{th} to 11^{th} graders interviewed annually, an episodic relationship of co-occurring alcohol use and depressive symptoms using multi-group growth curve modeling. They also found that initial levels of alcohol use did not predict increases in depression but the opposite was true, with high levels of depression predicting increased alcohol use. Using logistic regression analysis, Kumpulainen (2000) found that 12-year-old children with depression are at risk for excessive alcohol use at age 15. Those with both depression and externalizing behavior were at an even greater use for later excessive

alcohol use. However, no information on the level of alcohol use at age 12 was collected so levels of use at the first time point is unknown.

Similarly, but from a different predictive direction, Meririnee et al. (2010), using logistic regression, found that excessive alcohol use (defined as weekly drunkeness) negatively affects the course of adolescent depression. They also found that excessive alcohol use comorbid with depression predicts a greater likelihood of continued depression. This study, however, had a relatively small sample size (N=197), which can lead to overestimated odds ratios.

Owens and Shippee (2009) (N=1015) demonstrated the biderectionality of depression and alcohol use using block-recursive structural equation model. They found that depressed mood is associated with decreased short term drinking (concurrently) but with increased drinking in the medium term (one year later) and long term (2 years later). They also found that drinking had a negative effect on emotional well-being as soon as one year later (for boys) and as delayed as three years later (for girls). However, this study only assessed the number of days the subjects drank, and not the quantity.

Several studies also examined the longer-term longitudinal association across the transition from adolescence to young adulthood (up to age 26). Three of these four studies used either the first three or the first and third sample years of the Add Health data, the same data set used for this study. This study will use, in comparison, a subset of the second, third, and fourth (not yet used by published studies) sample years. None of the studies addressed the measurement invariance, to ensure they are measuring the same construct over time, of either the depressive measure, an adapted version of the Center for Epidemiological Studies - Depression Scale (CES-D), or constructed substance use

variables. Needham (2007) (N=10828) found that the association between depressive symptoms and substance use was bi-directional. Both Needham (2007) and Bryant (2010) reported that those with higher levels of depression at the beginning of the study, as adolescents, had higher initial levels of use than non-depressed peers and that those with problematic alcohol use had higher levels of depression than those in the non-problematic alcohol use group. However, adolescents with higher levels of depression were less likely to have increases in binge drinking, as they transitioned into young adulthood. Those with higher levels of alcohol use at time 1 (7^{th}-12^{th} grade) had a greater decline in depressive symptoms at time 3 (18-26 years old) than those who started with lower levels of substance use. However, despite the greater decline, those with higher initial substance use levels had more depressive symptoms at all three time points measured. Both studies used latent growth curve analysis.

Overall, there was a continued association between depression and alcohol use during the third wave of the Add Health study. Bryant (2010) also found that the initial problem of either depression or alcohol use in adolescence, and perhaps not the interaction of the two, was the most important factor in determining alcohol use and depression six or seven years later in young adulthood. "A depressed adolescent with problematic alcohol use as the driving influence does not transition into young adult depression, but transitions into a young adult problematic alcohol user. A problematic alcohol using adolescent with depression as the driving influence transitions into a depressed young adult with no problematic alcohol use" (p. 93).

Paschall, Freisthler, and Lipton (2005) (N=13892), using bivariate and linear regression analysis with the same data set, found that when the sample was in young

adulthood, moderate drinkers had lower levels of depressive moods compared to lifetime abstainers, ex-drinkers, or infrequent drinkers and frequent heavy drinkers. The researchers speculate that moderate drinkers have the best outcomes because drinking is associated with reducing stress and anxiety and elevating positive mood. However, this speculation should be viewed with caution as the results are correlational in nature, not causal and another factor could easily explain the association between moderate drinking and lower levels of depressive mood.

Vida et al. (2009) (N=219), the only study examining the longer-term longitudinal association across the transition from adolescence to young adulthood (up to age 26), which did not use Add Health data, tracked participants over a 12 year span, gathering data at ages 12, 19, and 25. Although they use a comparatively small sample from a very specific population of those with speech or language difficulties, potentially compromising the generalizability of their results, their results are in line with past research. Using Repeated Measures MANOVA analysis, they found that those with co-occuring depression and alcohol use at time one had a reduction of symptoms over time, but remained at greater risk for both depression and alcohol use than those without difficulties at time one.

Just one study looked at the longitudinal association between alcohol use and depression within a population of young adults. Hussong, Hicks, Levy, and Curran (2001) looked at the association over a shorter period of time (1 month duration only) but with great frequency during that time period, examining some of the more nuanced short-term bi-directional influences of substance use and depression. Participants reported their alcohol use for any given day within 24 hours. All other studies used self-report,

retrospective recall which is much more likely to be inaccurate. Using autoregressive latent trajectory, they found that those with fewer close and supportive friends were at greater risk for higher levels of drinking compared to peers with more friendships following elevations in sadness. These heavier drinking episodes then, in turn, predicted subsequent elevations in negative affect in the following week. Greater weekend drinking predicted greater weekday negative affect. However, greater weekday drinking was not predictive of greater negative affect. Positive affect actually predicted greater weekday drinking. Also, greater weekday drinking predicted greater positive affect on the weekends. The researchers attribute these last findings to "celebration and social facilitation as reasons for drinking among college students. Moreover, such celebratory drinking appears to further good cheer, as weekday drinking in turn also predicted subsequent positive affect" (p. 459). However, the results are correlational so causal statements should be interpreted with caution. Additionally, results of this study should be generalized with caution as results were based on a small sample size (N=74) from a single college.

No studies were found that tracked the relationship between depression and alcohol use from adolescence, beyond young adulthood, and into adulthood (over age 26), which is what the current study did. However, two studies were found that tracked the relationship within an adult population. Both studies, however, use proxy indicators or alcohol use disorders (AUDs), instead of amount or frequency of alcohol use. Jackson and Sher (2003) (N=378), using state-trait modeling analysis, found that AUDs and trait distress were correlated over their 11-year study with a baseline age of 18.5. However, they also found that most of the association was due to a third variable such as childhood

stressors or behavioral under-control. McCarty et al. (2009) (N=776) collected data from a community sample from one city at ages 24, 27, and 30. Using multivariate cross-lagged path analysis conducted separately for men and women, they found that **a**mong women, depression was positively related to later alcohol abuse or dependence. For men, they did not find a longitudinal affect but did find that at age 30, men were likely to have concurrent comorbidity between major depression and AUDs. The researchers speculate that their sample may have under reported symptoms due to the in-person interviews conducted instead of using a more private paper and pencil questionnaire.

Predictive and Protective Factors

Educational Environment and Attainment. An additional search of the literature was conducted to examine the effect of educational factors on the relationship to both alcohol use and depression. Educational factors were found to be related to alcohol use in a number of ways. During high school, alcohol use is associated with later declines in academic performance and academic achievement is associated with decreased alcohol use (Crosnoe & Riegle-Crumb, 2007; Mason & Windle, 2001). In general, alcohol consumption increases during the transition from high school to college (Fromme, Corbin, & Kruse, 2008). College heavy drinking is predicted by pre-college heavy drinking, pre-college peer drinking norms, pre-college other substance use, and pre-college party motivation for attending college (Sher & Rutledge, 2006).

Crosnoe and Riegle-Crumb (2007) (N=6,308) examined the interaction of the life course model of education and alcohol use with hierarchical linear modeling, using the first and third wave of the Add Health data. The study found that during high school, students of higher academic status drank less, but upon reaching college age, drank more

than their peers of lower academic status. Among those with similar drinking habits at Wave I of the Add Health data, the odds of being a regular drinker at Wave III rose by 10% with every notch up the math course-taking sequence during high school, a good predictor of academic status, and by about 20% for every .1 increase in cumulative GPA during high school. Those who went to 4-year colleges after high school were more likely to become current drinkers than those who did not go on to college (either finished high school only or dropped out of high school). "Students who do well in high school will enter an environment that presents many opportunities to drink and that often exacts social costs for not drinking. In contrast, students of lower academic status will be more likely to enter the labor force as well as early marriage and parenting roles, all of which curtail time available for partying and increases the social and economic costs of drinking-related problems. Thus, students who do poorly in high school will enter contexts with fewer opportunities for and greater constraints on drinking" (p. 269).

Further analysis revealed that the association between increased odds of drinking and high school GPA was not completely explained by college entry. Inclusion of such post-high school educational markers, however, reduced but did not eliminate the contribution of the highest math-course taken. The authors note that “high school academic status had a carry-over effect on young people even after they left high school, regardless of the contexts they entered after high school…. Their post-high school increase in drinking was partly a function of their transition from high school to college, but academically elite students demonstrated this increase independently of whether they went to college. Those who did not attend college may have cultivated a model of what young adulthood and adulthood entail for ‘people like them,’ a model that included

drinking: party drinking in young adulthood, and social drinking (happy hours, cocktail parties) in adulthood. This model, then, shaped their drinking regardless of their actual life circumstances" (Crosnoe & Riegle-Crumb, 2007, p. 279). They also note that past research in drinking has generally documented declining levels of alcohol use through the 20s and into the 30s. They predict a possible reversal of association between academic status and drinking during this timeframe. The current study sheds some light on this prediction.

While academic status influences levels of drinking, the opposite also seems to be true. A study by Staff, Patrick, Loken, and Maggs (2008) (N=9107) looked at the impact of alcohol use at age 16 on educational attainment in adulthood using propensity score matching. Heavy drinking at age 16 had a negative impact on educational attainment at age 42 for males but not for females. In particular, males from working class backgrounds were most negatively affected by drinking heavily at age 16. Heavy alcohol use had little effect on female educational attainment. However, results should be interpreted with caution as the alcohol measure only spanned a one-week period so may not be representative of an individual's drinking patterns over time.

Several studies examined motives for drinking in college. A study by Vaughan, Corbin, and Fromme (2009) (N=1,447) examined the differences in drinking based on social versus academic motives in college through structural equation modeling. They found that social motives were moderately associated with alcohol use and problem drinking in college. Academic motives, however, had a small but significant inverse relationship to alcohol use and problem drinking. Social motives and behaviors proved to be the greatest influence on drinking behavior during the transition from high school to

college. For women, academic achievement orientation was protective against drinking and problem drinking. For men, this was only protective senior year of high school. A study by Martin and Hoffman (1993) examined the influence of several variables on college drinking. They found that positive expectancies associated with alcohol use had the largest influence, particularly social and physical pleasure and social assertion. College living environment also influenced drinking behavior, with those living in fraternities, group houses, and residence halls drinking significantly more than those living at home. Peer living environments may therefore influence peer norms of drinking. Peer influence was also a significant predictor of alcohol consumption with those who had heavy drinkers as friends tending to be heavier drinkers themselves.

Gonzalez, Bradizza, and Collins (2009) (N=91) examined a population of college students with past or current suicidal ideation. Using regression analysis, they found that current suicidal ideation was associated with heavy solitary drinking, as was drinking to cope. Among social (as opposed to solitary) drinkers, enhancement motives were important while drinking to cope was not. As the authors note, "drinking context plays an important role in the relationship between suicidal ideation and heavy episodic drinking among underage college students" (p. 997). However, these results are based on a small sample size from a single college.

Several studies found differences in racial groups in the interaction of alcohol use and education. Four-year college attendance increases the likelihood of heavy drinking for Caucasian students but was inversely related to heavy drinking for African Americans and Asian Americans. This increase for Caucasian students was associated with being away from home, friends' heavy drinking, and time spent socializing with friends. The

causal direction between these factors and alcohol use, however is unknown. Two-year college status was also inversely related to heavy drinking for African Americans, Hispanics, and others. (Paschall, Bersamin, & Flewelling, 2005). For Latino students, academic achievement orientation was more protective than for Caucasian students during college (Vaughan, Corbin, & Fromme, 2009).

Educational factors are also related to depression in a number of ways. Several studies found that depressive symptoms can influence the level of educational attainment achieved. Depressive symptoms during adolescents are associated with decreased odds of completing high school for girls (Fletcher, 2008; Needham 2009). Furthermore, GPA was inversely related to depression (reducing odds of depression by almost 40% for each 1 point increase in GPA) (Fletcher, 2008). Depressive symptoms are also associated with a decreased likelihood of entering college. (Fletcher, 2008; Needham, 2009).

Educational attainment has also been found to be protective against depression. Educational level is significantly related to depression in both cross-sectional and longitudinal analyses. Those who completed high school by age 21 were less depressed in adulthood (Topitzes, Godes, Mersky, Ceglarek, & Reynolds, 2009). Longitudinal analyses found a protective effect of education that accumulates over time (Bjelland, Krokstad, Mykletun, Dahl, Tell, & Tambs, 2008). Association between depression and level of education strengthens with age, with those with lower levels of education more likely to be depressed (Bjelland et al., 2008; Miech & Shanahan, 2000). A curvilinear relationship between depression and age was found, with depression levels being the highest at age 18 and in the 80s/90s and lowest in the 50s/60s age period. However, educational level is protective of this, with those with greater education starting at lower

levels of depression and decreasing more in level of depression and remaining less depressed over time, even into old age. The increase of depression in old age happens at a significantly later time point for those with higher levels of education (Miech & Shanahan, 2000; Ross & Mirowsky, 2006). Depression decreases more steeply for women than for men as their educational level rises. The gender gap in depression is essentially eliminated with a college education or higher.

Gender. Gender has been found to affect many of the variables discussed thus far. There are gender differences in alcohol use. Studies have consistently shown higher levels of alcohol consumption, higher trajectories, and greater prevalence of abuse/dependency among men than women (Dawson, et al., 2008; Palmer et al., 2009; Kumpulainen, 2000). These differences start at a relatively young age. Gender differences in drinking were not yet apparent in the middle school students, but once the transition to binge drinking is made, boys binge drink more than girls (Guilamo-Ramos, Jaccard, Turrisi, & Johansson, 2005). Boys were generally more likely to be heavier users by age 15 (Kumpulainen, 2000). Substance use increases steadily over time, but at a faster rate for boys and girls (Fleming et al., 2008). Men engaged in both heavy solitary and heavy social drinking more often than women (Gonzalez, Bradizza, & Collins, 2009). However, in recent years gender differences in drinking have narrowed (Palmer et al., 2009; *Addiction* commentary, 2008). However, there is still more heterogeneity in attitudes regarding the acceptability of heavy drinking among women which likely accounts for the continued gender differences (*Addiction* commentary, 2008).

Several studies also found gender differences in the intersection between educational factors and drinking. A study by Staff, Patrick, Loken, and Maggs (2008)

found that, for males, both heavy drinking and socio-economic status affected later educational attainment. Heavy drinking did not have an impact on female educational attainment (Staff, Patrick, Loken, & Maggs, 2008). Vaughan, Corbin, and Fromme (2009) found that, for women, academic achievement orientation was protective against drinking and problem drinking. For men, this was only protective senior year of high school.

Many studies also found gender differences in levels of depression. Several studies found that females demonstrated about a third higher level of depression then males (Bryant, 2010; Weller et al., 2006). While the overall levels varied across age groups, means for depressive symptoms were higher for girls than boys at each time point. Even with this variability, a high degree of stability was found across time in depressive symptoms in participants (Fleming et al., 2008). One study found that while the prevalence of major depression was similar for men and women, the prevalence of minor depression and prescription use significantly higher for women (Andersen, Thielen, Nygaard & Diderichsen, 2009).

There were also gender differences in the interaction between educational level and depression. For females only, those with greater depression are less likely to graduate from high school (Needham, 2009; Fletcher, 2008). Depressed female adolescents are also less likely to enroll in college (Fletcher, 2008). Depression decreases more steeply for women than for men as their educational level rises. The gender gap in depression is essentially eliminated with a college education or higher (Ross & Mirowsky, 2006).

Somewhat contradictory gender differences were found in the interaction between alcohol use and depression. A few studies found that males are more likely to be affected

by this interaction than girls. Bryant (2010) found that depressed young adult males were more likely to be problematic drinkers. Kumpulainen (2000) found that boys with depressive symptoms at age 12 were more likely to be heavy users at age 15 than girls who had depressive symptoms at age 12. However, boys were also generally more likely to be heavier users by age 15. Hussong, Hicks, Levy, and Curran (2001) found that, in general, gender did not influence relationship between drinking and affect but that there was an association between weekend sadness and elevated weekday drinking for men but not for women.

On the other hand, some studies found just the opposite: females are more likely to be affected by the interaction between alcohol use and depression than boys. Waller et al. (2006) found that for females, those who drank were two and a half times more likely to be depressed than abstainers. For males, there was not a great association between alcohol use and depression. They also found that girls with risky behavior were at greater risk for depressive symptoms than boys with similarly levels of risky behavior. Strandheim, Holmen, Coombes, and Bentzen (2009) found that depressive symptoms were highly associated with number of alcohol intoxications. While there was not a great difference between the genders in the number of intoxications, there was association with depressive symptoms and intoxication only for females aged 13-19 years old. Furthermore, McCarty et al. (2009) found that for females, this increased comorbidity between alcohol use and depression increased through young adulthood while it declined for males.

One study suggests different pathways for males and females for the interaction of substance use and depressive symptoms. Owens and Shippee (2009) found differences in

gender between short and long term association between depressed mood and increased drinking. They also found differences in the magnitude of affect by gender. Drinking had negative effects on emotional well being in 10th grade for boys, but not until 12th grade for girls.

Race/Ethnicity. Racial/ethnic background also proved to be relevant factors in predicting levels of drinking. Caucasian students drank more than Asian American, African American, and Hispanic/Latino students (Fromme, Corbin, & Kruse, 2008; Watt & Rogers, 2007). Racial/ethnic background was also correlated with depression. Hispanic students were found to be 30 percent more likely to be depressed than non-Hispanic peers (Fletcher, 2008).

Other Predictive and Protective Factors. There are a number of other protective or predictive factors for alcohol use, depression, and educational attainment noted in the literature. Some of these factors may have only spurious effects, however this possibility was generally not discussed or accounted for in the literature in great length. As a result, all possible factors noted in the literature have been included here. Several factors were found to influence the relationship between drinking and depression. Jackson and Sher (2003) found that the association is mediated by neuroticism and behavioral under control (i.e. conduct disorder and delinquency), family history and childhood stressors. McCarty et al. (2009) found that alcohol use disorders predict obesity and obesity predicts depression in the mid to upper 20s. Finally, Goodman and Huang (2002) found that SES and alcohol use are inversely related, however this relationship weakened when depressive symptoms were taken into account. Close, supportive friendships were found to be protective against drinking after depressive episodes.

Several factors were found to influence levels of drinking, without taking into account depression. A family history of drinking problems was an important predictor of drinking. Parental alcoholism was strongly associated with adolescent binge drinking (Shin, Edwards, & Heeren, 2009). Vaughan, Corbin, and Fromme (2009) found that while academic achievement orientation was protective of problem drinking for those with family history during fall of sophomore year of college, it was protective for all of freshman and sophomore year for those with no family history.

Family relationships proved to be another influencing factor in levels of alcohol use. Family social support was indirectly associated with decreased alcohol consumption. Religiosity, school grades, and peer alcohol use were also related and affected family social support (Mason & Windel, 2001). Low scores on parenting variables, which included communication quality, use of reasoning, and control and supervision, were predictive of binge drinking during high school. Moderate levels of control and supervision proved optimal to decrease binge drinking. Families on the low and high end of spectrum resulted in highest level of binge drinking among kids (Guilamo-Ramos, Jaccard, Turrisi, & Johansson, 2005). Childhood maltreatment was also a strong predictor of adolescent binge drinking, particularly when multiple co-occuring maltreatment was present (Shin, Edwards, & Heeren, 2009), as was exposure to violence (Taylor, & Kliewer, 2006).

Several school variables also influenced levels of drinking. In schools with a culture of caring fostered by the teachers students were less likely to binge drink (Guilamo-Ramos, Jaccard, Turrisi, & Johansson, 2005). Those from high schools in urban or rural areas reported higher levels of drinking then suburban schools (Fromme,

Corbin, & Kruse, 2008). Those who opted to live in private dorms instead of university dorms tended to be heavier and more frequent drinkers. Those living in the private dorms also had an increase over time in alcohol consumption (Fromme, Corbin, & Kruse, 2008). Attention problems, hyperactivity, and conduct problems were strongly associated with frequent alcohol use for both girls and boys (Strandheim, Holmen, Coombes, & Bentzen, 2009; Kumpulainen, 2000).

The literature also demonstrates that depression, apart from alcohol use, is influenced by a number of other factors. One factor is one's physical health. Those with both physical health problems and lower educational levels were at greatest risk for depression (Miech & Shanahan, 2000). Income, employment, and other SES variables can also impact levels of depression. Associations of depression were found to be stronger for low income and non-employment than for low education (Andersen, Thielen, Nygaard & Diderichsen, 2009). Those with lower maternal education and from high-poverty neighborhoods were more likely to be depressed (Fletcher, 2008). Childhood maltreatment was also found to be associated with emotional problems (Shin, Edwards, & Heeren, 2009). Additionally, depression levels were affected by other drug use. Depression is associated with cigarette smoking, even if the smoker started and quit (Steuber & Danner, 2006)

Several individual difference factors have also been cited as influencing depression levels. One's level of intelligence is one such factor. Those with higher intelligent quotients in childhood (age 10 and age 11) were at lower risk for psychological distress (as assessed by a measure of anxiety and depression) at age 30.

This factor remained when controlling for life event predictors and educational attainment (Gale, Hatch, Batty, & Deary, 2009).

Summary and Overall Conclusions

Past research has shown that higher levels of drinking are associated with depression both concurrently and longitudinally. This longitudinal association holds true regardless of the age set examined. More studies found that depression proceeds alcohol use than the converse. However, this was not universally true and many reciprocal interactions are likely present. Additionally, other mediators or moderators likely further confound the relationship between depression and alcohol use. This association between depression and alcohol use was less pronounced during the college years, however, even during this time, the motivation for drinking was more likely to be due to coping with negative emotions for depressed students. Non-depressed students were more likely to drink for social reasons. While few studies examined the interaction of educational factors on both depression and alcohol use at the same time, some did look at the influence of educational factors on each of these factors independently. College attendance is likely to increase alcohol use in adulthood. College attendance is inversely related to depression, however. Gender was also a relevant factor in considering alcohol use, depression, and the interaction of the two. Females are likely to drink less than males, however, they are more likely to be depressed. These differences, in turn, influence the interaction of alcohol use and depression, although exactly how is less clear in the literature. Race and ethnicity also serve as an influencing variable since White students are generally more likely to drink and to have increases in drinking associated with depression.

While past research has covered aspects of the proposed research questions, none has looked at all aspects simultaneously, and few have come close to the proposed time span. Past research has demonstrated associations between alcohol use and depression, alcohol use and educational factors, and depression and educational factors. The current study examines all of these in conjunction. Furthermore, the study investigates these interactions using a large national data set, over a considerable length of time, making this a valuable and unique research contribution.

Chapter III: Methodology

Participants

The study analyzed data from The National Longitudinal Study of Adolescent Health (Add Health), a multi-year, longitudinal study (Harris, 2009). Add Health used a nationally representative, multistage, stratified, school-based, cluster sampling design, geared towards examining adolescent health-related behaviors and young adult and adulthood outcomes. The researchers stratified the US population by geographic region, urban versus suburban versus rural, school size, school type, percentage white, percentage black, and grade span. All high schools with an 11th grade and at least 30 students were included. Of these schools, 80 high schools were selected from the strata and are the sampling unit of the study. For schools that did not include 7^{th} and 8^{th} grades, a feeder school including these grades was also included. Seventy-nine percent of the selected schools agreed to participate, resulting in a final sample of 134 middle and high schools, ranging in size from less than 100 to over 3000 students. An in-home sample of 27,000 adolescents was drawn at the first wave of the study consisting of a core sample from each community to form a representative sample plus selected special over samples. This sample was followed over a total of 14 years and is where the sub-sample used for this study was drawn.

Data were collected at four occasions. Wave I of the Add Health data were collected in 1995 and yielded a total sample of 20,745. At this initial data collection point, participants ranged from grades 7 to 12. Wave II was collected one year later, in 1996, with a total of 14,738 adolescent respondents. This sampling point excluded the

seniors from the previous year who were now no longer in high school. From July 2001 to April 2002, Wave III was collected, resulting in 15,197 participants, all now young adults. Wave IV data were collected from 2007-2008 when the participants were 24-32 years of age.

The research questions examined in this study are all longitudinal in nature. They address the relations among variables over 11 years. Wave I was not used in this study. For clarity purposes, the sub-sample used from Wave II are referred to as T1, Wave III as T2, and Wave IV as T3. This study analyzed data collected for 9th and 10th graders during Wave II (T1 for this study). This sub-sample was followed up at Wave III (T2 for this study), which designates data collected in 2002, when the participants were aged 20-22. This same sub-sample was also followed up at Wave IV (T3 for this study), which designates data collected in 2007-2008, when the participants were mainly 26-29. Selecting these students provided a more narrow age/grade range, allowing for an examination of students first in high school, then potentially in college (since those who follow a traditional higher education trajectory should be juniors and seniors in college at Wave III) and, then finally when they were in their upper 20s or early 30s.

Restricting the sample in this way resulted in a sub-sample of 3194 participants who were interviewed at all three occasions for this project. At Wave II (T1) 1,482 of the participants were in 9th grade and 1,712 were in 10th grade. Approximately 45 percent of the sample is male and 55 percent is female. The bulk of the participants were 14 to 16 years of age at T1 although the total age range is 12 to 19 years of age. Approximately 57 percent of the sample is White, 21 percent is African American, 3 percent is Native American, 5 percent is Asian, 13 percent is Hispanic, and less than 1 percent is classified

as other. Those classified as other were eliminated from the data set when Race/Ethnicity is included in the analysis. Due to missing data of sampling weights, 234 participants were excluded from the analysis. Baseline characteristics of the sample are summarized in Table 2.

Table 2
Descriptive information of the sample

Descriptives	Sample
Total Sample Size	3194
Mean Age at T1 (SD)	15.41 (.83)
Gender	
Female	1766 (55.3%)
Male	1428 (44.7%)
Ethnicity	
White	1840 (57.6%)
African American	683 (21.4%)
Aisan	149 (4.7%)
Native American	94 (2.9%)
Hispanic	420 (12.8%)
Other	19 (.6%)
College Attendance at T2	
Yes	1007 (31.5%)
No	2187 (68.5%)

The analysis accommodated the unequal weighting of the Add Health sample and adjusted for the design effects due to the stratification and clustering sampling used in collecting the sample. A manual method, which calculates and incorporates Design Effect Adjusted Weights into the analysis, was used. The Design Effect Adjusted Weight is calculated by dividing the appropriate original weights provided in the Add Health restricted use data set by their mean and then dividing the quotient of the previous calculation by the mean of the design effect (DEFF). DEFF = 1 + ICC (N – 1), where *ICC* = Intraclass Correlation and *N* = average number of subjects per cluster) resulting in the following formula:

$$\frac{1}{DEFF} \times \frac{wt}{\text{mean of } wt}$$

The DEFF measures the impact of the departure of the study's complex sample design from a simple random sample design and helps adjust for inflated standard errors. The normalized weight (*wt*/mean of *wt*) allows for correct point estimates. The DEFF value for each of the three dependent variables, the reduced CES-D measure, the Binge Drinking measure, and the Drunkenness measure, was calculated separately and was used to create three Design Effect Adjusted Weights. The three different weights were used, respectively, when their corresponding measures were the dependent variables in any given analysis. The new weight was applied to the sample size, resulting in a deflated sample size and a consequent reduction in calculated standard errors and degrees of freedom (Bryant, 2010; Hahs-Vaughn, 2005, 2006). As a result of using three different Design Effect Adjusted Weights, different sample sizes than those reported in Table 2 were used in the analysis depending on the weight used. These new sample sizes are reported in conjunction with the results of the particular analysis.

Procedures and Measures

Data were collected through a 135 page in-home survey. The data collection instruments have multiple items and are intended to measure underlying theoretical constructs, which allow for more reliable and accurate measures as compared to most large-scale longitudinal studies. For more sensitive material, students listened to questions through headphones and entered responses directly into a computer to avoid having them alter responses due to interviewer or parental presence. Past research has demonstrated that adolescents have a greater probability of reporting drug and alcohol use through computer-assisted interviews, such as those used in the Add Health data

collection, when compared to written questionnaires (Supple, Aquilino, & Wright, 1999). However, all data were self-reported which can be inaccurate due to inaccuracies in retrospective recall or purposeful alteration of responses, even after the privacy measures taken through the use of the headphones. Once the data were collected, data from the different sources for each student were merged while maintaining confidentiality.

The measures selected from the larger survey to answer the research questions in the study are outlined in Table 3. Responses such as "refused" or "don't know" were

Table 3
Summary of Measures

Variables	T	Description of Measure	Range	Response Type
Gender		Self report variable	0-1	0= Males, 1= Females
Race/ Ethnicity		Constructed from racial/ethnic identify self-reports	1 to 5	1= White, 2= Black, 3= Native American, 4 = Asian, 5 = Hispanic
Binge Drinking	T1, T2, & T3	Over the past 12 months, on how many days did you drink 5 or more [5 or more/4 or more depending on sex for T3] drinks in a row?	0 to 6	0= none, 1= 1 or 2 days in the past 12 months, 2= once a month or less (3 to 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.
Drunkenness	T1, T2, & T3	Over the past 12 months, on how many days have you gotten drunk or very, very high on alcohol?	0 to 6	Same as above.
Depressive Symptoms	T1, T2, & T3	5-item self report modified version of the CES-D at TI. A subset of these 5 will be used at T2 and T3: 3 of those 5 questions are available at T2 and 4 of the 5 items are available at T3	0 to 3	0 = never or rarely, 1 = sometimes, 2 = a lot of the time, and 3 = most or all of the time. Continuous average score ranging from 0-3.
Current College Enrollment	T2	Current full time enrollment in a four-year college	0-1	1=Yes, 0=No

coded as missing for all measures.

Heavy Drinking Measures. Two questions from the data set were used to gauge participants' heavy drinking. An analysis was conducted separately for each question. The first analysis used a measure of Binge Drinking. At each Wave respondents were asked how often during the past year they binge drank. Binge drinking is considered consuming five or more drinks in 1 sitting at T1 and T2. At T3 binge drinking was considered five or more for males, but four or more for females. The second measure of heavy/problematic drinking is a measure of drunkenness. Participants were asked how many days have you gotten drunk or "very, very high" on alcohol over the past 12 months Possible responses for each question include never (0), one or two days in the past year (1), once a month or less (2), two or three days per month (3), one of two days per week (4), three to five days per week (5), and every day or almost every day (6). Both measures are continuous, with scores ranging from 0-6. Frequencies and percentages for these two measures (for total sample, for just those who attended college at T2, and for those who did not) can be found in Table 4. Rates of drinking as reported in the Add Health data set were somewhat lower than other data sources such as Monitoring the Future (Johnston, O'Malley, Bachman, & Schulenberg, 2009). Particularly, rates at T2 were somewhat lower than other studies (SAMHSA, 2007). This is a common issue when studying drinking using the Add Health data set (Crosone & Riegle-Crumb, 2007).

Table 4
Frequencies of Levels of Heavy Drinking by Time and by College versus no College

Measure	Total	No Binge Drinking	1-2 days in past year	3-12 days in past year	2-3 days a month	1-2 days a week	3-5 days a week	almost every day
				Binge Drinking				
T1 Total	3187	2338 (73%)	306 (10%)	190 (6%)	154 (5%)	113 (4%)	50 (2%)	36 (1%)
T1 Attended College	916	715 (78%)	79 (9%)	48 (5%)	46 (5%)	22 (2%)	3 (.4%)	3 (.4%)
T1 No College	2271	1622 (71%)	227 (10%)	142 (6%)	108 (5%)	91 (4%)	47 (2%)	33 (1%)
T2 Total	3187	1531 (48%)	460 (14%)	361 (11%)	296 (9%)	379 (12%)	139 (4%)	25 (1%
T2 Attended College	916	364 (40%)	127 (14%)	114 (13%)	102 (11%)	149 (16%)	59 (6%)	2 (.2%)
T2 No College	2271	1168 (51%)	333 (15%)	246 (11%)	194 (9%)	228 (10%)	80 (4%)	22 (1%)
T3 Total	3187	1494 (47%)	585 (18%)	378 (12%)	327 (10%)	285 (9%)	95 (3%)	24 (1%)
T3 Attended College	916	354 (39%)	177 (19%)	157 (17%)	116 (13%)	88 (10%)	19 (2%)	4 (.5%)
T3 No College	2271	1140 (50%)	407 (18%)	221 (10%)	210 (9%)	197 (9%)	76 (3%)	20 (1%)
				Drunkenness				
T1 Total	3190	2299 (72%)	361 (11%)	182 (6%)	159 (5%)	102 (3%)	55 (2%)	33 (1%)
T1 Attended College	916	695 (76%)	97 (11%)	53 (5%)	44 5%)	19 (2%)	5 (.6%)	4 (.5%)
T1 No College	2274	1604 (70%)	264 (12%)	129 (6%)	115 (5%)	83 (4%)	49 (2%)	29 (%)
T2 Total	3179	1472 (46%)	504 (16%)	441 (14%)	325 (10%)	345 (11%)	83 (3%)	10 (.3%)
T2 Attended College	915	312 (34%)	144 (16%)	152 (17%)	124 (14%)	150 (16%)	34 (4%)	0
T2 No College	2277	1160 (51%)	359 (16%)	288 (13%)	201 (9%)	196 (9%)	49 (2%)	10 (.4%)
T3 Total	3191	1465 (46%)	732 (23%)	438 (14%)	268 (8%)	216 (7%)	60 (2%)	11 (.4%)
T3 Attended College	916	322 (35%)	219 (24%)	183 (20%)	103 (11%)	74 (8%)	11 (1%)	3 (.4%)
T3 No College	2277	1143 (50%)	513 (22%)	256 (11%)	164 (7%)	143 (6%)	48 (2%)	8 (.4%)

Depressive Symptoms Measure. Adolescent, Young Adult, and Early Adult Depression was measured by abbreviated versions of the Center for Epidemiological Studies-Depression Scale (CES-D). The full 20-item version of the measure is a valid and widely used measure to assess depressive symptoms in the general population. The scale, developed in 1976 is not intended as a diagnostic tool but can be used to identify those at risk for depression. This is an important distinction as the criteria for Major Depressive Disorder as defined by the Diagnostic and Statistical Manual, Fourth Edition, Text Revision (DSM-IV TR) (American Psychiatric Association, 2000) includes only 9 symptoms. Additionally, in order to meet the criteria laid out by the DSM-IV TR, clinical judgment of a trained clinician is required. Furthermore, at least one of the symptoms must be either "depressed mood" or "loss of interest or pleasure."

Four dimensions associated with depression (depressed affect, positive affect, somatic-retarded activity, and interpersonal factors) are assessed with this measure (Randolff, 1977). The CES-D is one of the most popular instruments for identifying depressive symptoms in community samples and has been used in many large national surveys in either shortened or full-length versions (Link 2002; Schwartz, 2002).

A somewhat altered version of the CES-D is available in the Add Health data. At Waves 1 and 2 (T1) 19 items are included. Two of the original items are not included but one additional item has been added (I felt that life was not worth living) because it was deemed an important component of depression in adolescence. In addition, two items have been slightly reworded from the original. At Wave 3 (T2) only nine of the items are available. At Wave 4 (T3) those same nine items, plus an additional item, for a total of 10 of the original 20 questions, are included. Needham (2007), a study that used the Add

Health data, found the correlation of the 19- and 9-item CES-D scales at the first two waves to be .68. The study also reported that the Cronbach alpha reliability of the scale was .80 at Wave 1 and .81 at both Wave 2 (T1) and Wave 3 (T2). Four of the 19 items were reverse coded in order to make the scale consistently reflect higher values indicating greater psychological distress. Respondents were asked how often they experienced, depending on the Wave of data either 19, 9, or 10 symptoms in the past week (0 = never or rarely, 1 = sometimes, 2 = a lot of the time, and 3 = most or all of the time). The average (0-3) score were taken for each wave so as to maintain a consistent scoring metric regardless of the number of items.

All but one of the studies reviewed in Chapter 2 that used versions of the CES-D from the Add Health data set used either the 19 or 9 items available at the time of assessment (no studies using Wave 4 data with 10 items available have yet been published) (Needham, 2007; Paschall, Freisthler, & Lipton, 2005; Waller et al., 2006; Goodman & Huang, 2002; Steuber & Danner, 2006; Hallfors et al., 2005; Bryant, 2010). Many of these authors stated that the CES-D is a widely used measure and some provided reliability statistics (Needham, 2007; Paschall, Freisthler, & Lipton, 2005) or reported correlations between the CES-D items and another measure in order to measure criterion related validity (Steuber & Danner, 2006; Bryant, 2010). However, none of the reviewed studies performed any further statistical analyses such as a factor analysis or testing for measurement invariance to ensure consistent measurement across demographic or temporal groups. A study by Perreira, Deeb-Sossa, Harris, and Bollen (2005) was a notable exception, concluding that a 5-item subset from the CES-D was the best way to

assess depressive symptoms in this data set, after attempting to validate the measure for use in the multiethnic and foreign-born populations.

In order to determine if the CES-D can be validly used to make multi-group comparisons and model the measurement structure in analyses, Perreira et al. (2005) first examined the structural form of the measure across four racial/ethnic groups and three immigrant generations. There were four commonly identified structural forms: single-factor model, four-factor model first identified by Randolff (1977) and replicated by many others, and two three-factor models that have been identified as superior for some populations (Riddle, Blais, and Hess, 2002). They found that the four-factor model had best statistical fit with a CFI value of .91. However, they found that this model did not fit the 11 ethnocultural groups well, meaning that the structural form of CES-D is not equivalent within each group, indicating a lack of measurement invariance across racial/ethnic and generational groups.

Since the measure lacked measurement invariance, the researchers decided to disaggregate the construct into more discrete sets of underlying concepts. The CES-D mixes effect indicators, cause indicators, and outcomes (Bollen and Lennox 1991; Perreira et al., 2005) so they disaggregated the measure across these lines and focused on the effect indicators; those items measuring negative/depressed affect but not causes or outcomes associated with a depressed affect. They identified five effect items (depressed, life, happy, sad, and blues) (Table 3) and created a reduced CES-D scale since "techniques for the evaluation of multi-item scales (e.g. reliability estimates) rest on the assumption that all scale items are effect indicators. Effect indicators are determined by the latent variable or factor that they are presumed to be measuring and should be

positively correlated. Causal indicators, in contrast, are indicators that determine the latent variable and may be either positively or negatively correlated with each other. Outcomes are not indicators at all but are consequences of the latent variable" (Perreira et al., 2005, p. 1578). Additionally, items measuring somatic complaint and those about interpersonal relationships are more likely to be biased by health status, gender, age and race than other items on the CES-D (Cole et al., 2000; Office of the Surgeon General 2001; Vega and Rumbaut, 1991), are more likely to be related to other constructs (i.e. health), and are more likely have less discriminative validity (Perreira et al., 2005).

Perreira et al. (2005) acknowledged that the five-item scale takes away causes and consequences of depression, variables that could be very helpful in some research. However, the authors argued that the five-item scale was appropriate for comparative purposes (especially across cultural groups) in population-based surveys, such as the current study. The shortened version also likely improves invariance across age and gender as well. Since the current study makes group comparisons across ethnic/cultural groups, age groups, and genders, this five-item scale will be used at T1. A smaller subset of these five were used at T2 and T3 as only three of these items are available at T2, and 4 are available at T3. Since all of the items are effect indicators, the full number of items available at each time point will be included. Since they each measure the same underlying construct, having a different number at each time point should not negatively affect the analysis. Additionally, the item that is available only at T1 (life is not worth living), was added to the data set to increase the applicability of the original CES-D scale to an adolescent audience. Therefore, maintaining this item even though it was only available at one time point was deemed worthwhile. Preliminary analysis including

psychometric properties and longitudinal measurement invariance, described below, were conducted to ensure that despite the different items available across the times, that a unitary construct was measured across the three time points. The symptoms assessed by CES-D in T1, T2, and T3 are listed in Table 5. Descriptive statistics are listed in Table 6.

Table 5

CES-D Items Available During Each Wave

	Items Included in:			
Symptoms Assessed	T1	T2	T3	5 Item Scale
feeling bothered by things	X	X	X	
having a poor appetite	X			
feeling blue	X	X	X	X
feeling just as good as other people (reverse coded)	X	X	X	
having trouble focusing	X	X	X	
feeling depressed	X	X	X	X
feeling tired	X	X	X	
feeling hopeful about the future (reverse coded)	X			
feeling that life had been a failure	X			
feeling fearful	X			
feeling happy (reverse coded)	X		X	X
talking less than usual	X			
feeling lonely	X			
feeling people were unfriendly	X			
enjoying life (reverse coded)	X	X	X	
feeling sad	X	X	X	X
feeling disliked by others	X	X	X	
feeling that it was hard to get started doing things	X			
feeling that life was not worth living	X			X

Table 6

Weighted Reduced CES-D Measure Descriptive Statistics

Measure	N	Mean	SD	Range
T1	3181	0.475	0.492	0-3
T2	3185	0.398	0.571	0-3
T3	3194	0.525	0.548	0-3

Preliminary analysis was conducted to determine the psychometric properties and longitudinal measurement invariance of these reduced versions of the CES-D. Analysis was conducted using the sub-sample of the Add Health data set defined above.

The internal consistency was established for the reduced version of the CES-D available at each time point. Weights were included in the analysis. While there is no widely agreed upon alpha level to determine adequate internal consistency (Pedhazur & Schmelkin, 1991), researchers often consider Cronbach's alpha of .70 or higher in the acceptable range (Nunnaly, 1978), and this alpha level was used as the cut off for the acceptable range in the current study. The internal consistency of the 5 item CES-D at T1 (r=.78), the 3 item CES-D at T2 (r=.82), and the 4 item CES-D at T3 (r=.80) were all acceptable (Table 7).

Table 7

Internal Consistency of Reduced Versions of the CES-D

	Cronbach's Alpha	Number of Items	N
T1 reduced CES-D	.78	5	3181
T2 reduced CES-D	.82	3	3185
T3 reduced CES-D	.80	4	3194

The Pearson correlations between the three reduced CES-D versions were determined. As shown in Table 8, all three versions were significantly positively correlated.

Table 8

Correlations Among Reduced Versions of the CES-D

	T1 reduced CES-D	T2 reduced CES-D
T1 reduced CES-D		
T2 reduced CES-D	.24**	
T3 reduced CES-D	.26**	.28**

**p < .01.

The corrected item-total correlation for each item and Cronbach's alpha if any given item was deleted were calculated (Table 9). Of all of the items across the 3 subsets of questions, only one item slightly lowered the internal consistency of the scale. The Happy item (reverse coded), part of the reduced CES-D at T1 and T3, lowered the internal consistently slightly at both times. However, this reduction was very small and does not warrant removal. This item had the lowest corrected item-total correlation at both time points.

Table 9

Item Level Statistics

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
T1 Reduced CES-D		
Feeling Blue	.60	.73
Feeling Depressed	.69	.69
Feeling Happy (reverse coded)	.43	.79
Feeling Sad	.64	.71
Life Not Worth Living	.49	.77
T2 Reduced CES-D		
Feeling Blue	.73	.71
Feeling Depressed	.66	.77
Feeling Sad	.65	.78
T3 Reduced CES-D		
Feeling Blue	.62	.76
Feeling Depressed	.70	.71
Feeling Happy (reverse coded)	.53	.81
Feeling Sad	.65	.74

Exploratory factor analysis (EFA) for the reduced CES-D was then conducted to explore structural validity. An EFA is necessary when using a new measure to determine the main constructs or dimensions account for the correlations between items and, therefore, ensure the intended construct(s) is indeed being measured (Kline, 1994). The EFA and CFA were carried out using Mplus 3.11 (Muthén & Muthén, 2001).

Polychoric correlations from the thresholds that Mplus computes on the categorical data were used for the EFA with a WLSMV estimation method. A Quartamin oblique rotation was used to produce efficient analytic simple structure rotation and to find the most parsimonious solution (Kline, 1994). This technique allows the factors to correlate and is considered highly flexible. The factors must be rotated in order to be interpreted and therefore explain and account for the observed correlations. A one factor and a two-factor model were used in order to find the best fit. Results of the EFA are presented in Chapter 4.

Measurement invariance was also examined to ensure longitudinal validity of the reduced composite measure. When a measure is used to study change over time, it is important to establish the longitudinal validity of its scores. Evidence establishing that the items function in the same way over time so that observed changes can be attributed to changes in the latent construct is of primary importance (Conroy, Metzler, & Hofer, 2003; Long & Brekke, 1996; Long et al., 2007; Pentz & Chou, 1994; Rahu, Laffitte, & Byrne, 2002; Schaie, Maitland, Willis, & Intrieri, 1998). If the assumptions for consistency of measurement properties over time were met it would have been re-evaluated and adjusted as necessary until adequate measurement invariance was obtained.

A series of models was fit to examine factorial invariance of the single latent variable across time. A confirmatory model was used in order to assess the extent of variation in model parameters over time. In determining factorial invariance for repeated measures data, a model is specified and compared over time by setting some parameter values at one measurement occasion equal to those at another measurement occasion. The more parameters that are set equal to each other, the more stringent the test of

factorial invariance (Blozis, 2006; Harring, 2009; Long et al, 2007). Given the longitudinal nature of this study both, *within- time* constraints that define a particular cross-sectional measurement model, and *between-time* constraints that determine the extent of longitudinal invariance are important (Long et al., 2007).

Establishing factorial invariance involves a hierarchy of levels that includes gradations in stringency levels. These gradations of measurement invariance are the result of setting some parameter values at one measurement time equal to those at another measurement time. The least stringent, configural invariance, indicates the extent of unidimensionality of the factor structure by observing if the manifest variables load on a single factor at each measurement occasion and assesses if the same construct is measured over time (Harring, 2009). Pattern (metric or weak) factorial invariance implies that the factor loadings (parameters that connect each observed variable to the corresponding latent variable) are invariant across time points (Horn & McArdle, 1992; Teresi, 2006). Strong factorial invariance requires, in addition to previous conditions, that specific factor means are equal across times. Strict factorial invariance requires that, in addition to equal factor loadings and intercepts, the residual (specific factor plus error variable) variances are equivalent across groups (Harring, 2009; Teresi, 2006).

To assess the measurement invariance of the revised CES-D measure over time, analysis to compare the increasingly constrained models was carried out. For identification purposes, the mean structure was specified and the factor variances were constrained to be equal to one. The factors were also correlated. As was done in other longitudinal invariance studies (e.g., Conroy, Metzler, & Hofer, 2003; Long et al., 2007; Pitts, West, & Tien, 1996; Schaie, Maitland, Willis, & Intrieri, 1998) item residuals were

allowed to correlate for adjacent time points which creates a first-order autocorrelation structure. Results of the measurement invariance analyses are reported in Chapter 4.

College Enrollment. At T1, all respondents of the proposed sub-sample were enrolled in 9th of 10th grade of high school. At T2, 6 years after T1, respondents reported if they are enrolled in school and what type of school they are enrolled in. For the purposes of this study, the participants are reported as either currently enrolled or not enrolled in a full time four-year college. Those enrolled in a two-year college were not included. This is an important distinction as including those who were enrolled in a two-year college or including all those who had ever been enrolled to college would have led to a larger sample of students in this category. According to the U.S. Department of Education, college enrollment has grown over time with 36% of 18-24 year olds enrolled in a two- or four-year college in 1999 and 41% enrolled in 2009 (U.S. Department of Education, 2011). Similarly the Current Population Survey from the Census Bureau reports that 39.6% of all young adults aged 18-24 were enrolled in a two- or four-year college in 2008 (Davis & Bauman, 2011). By comparison, 31.5% of the Add Health sample used in this study reported that they were enrolled in a four-year college. The somewhat smaller sample found in the Add Health data can likely be attributed to only counting enrollment in 4 year colleges.

Control Variables. Gender was included as a control variable in the analysis. Self-reported race/ethnicity (White, Black, Hispanic, Asian, and American Indian,) was also included.

Data Analysis

The study is a within-subjects design and repeated measures analysis of variance (RM-ANOVA) with covariates was used for the data analysis. Repeated measures ANOVA is an appropriate analytic technique when measuring the same participants over time on the same dependent variables (Lix & Keselman, 2010), as is the case with the current study. A mixed design was used in order to assess change over time and between-subjects and within-subjects factors.

An alternative analytic method for analyzing longitudinal data to RM-ANOVA, especially when multiple indicators are available to model the response is structural equation modeling (SEM). SEM is a technique for modeling relations between observed and latent variables and relations among the latent variables as well. This technique was not chosen as the research questions do not contain a priori specified hypotheses about causal relations among variables. As such, this study's goal is not to model relationships based on substantive theory, which is the purpose of SEM (Mueller & Hancock, 2010). Therefore, SEM was not deemed necessary or appropriate for the current analysis.

Using a within-subjects RM-ANOVA design, including the use of covariates, was used to determine which independent variables influenced the mean response over time and if any of the independent variables being studied produced interaction effects. Covariates were used as control variables in some instances, and to assess covariate by time interaction effects in other instances (Lomax, 2001). While RM-ANOVAs only shed light on whether there is evidence of a mean difference in the response variable across the three time periods, appropriate multiple comparison and correlational procedures were utilized when an effect or interaction was detected in order to gain more

detailed information about over which time intervals the mean difference in response differed from one another. More specific information about how analyses were conducted for the specific research questions can be found below after the listed research questions.

Prior to any formal modeling and inferential tests were performed, the normality assumption of ANOVA was tested using SPSS 17.0 (SPSS Inc., 2007). This is an important step since ANOVA compare group means, assuming a variable of interest follows a normal probability distribution. Skewness (symmetry) and kurtosis (tail weight) for each measurement occasion was tested (Lix & Kesselman, 2010). Skew and Kurtosis are considered to represent a normal distribution at a value of 0 (DeCarlo, 1997). The skewness but not the kurtosis of the reduced CES-D measure reflect approximately normal response data in the population (Table 10).

When assessing normality, measures of skew and kurtosis in conjunction with omnibus tests, such as the Shapiro-Wilk test is recommended (DeCarlo, 1997). Results of the Shapiro-Wilk (Shapiro and Wilk, 1965) and the Kolmogorov-Smirnov test for distributional correspondence are reported in Table 11. The Kolmogrov-Smirnov test is recommended for larger sample sizes. A significance value greater than 0.05 indicates normality when examining distributions. Results indicate that the response variables most likely come from populations where the score distributions are non-normal.

Table 10

Reduced CES-D Tests of Normality: Skewness and Kurtosis

	Std.	Skewness		Kurtosis	
Measure	Statistic	Statistic	Std. Error	Statistic	Std. Error
T1 Reduced CES-D	0.500	1.604	0.043	3.246	0.087
T2 Reduced CES-D	0.574	1.885	0.043	3.869	0.087
T3 Reduced CES-D	0.554	1.421	0.043	2.207	0.087

Table 11

Reduced CES-D Tests of Normality: Kolmogorov-Smirnov & Shapiro-Wilk

	Kolmogorov-Smirnov			Shapiro-Wilk		
Measure	Statistic	Df	Sig.	Statistic	Df	Sig.
T1 Reduced CES-D	0.188	3185.000	0.000	0.838	3185.000	0.000
T2 Reduced CES-D	0.261	3187.000	0.000	0.729	3187.000	0.000
T3 Reduced CES-D	0.198	3194.000	0.000	0.842	3194.000	0.000

However, the *t*-test and *F*-test associated with ANOVA not very sensitive to moderate deviations from normality. Simulation studies, using a variety of non-normal distributions, have shown that the false positive rate, the primary threat of using non-normal data, is not substantially affected by this violation of the assumption (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996). In RM-ANOVA, the *F*-test is robust to violations of multivariate normality and homogeneity of covariance matrices. This is fortunate as true normality is relatively rare in psychology (Micceri, 1989). Analyses therefore proceeded despite the somewhat non-normal nature of the data.

Sphericity, a core underlying assumptions in the univariate RM-ANOVA procedure, was tested using Mauchly's Test, which tests for the equivalence of the hypothesized and the observed variance/covariance patterns. For all analysis, sphericity is assumed. While not all of the Mauchly statistics were non-significant, commonly used criteria to assess sphericity, the epsilon values for those non-significant Mauchly statistics were all very close to 1.00 (ranging from .997-.942). The closer the reported epsilon value is to 1.00, the more homogeneous are the variances of differences between the repeated measures, and consequently the closer the data were to being spherical (Girden, 1992). The SPSS Advanced Statistics 17.0 (SPSS Inc., 2007) states that "for large

sample sizes, the test may be significant even when the impact of the departure on the results is small. If the significance of the test is large, the hypothesis of sphericity can be assumed." Given the large sample size of the data set used and the small departure in the epsilon value from 1.00, sphericity was assumed for all analyses.

Covariates were added into the analysis when appropriate. A Chi-square test was performed between each of the demographic variables to determine if any of the variables were related to one another. Results indicated that there was a relationship between Race/Ethnicity and College Attendance. Therefore, when one of these two variables was entered as a between-subject variable, the other served as a control variable. Gender was not correlated with either Race/Ethnicity or College Attendance so no covariates were added when Gender was the between-subject variable.

Research Questions with Depressive Symptoms as Dependent Variable

1. Is there a change over time for depressive symptoms at adolescence (T1), young adulthood (T2), and adulthood (T3)?

1a-c.) Is there an interaction between change-over-time and each of the variables listed below?

1a. Gender

1b. Race/Ethnicity

1c. College enrollment at Time 2

2.) What is the effect of adolescent (T1) depressive symptoms on change over time of depressive symptoms as measured at young adulthood (T2) and adulthood (T3)?

3.) What is the effect of adolescent (T1) binge drinking on depressive symptoms over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

3a-c.) Is there an additional interaction effect for each of the variables listed below?

3a. Gender

3b. Race/Ethnicity

3c. College enrollment at Time 2

4.) What is the effect of adolescent (T1) drunkenness on depressive symptoms over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

4a-c.) Is there an additional interaction effect for each of the variables listed below?

4a. Gender

4b. Race/Ethnicity

4c. College enrollment at Time 2

Research Questions with Binge Drinking as Dependent Variable

5.) Is there a change over time for binge drinking at adolescence (T1), young adulthood (T2), and adulthood (T3)?

5a-c.) Is there an interaction between change-over-time and each of the variables listed below?

5a. Gender

5b. Race/Ethnicity

5c. College enrollment at Time 2

6.) What is the effect of the frequency of adolescent (T1) binge drinking on change over time of binge drinking as measured at young adulthood (T2) and adulthood (T3)?

7.) What is the effect of adolescent (T1) depressive symptoms on binge drinking over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

7a-c.) Is there an additional interaction effect for each of the variables listed below?

7a. Gender

7b. Race/Ethnicity

7c. College enrollment at Time 2

Research Questions with Drunkenness as Dependent Variable

8.) Is there a change over time for drunkenness at adolescence (T1), young adulthood (T2), and adulthood (T3)?

8a-c.) Is there an interaction between change-over-time and each of the variables listed below?

8a. Gender

8b. Race/Ethnicity

8c. College enrollment at Time 2

9.) What is the effect of the frequency of adolescent (T1) drunkenness on change over time of drunkenness as measured at young adulthood (T2) and adulthood (T3)?

10.) What is the effect of adolescent (T1) depressive symptoms on drunkenness over time as measured at adolescent (T1), young adulthood (T2), and adulthood (T3)?

10a-c.) Is there an additional interaction effect for each of the variables listed below?

10a. Gender

10b. Race/Ethnicity

10c. College enrollment at Time 2

Questions 1, 5, and 8 were addressed using two within-subjects repeated measures ANOVAs in order to test the equality of means. Each of these questions resulted in a simple one-way within-subjects RM-ANOVA with a dependent variable of either

Depressive Symptoms, Binge Drinking, or Drunkenness. This within-subject design can be designated by the following model:

$y_{ij} = \mu + \tau_j + \pi_i + \varepsilon_{ij}$

where the components are defined as:

μ- the overall mean
τ_j - the effect associated with the *j*th repeated measure
π_i - the random effect for subject *i*
ε_{ij} - random error for the *i*th individual at time *j*

Questions 1a-c, 5a-c, 8a-c resulted in an additional nine RM-ANOVAs. For each of these questions the main dependent variable of either: Depressive Symptoms, Binge Drinking, or Drunkenness were measured at each of the three waves (within-subjects factor). For each of these within-subject repeated measures ANOVA, the between subjects independent variable was one of the three demographic variables, creating a 2×3 factorial ANOVA for each question including either gender (1a, 5a, & 8a) or college enrollment (1c, 5c, & 8c) and a 5×3 ANOVA for the questions examining the impact of Race/Ethnicity (1b, 5b, & 8b). Running these analyses helped answer the question of whether depression or binge drinking varies over time, and if there was interaction between change by time and the demographic variables. The model with a within-subjects, between-subjects factor, and covariate control factors (when applicable) is the following:

$y_{igj} = \mu + \tau_j + \gamma_g + (\tau\gamma)_{jg} + \beta_1 x_{1gi} + \beta_2 x_{2gi} + \pi_{ig} + \varepsilon_{igj}$

where the components are defined as:

μ- the overall mean
τ_j - the effect associated with the *j*th repeated measure
γ_g- the effect associated with group *g*
β_g - slope of covariate of group g
x_{gi} - covariate

π_{ig} - the random effect for subject *i* in the *g*th group
ε_{igj} - random error for the *i*th individual in group *g* at time *j*

A one factor within-subjects RM-ANOVA design to test the equality of means was used for the questions 2, 6, and 9. For each question the main dependent variable of either: Depressive Symptoms, Binge Drinking, or Drunkenness was measured at two time periods, the second and third waves (the within-subjects factors). Each ANOVA included the respective measure at TI (Question 2: Depressive Symptoms; Question 6: Binge Drinking; Question 9: Drunkenness) as a covariate in order to assess the interaction of the level of Depressive Symptoms, Binge Drinking, or Drunkenness at TI with these measures at T2 and T3. Each question therefore resulted in a mixed model repeated measures ANOVA aimed at identifying a between subject by time interaction. Running this analysis helped answer the question of how early depressive symptoms influences later depression and how early heavy drinking influences later heavy drinking. The model with a within-subjects and a covariate of interest is specified as follows:

$$y_{igj} = \mu + \tau_j + \beta_1 x_{1gi} + \beta_2 x_{2gi} + \pi_{ig} + \varepsilon_{igj}$$

where the components are defined as:

μ- the overall mean
τ_j - the effect associated with the *j*th repeated measure
β_g - slope of covariate
x_{gi} - covariate
π_{ig} - the random effect for subject *i* in the gth and *kth* group
ε_{igj} - random error for the *i*th individual in group *g* and *k* at time *j*

Primary Research questions 3, 4, 7, and 10 were answered using a mixed-model repeated measures ANOVA design. For each question the main dependent variable of either Depressive Symptoms (question 3 and 4), Binge Drinking (question 7), or Drunkenness (question 10) was measured at all 3 time periods which represent the

within-subjects factors. Each ANOVA included a between-subjects factor in order to assess the interaction of the covariate with the dependent variable. The between-subjects factor for question 3 was the level of adolescent Binge Drinking at T1. The between-subjects factor for question 4 was the level of adolescent Drunkenness at T1. The between-subjects factor for questions 7 and 10 was the level of adolescent Depressive Symptoms at T1. Running this analysis helped to determine if depressive symptoms at an early age affects heavy drinking over time, and vice versa. The model with a within-subjects and a covariate of interest is specified as follows:

$$y_{igj} = \mu + \tau_j + \beta_1 x_{1gi} + \beta_2 x_{2gi} + \pi_{ig} + \varepsilon_{igj}$$

where the components are defined as:

μ- the overall mean
τ_j - the effect associated with the *j*th repeated measure
β_g - slope of covariate
x_{gi} - covariate
π_{ig} - the random effect for subject *i* in the gth and *kth* group
ε_{igj} - random error for the *i*th individual in group *g* and *k* at time *j*

Additionally, each of these four questions (questions 3a-c, 4a-c, 7a-c, & 10a-c) was evaluated with the addition of demographic variables. These questions were addressed using 12 additional 3×2 mixed-model RM-ANOVAs. For each question the main analysis was repeated but with one additional between-subjects factor (one of the demographic variables) added. The impact of the demographic variable added to any given question was determined by the interaction term produced by multiplying the two between-subject factors together. This analysis indicated if there was a significant interaction of Depressive Symptoms at T1 (questions 3 and 4), Binge Drinking at T1 (question 7), or Drunkenness at T1 (question 10) and each of the demographic variables, entered separately. This first answered the more general questions of if there are

individual differences that impact or moderate how the covariates of depressive symptoms or heavy drinking interact with the dependent variables over time. The model with a within-subjects, between-subjects factor, and covariate control factors is the following:

$$y_{igkj} = \mu + \tau_j + \gamma_g + s_k + (\tau\gamma)_{jg} + (\tau s)_{jk} + (\gamma s)_{jk} + (\tau\gamma s)_{jgk} + \beta_1 x_{1gi} + \beta_2 x_{2gi} + \pi_{igk} + \varepsilon_{igkj}$$

where the components are defined as:

μ- the overall mean
τ_j - the effect associated with the *j*th repeated measure
γ_g- the effect associated with group *g* of factor 1
s_k - the effect associated with group *k* of factor 2
β_g - slope of covariate
x_{gi} - covariate
π_{igk} - the random effect for subject *i* in the gth and *kth* group
ε_{igkj} - random error for the *i*th individual in group *g* and *k* at time *j*

A summary of all ANOVA models can be found in Table 12 below:

Table 12
Summary of ANOVAs

Question	Dependent Variable	Within Subjects Factor	Between Subjects Factor	Covariate of Interest	Control Variables (Covariate)
1	Depressive Symptoms	Time (T1, T2, T3)	None	None	None
1a	Depressive Symptoms	Time (T1, T2, T3)	Gender	None	None
1b	Depressive Symptoms	Time (T1, T2, T3)	Race/Ethnicity	None	College Enrollment
1c	Depressive Symptoms	Time (T1, T2, T3)	College Enrollment	None	Race/Ethnicity
2	Depressive Symptoms	Time (T2, T3)	None	Depressive Symptoms at T1	None
3	Depressive Symptoms	Time (T1, T2, T3)	None	Binge Drinking at T1	None
3a	Depressive Symptoms	Time (T1, T2, T3)	Gender	Binge Drinking at T1	None
3b	Depressive Symptoms	Time (T1, T2, T3)	Race/Ethnicity	Binge Drinking at T1	College Enrollment

Question	Dependent Variable	Within Subjects Factor	Between Subjects Factor	Covariate of Interest	Control Variables (Covariate)
3c	Depressive Symptoms	Time (T1, T2, T3)	College Enrollment	Binge Drinking at T1	Race/Ethnicity
4	Depressive Symptoms	Time (T1, T2, T3)	None	Drunkenness at T1	None
4a	Depressive Symptoms	Time (T1, T2, T3)	Gender	Drunkenness at T1	None
4b	Depressive Symptoms	Time (T1, T2, T3)	Race/Ethnicity	Drunkenness at T1	College Enrollment
4c	Depressive Symptoms	Time (T1, T2, T3)	College Enrollment	Drunkenness at T1	Race/Ethnicity
5	Binge Drinking	Time (T1, T2, T3)	None	None	None
5a	Binge Drinking	Time (T1, T2, T3)	Gender	None	None
5b	Binge Drinking	Time (T1, T2, T3)	Race/Ethnicity	None	College Enrollment
5c	Binge Drinking	Time (T1, T2, T3)	College Enrollment	None	Race/Ethnicity
6	Binge Drinking	Time (T2, T3)	None	Binge Drinking at T1	None
7	Binge Drinking	Time (T1, T2, T3)	None	Depressive Symptoms at T1	None
7a	Binge Drinking	Time (T1, T2, T3)	Gender	Depressive Symptoms at T1	None
7b	Binge Drinking	Time (T1, T2, T3)	Race/Ethnicity	Depressive Symptoms at T1	College Enrollment
7c	Binge Drinking	Time (T1, T2, T3)	College Enrollment	Depressive Symptoms at T1	Race/Ethnicity
8	Drunkenness	Time (T1, T2, T3)	None	None	None
8a	Drunkenness	Time (T1, T2, T3)	Gender	None	None
8b	Drunkenness	Time (T1, T2, T3)	Race/Ethnicity	None	College Enrollment
8c	Drunkenness	Time (T1, T2, T3)	College Enrollment	None	Race/Ethnicity
9	Drunkenness	Time (T2, T3)	None	Drunkenness at T1	None
10	Drunkenness	Time (T1, T2, T3)	None	Depressive Symptoms at T1	None
10a	Drunkenness	Time (T1, T2, T3)	Gender	Depressive Symptoms at T1	None
10b	Drunkenness	Time (T1, T2, T3)	Race/Ethnicity	Depressive Symptoms at T1	College Enrollment
10c	Drunkenness	Time (T1, T2, T3)	College Enrollment	Depressive Symptoms at T1	Race/Ethnicity

Chapter IV: Results

Exploratory and Confirmatory (Measure Invariance) Factor Analysis:

An exploratory factor analysis was performed to determine the best factor model using the reduced CES-D measure, and multiple confirmatory factor analyses were performed to establish longitudinal measurement invariance. Results of the exploratory factor analysis were evaluated using both comparative and parsimonious fit indices. The comparative fit index (CFI) (Bentler, 1990) and the Tucker-Lewis index (TLI) (Tucker & Lewis, 1973) were used to assess the comparative fit of the models The root mean square error of approximation (RMSEA) (Browne & Cudeck, 1992; Steiger & Lind, 1980), often considered the best fit index, was used to assess the parsimonious fit of the models. The criterion for acceptable fit, based on results of simulation studies (e.g., Hu & Bentler, 1999; Hutchinson & Olmos, 1998), was around 1 ($\geq .95$) for the CFI and TLI (Long et al., 2007; Perreira et al., 2005) and close to zero ($\leq .06$) for the RMSEA (Long et al., 2007).

Both a one factor and a two factor model were tested. An oblique rotation was used given that the data were correlated. The rotated loadings revealed the one factor model to provide superior fit compared to the two factor model (Table 13). The first factor explained at least 80% of the total variance, and all factor loadings statistically significant and above .55. Furthermore, the two factor model shared a significant amount of variance, indicating they are highly correlated. Given the conceptualization of the Reduced CES-D as a one factor model measuring a unitary construct of depression, and the results of the EFA, a 1 factor model was the better fit.

Fit indices of the one factor model are summarized in Table 14. The RMSEA point estimate was compared to a cut-off point to determine the level of fit. A point estimate ≤ .05 refers to a close fit, ≤ 0.08 a mediocre fit, and > 0.10 a poor fit value (Browne & Cudeck, 1992). A RMSEA of .047, therefore, indicates a close fit. The one factor model had acceptable fit for the CFI (0.997), TLI (0.993) and RMSEA (.047) indices for the factor model.

Confirmatory factor analysis was used to assess measurement invariance for the Reduced CES-D scale. The most constrained model was evaluated in terms of acceptability based on the absolute fit statistics. Results are presented in Table 14. Acceptable fit was ≥ .95 for the CFI and TLI and ≤ .06 for the RMSEA. The model representing the most stringent level of measurement invariance for the Reduced CES-D had acceptable fit for the CFI (0.993), TLI (0.993) and RMSEA (.030) indices for the most stringent model. The RMSEA value indicates a close fit (Browne & Cudeck, 1992). The Reduced version of the CES-D has longitudinal measurement invariance and was therefore used in the rest of the analysis.

Table 13
EFA Results: Quartimin Rotated Loadings for Reduced CES-D

	One Factor Model	Two Factor Model	
Item	1	1	2
1	0.800	0.864	-0.065
2	0.906	0.898	0.013
3	0.559	0.153	0.435
4	0.822	0.738	0.738
5	0.725	-0.002	0.811

*Factor correlations: 1 for One Factor Model; .873 for 2 factor Model

Table 14

Exploratory and Confirmatory Factor Analysis results for Reduced CES-D

Analysis	CFI	TLI	RMSEA
Exploratory	0.997	.993	.047
Confirmatory	0.933	0.933	.030

*CFI comparative fit index; TLI Tucker-Lewis index; RMSEA root-mean-square error of approximation

Primary Analysis: Repeated Measures Analysis of Variance with Covariates:

Summary of Results. The following is an overview of the study findings. The results will be discussed in greater detail in the sections below.

- **Depressive Symptoms**
  - Longitudinal changes in levels of Depressive Symptoms over time, with Depressive Symptoms at their lowest level at T2
  - Depressive Symptoms at T1 are related to later Depressive Symptoms. More specifically, scores at T1 are related to both T2 and T3 individually as indicated by correlational analysis
  - Gender: generally, levels of depressive symptoms differed by gender with females showing higher levels
  - Race: overall levels of depressive symptoms differed by race/ethnicity with all groups' lowest levels at T2
  - College: there is a between group difference with those attending college, having lower levels of depressive symptoms at all three time points

- **Heavy Drinking**
  - Significant change across time for both heavy drinking measures (medium effect size)
  - Levels of heavy drinking increase more steeply when younger and then begin to level off as participants reach their late 20s and early 30s.
  - Levels of heavy drinking at T1 were generally related to later heavy drinking. More specifically, T1 was related to both T2 and T3 individually (correlational analysis).
  - Gender: affects the trajectory of the change over time. Additionally, males had higher levels of heavy drinking at all three time points.
  - Race: affects trajectory of Binge Drinking, although not Drunkenness. Race is also generally related to heavy drinking (both measures).
  - College Attendance: affects the trajectory of heavy drinking over time.
- Interaction of Depressive Symptoms and Heavy Drinking
  - Change over time
    - There was little impact of either heavy drinking measure at T1 on the change over time of depressive symptoms
    - Conversely, there was a relationship between depressive symptoms at T1 and the change over time of heavy drinking
  - General Relationship
    - Generally, heavy drinking at T1 is related to depressive symptoms

(1) both heavy drinking measures at T1 are significantly positively correlated with depressive symptoms at T1 and T2 but not at T3 (correlational analysis)

- Conversely, depressive symptoms at T1, in general, is not related to the average binge drinking over the three time periods.

(1) higher depressive symptoms related to more drinking at T1 but to lower levels of binge drinking at T2 and not significantly correlated at T3 (correlational analysis)

- Predictive Directions
  - Overall, heavy drinking seems to predict concurrent and 6 year later depressive symptoms.
  - Early depressive symptoms (T1) were related to concurrent heavy drinking. However, in an opposite than expected relationship, early depressive symptoms predicting lower levels of heavy drinking at T2.
  - No relationships found at T3. Time frame appears to be too far removed
- Demographics
  - Overall, demographics were same as when the additional factor of either depressive symptoms or heavy drinking was not entered
  - Correlational analysis did reveal more specific differences of interaction of heaving drinking and Depressive Symptoms based on demographic variables

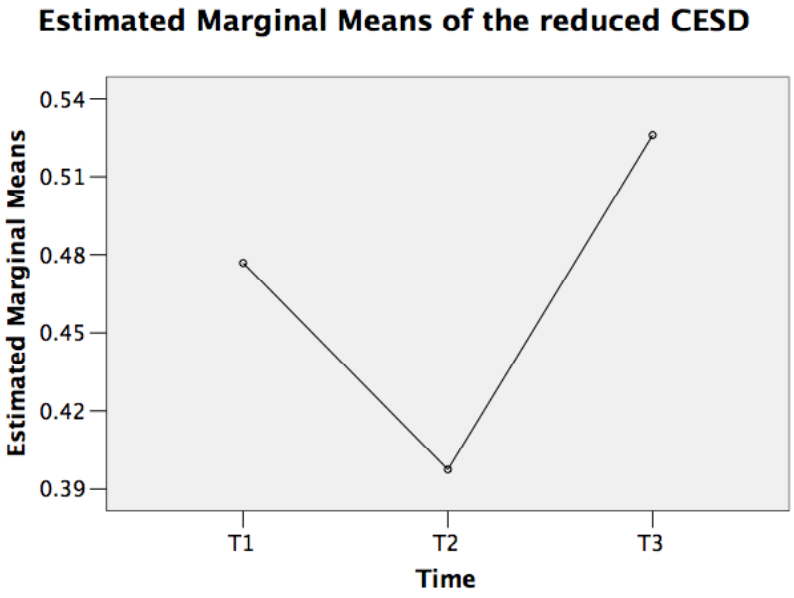
In the remainder of the this chapter results that were not statistically significant at the .05 level or that were significant, but had trivial effect sizes ($\eta_p^2 < .01$) are not

described in the text. However, the results of all statistical tests, irrespective of level of significance or effect size, are included in the tables that display statistical results.

Research Questions with Depressive Symptoms as Dependent Variable. The Primary Analysis was conducted RM- ANOVAs in SPSS 13.0 for Macs (SPSS Inc., 2006). To determine if the observed difference is not only statistically significant but also important or meaningful, the effect size is also reported. The effect size is measured by Partial Eta-squared ($\eta_p^2 = SS_{factor}/(SS_{factor} + SS_{error})$), an alternative computation of Eta squared (Tabachnick & Fidell, 1989), which describes the proportion of total variation attributable to the factor, excluding other factors from the total non-error variation (Pierce, Block & Aguinis, 2004). The rule thumb for partial eta-squared based on Cohen (1988) is .01 constitutes a small effect size, .06 a medium effect size, and .14 a large effect size. An effect size smaller than .01 is considered trivial and, therefore, not meaningful or important.

To address the questions with the Reduced CES-D measure as the dependent variable and accompanying sub-questions (Questions 1, 2, 3, & 4), 13 RM-ANOVAS were conducted. Descriptive statistics for the reduced CES-D measure are in Table 15 and results for these RM-ANOVAS are in Table 16. A significant main effect indicating that there is a change in Depressive Symptoms across time was observed ($F[2, 4780] = 46.895$, $p < .001$, $\eta_p^2 = 0.019$). In this case, the effect size was considered to be small. Tests of within-subject contrasts show a significant, small change over time ($F[1, 2390] = 77.069$, $p < .001$, $\eta_p^2 = 0.031$), with the lowest mean reduced CES-D at T2, as seen in Figure 1.

Figure 1.

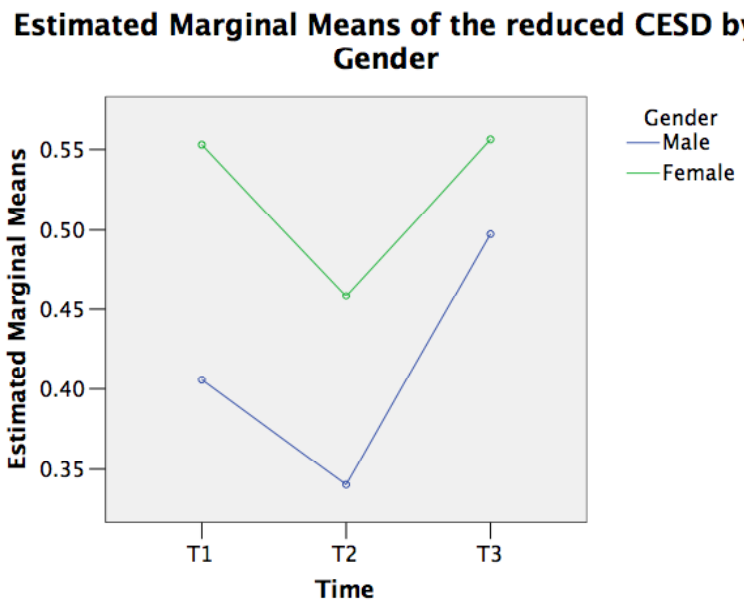


This RM-ANOVA was repeated with a between subject factor of either Gender, Race/ethnicity (called Race from here forward), or College Attendance at a 4 year University at T2 (called College Attendance from here forward) added to the model. For all analysis, when Race was the between-subject variables College was entered as covariates to serve as a control variables and vice versa.

For the RM-ANOVA with Gender entered, There was a significant general effect with a small effect ($F [1, 2389] = 48.984$, $p < .001$, $\eta_p^2 = .020$). In general, males showed lower reported depression than females (see Figure 2).

For the RM-ANOVA with Race entered as a between subject variable and College entered as a control variable (covariate), there was a general significant effect for Race ($F[4, 2366] = 10.073$, $p < .001$, $\eta_p^2 = .017$) with a small effect size. While Race did not affect the change over time of Depressive Symptoms, there are some differences in the overall averages based on Race. Generally, White participants had the lowest levels

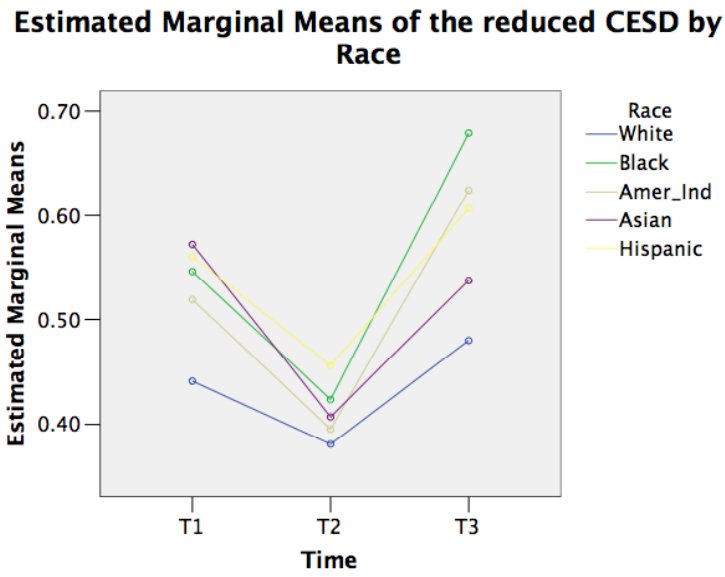
Figure 2.



of Depressive Symptoms and for each Race/Ethnic group, the lowest reduced CES-D mean was at T2 (see Figure 3). Tukey's post-hoc comparisons show significant differences between the White and Black and the White and Hispanic participants (Tukey, 1977).

The final demographic variable added was College, with Race as a control variable (covariate). While College Attendance did not affect the change over time of Depressive Symptoms, there were overall differences in average scores between the groups. The mean reduced CES-D score for those who attended a 4 year college or university at T2 was lower at all three time points.

Figure 3.



To address the question of whether Depressive Symptoms during 9th and 10th grade were related to Depressive Symptoms across time (Question 2), a repeated measures ANOVA of the reduced CES-D scores across the second two time periods (T2 & T3) with the reduced CES-D during the participants' 9th and 10th grade years (T1) as a covariate of interest was performed. The within-subjects effect of time at T2, when participants are at college age with those following a traditional higher education trajectory being juniors and seniors in college, and T3, when participants were in their upper 20s or early 30s, was significant with a small effect size (F [1, 2389] = 47.100, p < .001, η_p^2 = .019), indicating that there was a change in Depressive Symptoms between these two time periods. The general effect of the reduced CES-D at T1 was significant and had a medium effect size (F [1, 2389] = 242.569, p = <.001, η_p^2 = .092). While the level of Depressive Symptoms during the early high school years did not affect the change over time of Depressive Symptoms, depression at T1 was related to later depression, on average. This was further confirmed through correlational analysis.

Pearson correlations indicate a significant relationship at the .01 level between both Depressive Symptoms at T1 and T2 (Pearson correlation = .245) and T1 and T3 (Pearson correlation = .255) (Pearson, 1896).

For Research Question 3, Binge drinking during 9th and 10th grade (T1) was added as a covariate of interest to an RM ANOVA with the reduced CES-D scores at all three time points as the dependent variable, to determine if early drinking is related, generally, to Depressive Symptoms and to the pattern of Depressive Symptoms over time. There was a significant but small effect of Binge Drinking at T1 ($F [1, 2383] = 28.849$, $p < .001$, $\eta_p^2 = .012$), indicating that on average, Binge Drinking at T1 was related to Depressive Symptoms. Correlations between the Depressive Symptoms at each time point and both Binge Drinking (Table 17) and Drunkenness (Table 18) at each time point were also performed. Both heavy drinking measures at 9th and 10th grade of high school (T1) were significantly positively correlated with Depressive Symptoms at T1 and T2 but not at T3.

Gender, Race, and College Attendance were all added to this analysis individually as between subject factors. The change over time effect of the reduced CES-D with a covariate of Binge drinking at T1 remained unchanged with Gender added ($F [2, 4764] = 43.085$, $p < .001$, $\eta_p^2 = .018$ vs. $\eta_p^2 = .018$ without Gender covariate). There was a significant but small general effect of Gender ($F [1, 2383] = 52.951$, $p < .001$, $\eta_p^2 = .022$), indicating that, on average, there were differences by gender in reduced CES-D scores even after binge drinking is controlled for. Additional correlational analyses were conducted separately for males and females between Binge Drinking at T1 and the reduced CES-D at all three time points. For both males and females, there was a

significant positive relationship between Binge Drinking at T1 and Depressive Symptoms at both T1 (Males: Pearson Correlation = .105, p = .001; Females: Pearson Correlation = .198, p = .001) and T2 (Males: Pearson Correlation = .065, p = .05; Females: Pearson Correlation = .085, p = .001), but not at T3.

Adding Race as a between-subjects variable, with College Attendance as a control variable (covariate), to the RM-ANOVA reduced the main change over time effect of the reduced CES-D with a covariate of Binge drinking at T1 (F [2, 4718] = 27.440, $p < .001$, $\eta_p^2 = .011$vs. $\eta_p^2 = .018$ without Race covariate). The general effect of Race was significant and small in size (F [4, 2359] = 11.678, $p < .001$, $\eta_p^2 = .019$), indicating that, on average, there were differences in Depressive Symptoms, across Race even after binge drinking is controlled for. Additional correlational analyses were conducted separately for each Racial group between Binge Drinking at T1 and Depressive Symptoms at all three time points. For White (Pearson Correlation = .134, p = .001), Black (Pearson Correlation = .141, p = .001), Asian (Pearson Correlation = .244, p = .05), and Hispanic (Pearson Correlation = .248, p = .001) participants there was a significant positive relationship between Binge Drinking at T1 and Depressive Symptoms at T1. For Hispanic participants only, there was also a correlation between Binge Drinking at T2 and Depressive Symptoms at T2 (Pearson Correlation = .227, p = .001). Binge Drinking at T1 was not related to Depressive Symptoms at T3 for any group. For Native American participants, no correlation was found between Binge Drinking at T1 and Depressive Symptoms at any of the three time points.

Adding College Attendance as a between-subjects variable and Race as a control variable (covariate) to the RM ANOVA reduced the main change over time effect of the

reduced CES-D with a covariate of Binge drinking at T1 (F [2, 4724] = 10.485, $p < .001$, $\eta_p^2 = .004$ vs. $\eta_p^2 = .018$ without College Attendance covariate). The general effect of College Attendance was significant and small in size (F [2, 2362] = 57.448, $p < .001$, $\eta_p^2 = .024$), indicating that, on average, there were differences in Depressive Symptoms at T1, across College Attendance even after binge drinking is controlled for. Additional correlational analysis was conducted between Binge Drinking at T1 and Depressive Symptoms at all three time points. For non-college attenders, there was a significant positive relationship between Binge Drinking at T1 and Depressive Symptoms at both T1 (Pearson Correlation = .131, p = .001) and T2 (Pearson Correaltion = .068, p = .001). For College Attenders there was a significant positive relationship at T1 only (Pearson Correlation = 123; p = .001).

The above analyses were repeated with Drunkenness substituted in as the covariate of interest to determine if there was a relationship between the level of Drunkenness during 9th and 10th grade (T1) and concurrent and future (T2 & T3) Depressive Symptoms. Unlike Binge Drinking, Drunkenness in adolescence in general was not related to Depressive Symptoms. There was also a significant, small main effect of change over time for the reduced CES-D (F [2, 4772] = 46.131, $p < .001$, $\eta_p^2 = .019$ vs. $\eta_p^2 = .019$ without covariate). Other interaction and general effects were similar in nature to those found with Binge Drinking added (see results in Table 16).

Table 15

Descriptive Statistics for reduced CES-D Measure

		CES-D at T1		CES-D at T2		CES-D at T3	
Group	N	*Mean*	SD	*Mean*	SD	*Mean*	SD
Total	2391	0.4769	0.4954	0.3975	0.56652	0.526	0.54532
Male	1235	0.4057	0.43322	0.3404	0.52434	0.4974	0.51747
Female	1156	0.5529	0.54415	0.4585	0.60263	0.5562	0.57224
White	1632	0.4353	0.46775	0.3777	0.56054	0.475	0.51706
Black	310	0.5594	0.531	0.4312	0.579	0.6895	0.600
Native American	65	0.5446	0.586	0.4103	0.615	0.646	0.586
Asian	83	0.5494	0.524	0.3936	0.457	0.518	0.460
Hispanic	282	0.5794	0.544	0.4669	0.610	0.623	0.599
Attended College	666	0.3502	0.399	0.323	0.517	0.413	0.495
Did Not Attend	1706	0.5246	0.520	0.425	0.584	0.572	0.557

Table 16

Reduced CES-D Measure Within and Between Subjects RM-ANOVA Results

Effect	Error *df*	*Df*	F	*p*	η_p^2
Question 1: Change over Time					
Time	4740	2	46.895	< 0.001	0.019*
Time x Gender:					
Time	4778	2	46.349	< 0.001	0.019*
Time x Gender	4778	2	5.675	0.003	0.002
Gender	2389	1	48.984	< 0.001	0.020*
Time x Race:					
Time	4732	2	28.230	< 0.001	0.012*
Time x Race	4732	8	2.396	0.014	0.004
Race	2366	4	10.073	< 0.001	0.017*
Time x College:					
Time	4738	2	8.008	< 0.001	0.003
Time x College	4738	2	2.793	0.061	0.001
College	2369	1	63.389	< 0.001	0.026*
Question 2: Effects of Early Depressive Symptoms on Later Depressive Symptoms					
Time T2 & T3	2389	1	47.100	< 0.001	0.019*
Time T2 & T3 x CES-D at T1	2389	1	0.010	0.921	0.000
CES-D at T1	2389	1	242.569	< 0.001	0.092*
Question 3: Effects of Early Binge Drinking on Depressive Symptoms over Time					
Time	4766	2	43.173	< 0.001	0.018*
Time x Binge Drinking at T1	4766	2	9.85	< 0.001	0.004
Binge Drinking at T1	2383	1	28.849	< 0.001	0.012*

Effect	Error df	Df	F	p	ηp2
Time x Binge Drinking at T1 x Gender:					
Time	4764	2	43.085	< 0.001	0.018*
Time x Binge Drinking at T1	4764	2	10.621	< 0.001	0.004
Time x Gender	4764	2	6.449	0.002	0.003
Binge Drinking at T1	2383	1	33.555	< 0.001	0.014*
Gender	2383	1	52.951	< 0.001	0.022*
Time x Binge Drinking at T1 x Race:					
Time	4718	2	27.440	< 0.001	0.011*
Time x Binge Drinking at T1	4718	2	9.278	< 0.001	0.004
Time x Race	4718	8	2.19	0.025	0.004
Binge Drinking at T1	2359	1	29.859	< 0.001	0.012*
Race	2359	4	11.678	< 0.001	0.019*
Time x Binge Drinking at T1 x College:					
Time	4724	2	10.485	< 0.001	0.004
Time x Binge Drinking at T1	4724	2	9.826	< 0.001	0.004
Time x College	4724	2	2.503	0.082	0.001
Binge Drinking at T1	2362	1	24.039	< 0.001	0.010*
College	2362	1	57.448	< 0.001	0.024*
Question 4: Effects of Early Drunkenness on Depressive Symptoms over Time					
Time	4772	2	46.131	< 0.001	0.019*
Time x Drunkenness at T1	4772	2	7.795	< 0.001	0.003
Drunkenness at T1	2386	1	2663.77	< 0.001	0.007
Time x Drunkenness at T1 x Gender:					
Time	4770	2	45.983	< 0.001	0.019*
Time x Drunkenness at T1	4770	2	8.328	< 0.001	0.003
Time x Gender	4770	2	6.292	< 0.001	0.003
Drunkenness at T1	2385	1	19.993	< 0.001	0.008
Gender	2385	1	51.086	< 0.001	0.021*
Time x Drunkenness at T1 x Race:					
Time	4724	2	29.238	< 0.001	0.012*
Time x Drunkenness at T1	4724	2	7.217	0.001	0.003
Time x Race	4724	8	2.131	0.030	0.004
Drunkenness at T1	2362	1	17.271	< 0.001	0.007
Race	2362	4	10.927	< 0.001	0.018*
Time x Drunkenness at T1 x College:					
Time	4730	2	10.985	< 0.001	0.005
Time x Drunkenness at T1	4730	2	7.998	< 0.001	0.003
Time x College	4730	2	2.756	0.064	0.001
Drunkenness at T1	2365	1	13.997	< 0.001	0.006
College	2365	1	59.648	< 0.001	0.025*

*All p values less than .05 are considered to be significant.
**All partial eta squared (η_p^2) values over .01 are considered to be meaningful and are marked

with a *.

Table 17
Reduced CES-D & Binge Drinking Correlations

	Binge Drinking		
	T1	T2	T3
T1 CES-D	0.141**	-0.083**	-0.019
T2 CES-D	0.069**	0.014	-0.01
T3 CES-D	0.029	-0.045*	-0.004

**Correlation is significant at the 0.10 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 18
Reduced CES-D & Drunkenness Correlations

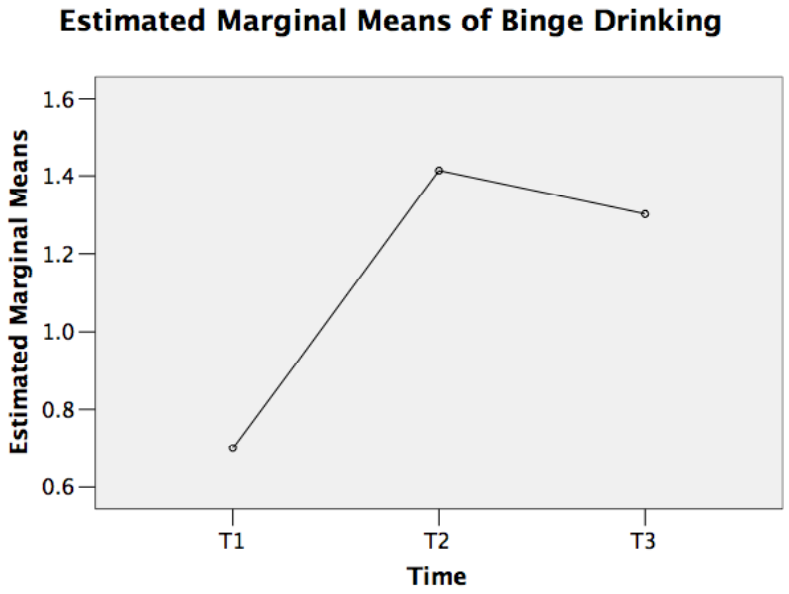
	Drunkenness		
	T1	T2	T3
T1 CES-D	0.112**	-.101**	-0.035
T2 CES-D	0.064**	0.032	-0.021
T3 CES-D	0.009	-0.045*	-0.040*

**Correlation is significant at the 0.10 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Research Questions with Binge Drinking as Dependent Variable. To address the questions with the Binge Drinking measure as the dependent variable and accompanying sub questions (Questions 5, 6, & 7), 9 RM-ANOVAS were conducted. Descriptive statistics for the reduced CES-D measure are in Table 19 and results for these RM-ANOVAS are in Table 20. To address Question 5, a one way RM-ANOVA of the Binge Drinking question across the three time periods was performed in order to determine the variance across time for this measure. A significant main effect indicating that there was a significant change in the Binge Drinking scores across time was observed ($F[2, 2460] = 104.633$, $p < .001$, $\eta_p^2 = 0.08$), with the lowest levels of Binge Drinking

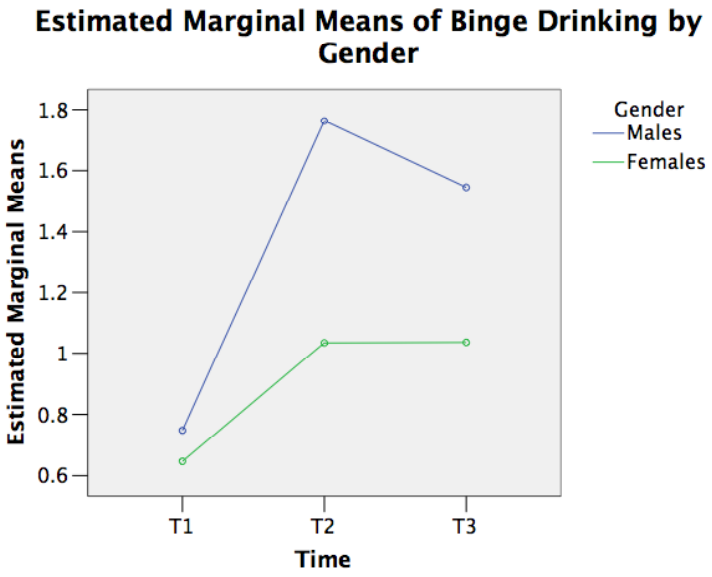
occurring at T1, when participants were 9th and 10th graders in high school. Binge Drinking appears to level off somewhat as the participants get older (Figure 4).

Figure 4.



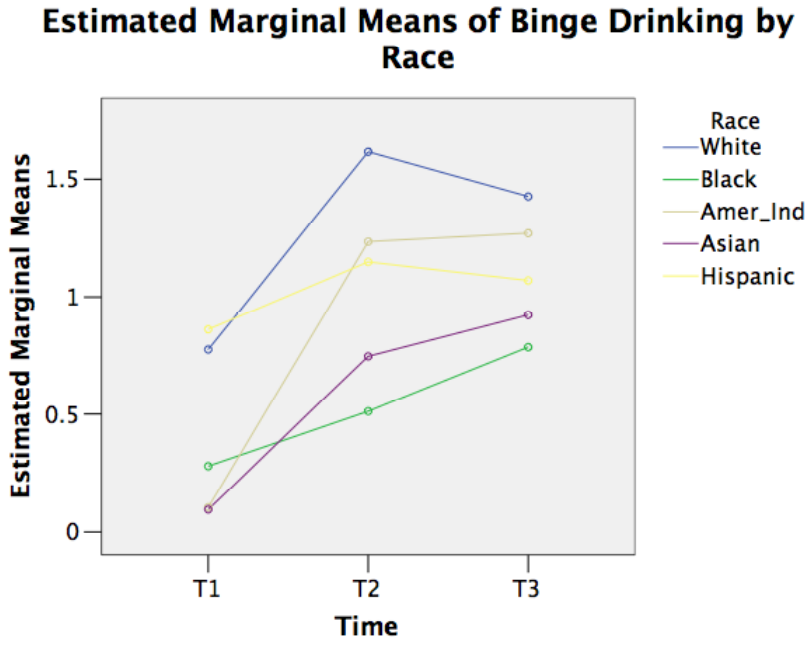
When between subject variable of Gender was added, there was a significant within-subject time by group interaction showing group differences over time for Gender ($F[2, 2404] = 18.125$, $p < .001$, $\eta_p^2 = .015$) with a small effect size, indicating that there were differences in changes over time in drinking between the genders. General effects were also statistically significant, with a small size ($F[1, 1202] = 53.007$, $p < .001$, $\eta_p^2 = .042$), indicating, that in general, gender was also related to average binge drinking. Both Males and Females reported the lowest frequency of binge drinking at T1, and at apparently similar rates between the sexes. It appears that the averages diverged at T2 with Men Binge Drinking more frequently than women (Figure 5).

Figure 5.



When the between subject variable of Race (with College Attendance as a control variable) was added, the Time by Group interaction showed group differences over time for Race ($F[8, 2378] = 3.367$, $p = .001$, $\eta_p^2 = .011$) with a small effect size, indicating that differences in change over time of drinking existed between Racial groups. For the Black, American Indian, and Asian participants' mean Binge Drinking frequency appears to increase at each time point. For White and Hispanic participants, their peak mean binge drinking frequency appears to have occurred at T2. General effects were also statistically significant but small in size $F[4, 1189] = 16.805$, $p < .001$, $\eta_p^2 = .054$). A post-hoc Tukey comparison revealed significant differences between White and Black and White and Asian participants, with White participants engaging in more Binge Drinking than the other two groups (Figure 6). Hispanic participants also binge drank significantly more than Black participants.

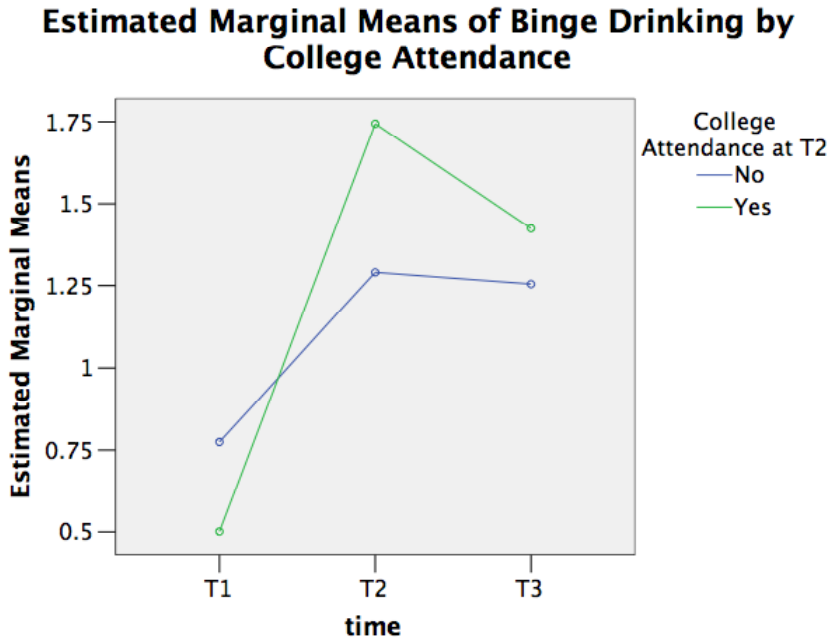
Figure 6.



When the between subject variable of College Attendance (with Race as a control variable) was added the time by College Attendance interaction was significant but had a small effect size (F [2, 2384] = 19.113, $p < .001$, $\eta_p^2 = .016$), indicating that differences in changes over time of Binge Drinking exist between those that were or were not attending a four-year college or university at T2. It appears that those who did not attend college subsequently started off Binge Drinking more frequently than those who did at T1. At T2, when participants were mostly in their early 20s and potentially juniors and seniors in college, the means reversed, with those attending college drinking more. At T3, when participants were mostly in their late 20s, it appears that those who had attended college had a greater decrease in frequency of Binge Drinking than those who had not attended,

although the college attendees' mean still remained higher (Figure 7).

Figure 7.



The RM ANOVA for Question 6 uses Binge Drinking at T1 (when participants were in 9th or 10th grade in high school) as a covariate and Binge Drinking just at T2 (when participants were mostly in their early 20s and are potentially juniors or seniors in college) and T3 (when participants were mostly in their late 20s) as the main dependent variable, to investigate the relationship of early binge drinking on later binge drinking. The general effect of Binge Drinking at T1 was significant and had a small effect size ($F [1, 1202] = 45.429$, $p < .001$, $\eta_p^2 = .036$), suggesting that in general, Binge Drinking at T1 did have an effect on later Binge Drinking (average over T2 and T3). This was further confirmed through correlational analysis. Pearson correlations indicated a significant relationship at the .01 level between both binge drinking at T1 and T2 (Pearson correlation = .190) and T1 and T3 (Pearson correlation = .173). The change over time at

T2 and T3 on the dependent variable was not significant (F [1, 1202] = 2.154, p = .142, η_p^2 = .002), indicating that levels of Binge Drinking at T2 and T3 did not differ substantially over time.

For Question 7, the reduced CES-D at T1 was added as a covariate of interest in order to investigate the relationship between Depressive Symptoms during the 9th and 10th grade years (T1) and Binge Drinking across the three time points. The Time by Group interaction between the Binge Drinking and the covariates of interest reduced CES-D at T1 (F [2, 2394] = 23.434, $p < .001$, η_p^2 = .019) was significant, although the effect size was small, meaning that there was a relationship between Depressive Symptoms during T1 and the change over time in Binge Drinking across the three time points. Correlations between Binge Drinking at each time point and depressive symptoms at each time point were also performed (table 17), indicating that a relationship emerges when binge drinking at the three timeframes are viewed separately. Depressive Symptoms as measured in 9th and 10th grade of high school (T1) were positively significantly correlated with Binge Drinking at T1, negatively significantly correlated at T2, and not significantly correlated at T3. The relationship changes over time with higher Depressive Symptoms related to more Binge Drinking at T1 but higher Depressive Symptoms related to lower levels of Binge Drinking at T2.

Gender, Race, and College Attendance were all added to this analysis individually as between subject factors to determine if these demographic variables affected the relationship between Depressive Symptoms and Binge Drinking. The change over time effect of Binge Drinking with a covariate of the reduced CES-D at T1 remained unchanged with Gender added (F [2, 2392] = 104.671, $p < .001$, η_p^2 = .080 vs. η_p^2 = .088

without Gender covariate). There was a significant time by Gender interaction effect on the within subjects design (F [2, 2392] = 12.523, $p < .001$, $\eta_p^2 = .010$). The effect size of this interaction was small, indicating that Gender was related to the change over time in binge drinking when controlled for by Depressive Symptoms at T1. There was a significant but small general effect for Gender as well (F [1, 1196] = 52.857 $p < .001$, $\eta_p^2 = .042$), indicating general differences in the average scores in Binge Drinking across gender. Additional correlational analysis was conducted separately for males and females between Depressive Symptoms at T1 and the Binge Drinking at all three time points. For both males and females, there was a significant positive relationship between Binge Drinking at T1 and Depressive Symptoms at T1 (Males: Pearson Correlation = .105, p = .001; Females: Pearson Correlation = .198, p = .001). For females only, there was also a correlation at T2 (Pearson Correlation = .063, p = .05).

Next, Race was added as a between-subject variable, with College Attendance included as a control variable. The size of the time by change effect of the Binge Drinking measure with a covariate of the reduced CES-D at T1 was greatly reduced when Race was added to the RM-ANOVA as a between-subjects variable (F [2, 2366] = 27.202, $p < .001$, $\eta_p^2 = .022$ vs. $\eta_p^2 = .088$ without between-subject variable of Race), indicating that group membership had a significant impact on the level of binge drinking over time, reducing the importance of differences based on time period. Additionally, there was a small but significant interaction effect with Race on the within subjects design (F [8, 2366] = 3.013, $p = .002$, $\eta_p^2 = .01$), indicating that Race was related to the change over time in Binge Drinking when controlled for by Depressive Symptoms at T1. There was also a significant but small general effect (F [4, 1183] = 17.214, $p < .001$, η_p^2

= .055), indicating general differences in the average scores in Binge Drinking, when controlled for by Depressive Symptoms at T1, across racial groups. Additional correlational analysis was conducted separately for each Racial group between Binge Drinking at T1 and the reduced CES-D at all three time points. For White (Pearson Correlation = .134, p = .001), Black (Pearson Correlation = .141, p = .001), Asian (Pearson Correlation = .244, p = .05), and Hispanic (Pearson Correlation = .248, p = .001) participants there was a significant positive relationship between Binge Drinking at T1 and Depressive Symptoms at T1. For White participants only there was also a negative correlation between Binge Drinking at T2 and Depressive Symptoms at T2 (Pearson Correlation = -.069, p = .001).

Finally, College Attendance was added as a between subject variable, with Race as a control variable. The change over time effect of the Binge Drinking measure with a covariate of the reduced CES-D at T1 remained unchanged with College Attendance added as a between subjects variable (F [2, 2372] = 103.551, $p < .001$, $\eta_p^2 = .080$ vs. $\eta_p^2 = .088$ without between subject variable of College Attendance). College Attendance had a small significant interaction effect on the within subjects design (F [2, 2372] = 14.077, $p < .001$, $\eta_p^2 = .012$), indicating that College Attendance was related to the change over time in binge drinking (when controlled for by depression at T1). The general effect, however, was not significant indicating that in general, College Attendance is not related to the average of Binge Drinking levels across the three time points. However, additional correlational analysis was conducted between the reduced CES-D at T1 and the Binge Drinking at all three time points which revealed some between group differences. For non-college attenders, there was a significant positive relationship between the reduced

CES-D at T1 and Binge Drinking at both T1 (Pearson Correlation = .131, p = .001) and T2 (Pearson Correaltion = .069, p = .001). For College Attenders there was a significant positive relationship at T1 only (Pearson Correlation = 123; p = .001).

Table 19
Descriptive Statistics for Binge Drinking Measure

		Binge Drinking at T1		Binge Drinking at T2		Binge Drinking at T3	
Group	N	*Mean*	SD	*Mean*	SD	*Mean*	SD
Total	1204	0.7	1.356	1.41	1.654	1.300	1.534
Male	627	0.75	1.433	1.76	1.793	1.55	1.624
Female	577	0.65	1.265	1.03	1.393	1.04	1.383
White	871	0.77	1.394	1.63	1.69	1.43	1.554
Black	121	0.31	1.073	0.46	1.057	0.77	1.401
Native American	28	0.14	0.448	1.18	1.416	1.250	1.624
Asian	36	0.06	0.232	0.81	1.470	0.940	1.330
Hispanic	139	0.9	1.481	1.09	1.551	1.050	1.426
Attended College	366	0.51	1.068	1.780	1.732	1.450	1.443
Did Not Attend	866	0.77	1.442	1.280	1.600	1.240	1.566

Table 20

Binge Drinking Measure Within and Between Subjects RM-ANOVA Results

Effect	Error *df*	*Df*	F	*p*	η_p^2
Question 5: Change over Time					
Time	2406	2	104.633	< 0.001	0.080*
Time x Gender:					
Time	2404	2	102.407	< 0.001	0.079*
Time x Gender	2404	2	18.125	< 0.001	0.015*
Gender	1202	1	53.007	< 0.001	0.042*
Time x Race:					
Time	2378	2	14.917	< 0.001	0.012*
Time x Race	2378	8	3.367	0.001	0.011*
Race	1189	4	16.805	< 0.001	0.054*
Time x College:					
Time	2384	2	87.009	< 0.001	0.068*
Time x College	2384	2	19.113	< 0.001	0.016*
College	1192	1	2.760	0.097	0.002
Question 6: Effects of Early Binge Drinking on Later Binge Drinking					
Time T2 & T3	1202	1	2.154	0.142	0.002
Time T2 & T3 x Binge Drinking at T1	1202	1	1.652	0.199	0.001
Binge Drinking at T1	1202	1	45.429	< 0.001	0.036*
Question 7: Effects of Early Depressive Symptoms on Binge Drinking over Time					
Time	2394	2	115.455	< 0.001	0.088*
Time x CES-D at T1	2394	2	23.434	< 0.001	0.019*
CES-D at T1	1197	1	0.028	0.866	0.000
Time x CES-D at T1 x Gender:					
Time	2392	2	103.671	< 0.001	0.080*
Time x CES-D at T1	2392	2	17.986	< 0.001	0.015*
Time x Gender	2392	2	12.523	< 0.001	0.010*
CES-D at T1	1196	1	0.766	0.184	0.001
Gender	1196	1	52.857	< 0.001	0.042*
Time x CES-D at T1 x Race:					
Time	2366	2	27.202	< 0.001	0.022*
Time x CES-D at T1	2366	2	15.665	< 0.001	0.013*
Time x Race	2366	8	3.013	0.002*	0.010*
CES-D at T1	1183	1	1.015	0.314	0.001
Race	1183	4	17.214	< 0.001	0.055*
Time x CES-D at T1 x College:					
Time	2372	2	103.551	< 0.001	0.080*
Time x CES-D at T1	2372	2	16.001	< 0.001	0.013*
Time x College	2372	2	14.077	< 0.001	0.012*
CES-D at T1	1186	1	0.680	0.410	0.001
College	1186	1	2.804	0.094	0.002

*All p values less than .05 are considered to be significant.

**All partial eta squared (η_p^2) values over .01 are considered to be meaningful and are marked with a *.

Research Questions with Drunkenness as Dependent Variable. To address the questions with the Drunkenness measure as the dependent variable and accompanying subquestions (Questions 8, 9, & 10), 9 additional RM-ANOVAS were conducted, to determine how Drunkenness varied over time and if between subject variables and covariates have an effect on their change over time. Descriptive statistics for the Drunkenness measure are in Table 21 and results for these RM-ANOVAS are in Table 22. Correlations between Drunkenness and Depressive Symptoms are in Table 18. Overall, the results were very similar to those found using the Binge Drinking measure as the main dependent variable. While not all F values, levels of significance, of effect sizes are exactly the same for the two measures results for the two measures are similar enough that the results, including host hoc comparisons and contrasts, warrant similar interpretation. Therefore, for results and interpretations see Table 22 and the write up of the results for the Binge Drinking measure. The only results for the dependent variable Drunkenness that will be discussed are results that differ in significance size or effect size from the Binge Drinking measure.

The first difference is in the effect size of a within subject Time by Group interaction showing group differences over time for Race ($\eta_p^2 = .008$). The effect size is considered trivial, while it was small for the Binge Drinking measure ($\eta_p^2 = .012$). Differences in Racial groups did not affect the change over time of Drunkenness while it did for Binge Drinking. However, the numerical difference between these two findings was very small, suggesting that the difference between the two measures was not large, despite the change in effect size classification.

There is also a difference in the general effect of College Attendance. For the Binge Drinking measure, the effect size was trivial ($\eta_p^2 = 0.002$) whereas for the Drunkenness measure, the effect size is small ($F[1, 975] = 18.890$, $p < .001$, $\eta_p^2 = .019$). This indicates that College Attendance was related to the average level of Drunkenness (across the three time points), whereas it was not for Binge Drinking. Similarly, there is a small effect size for the general effect of College Attendance in the RM-ANOVA with Drunkenness as the Dependent Variable, the reduced CES-D at T1 as the covariate of interest, College Attendance as a between subject variable (and Race as a control variable) ($F[1, 971] = 17.940$, $p < .001$, $\eta_p^2 = .018$). The results for the analogous RM-ANOVA with Binge Drinking as the Dependent Variable are non-significant and the effect size is trivial ($\eta_p^2 = .002$). The significant relationship between College Attendance and Drunkeness, in general, continued when the results are controlled for by Depressive Symptoms at T1.

Finally, there is a main effect of time for Drunkenness across T2 and T3 (when T1 was entered as a covariate), indicating that there was a difference in the level of drunkenness between T2 and T3 ($F[1, 983] = 10.326$, $p = .001$, $\eta_p^2 = .01$). This main effect was considered trivial in size for the Binge Drinking measure.

Table 21

Descriptive Statistics for Drunkenness Measure

		Drunkenness at T1		Drunkenness at T2		Drunkenness at T3	
Group	N	*Mean*	SD	*Mean*	SD	*Mean*	SD
Total	985	0.69	1.311	1.4	1.56	1.220	1.419
Male	539	0.72	1.349	1.66	1.674	1.43	1.511
Female	446	0.64	1.265	1.07	1.342	0.97	1.257
White	728	0.76	1.362	1.61	1.601	1.36	1.455
Black	92	0.23	0.713	0.37	0.752	0.53	1.043
Native American	21	0.48	1.123	0.9	1.338	1.190	1.327
Asian	25	0.08	0.400	1.12	1.481	0.800	0.957
Hispanic	112	0.77	1.446	1.05	1.438	1.010	1.352
Attended College	264	0.57	1.114	1.980	1.629	1.540	1.403
Did Not Attend	714	0.73	1.380	1.180	1.481	1.110	1.407

Table 22

Drunkenness Measure Within and Between Subjects RM-ANOVA Results

Effect	Error *df*	*Df*	F	*p*	η_p^2
Question 8: Change over Time					
Time	1968	2	92.728	< 0.001	0.086*
Time x Gender:					
Time	1966	2	86.705	< 0.001	0.081*
Time x Gender	1966	2	12.156	< 0.001	0.012*
Gender	983	1	32.875	< 0.001	0.032*
Time x Race:					
Time	1944	2	7.565	0.001	0.008
Time x Race	1944	8	1.999	0.043	0.008
Race	972	4	15.781	< 0.001	0.061*
Time x College:					
Time	1950	2	78.449	< 0.001	0.074*
Time x College	1950	2	28.985	< 0.001	0.029*
College	975	1	18.890	< 0.001	0.019*
Question 9: Effects of Early Drunkenness on Later Drunkenness					
Time T2 & T3	983	1	10.326	0.001	0.010*
Time T2 & T3 x Drunkenness at T1	983	1	0.000	0.998	0.000
Drunkenness at T1	983	1	43.910	< 0.001	0.043*
Question 10: Effects of Early Depressive Symptoms on Drunkenness over Time					
Time	1960	2	94.770	< 0.001	0.088*
Time x CES-D at T1	1960	2	16.112	< 0.001	0.016*
CES-D at T1	980	1	0.980	0.322	0.001
Time x CES-D at T1 x Gender:					
Time	1958	2	83.360	< 0.001	0.078*
Time x CES-D at T1	1958	2	12.759	< 0.001	0.013*
Time x Gender	1958	2	8.605	< 0.001	0.009
CES-D at T1	979	1	0.037	0.848	0.000
Gender	979	1	30.679	< 0.001	0.030*
Time x CES-D at T1 x Race:					
Time	1936	2	14.086	< 0.001	0.014*
Time x CES-D at T1	1936	2	8.893	< 0.001	0.009
Time x Race	1936	8	1.680	0.098	0.007
CES-D at T1	968	1	0.134	0.714	0.000
Race	968	4	16.045	< 0.001	0.062*
Time x CES-D at T1 x College:					
Time	1942	2	87.126	< 0.001	0.082*
Time x CES-D at T1	1942	2	9.590	< 0.001	0.010*
Time x College	1942	2	23.460	< 0.001	0.024*
CES-D at T1	971	1	0.007	0.935	0.000
College	971	1	17.940	< 0.001	0.018*

*All p values less than .05 are considered to be significant.

**All partial eta squared (η_p^2) values over .01 are considered to be meaningful and are marked with a *.

Chapter V: Discussion

The purpose of this study was to examine the pathways of depressive symptoms and heavy drinking from adolescence to adulthood. Depressive symptoms and heavy drinking were examined individually over time, as was the interaction of early depressive symptoms with concurrent and later heavy drinking and the interaction of early heavy drinking with concurrent and later depressive symptoms. Additionally, the influence of college attendance, gender, and race/ethnicity on each of these interactions was examined. In the previous chapter, the results were presented. In this chapter the results will be summarized and compared with previous literature in the area. First results dealing only with depressive symptoms over time and in relation to demographic variables will be discussed, followed by a discussion of results dealing only with heavy drinking over time and in relation to demographic variables. Finally results dealing with the influence of early heavy drinking on concurrent and later depressive symptoms and vice versa will be discussed, including the influence of the demographic variables. Strengths and limitations of the study will also be addressed. Lastly, implications of this study and areas of future research will be discussed.

Depressive Symptoms Over Time

To summarize the findings, there were longitudinal changes in levels of depressive symptoms over time, with depressive symptoms at their lowest level when participants were college age (T2) and at similar higher rates when participants were in 9th and 10th grade of high school (T1) and when participants were in their late 20s/early 30s (T3). One's age/stage of life appears to relate to depressive symptoms over time.

Contextual variables such as major life events, one's setting, one's place in society, and support systems may all influence this variable (Elder, 1998).

In general, as predicted by past research, levels of depressive symptoms differed by gender, with females demonstrating overall higher levels of depression. Past studies have found that females demonstrated about a third higher level of depression then males (Bryant, 2010; Waller et al., 2006). The change over time, however, was not affected by gender differences, which differs from past research showing that there are differences in the timing and trajectory of depression across genders (Flemming et al., 2008; Needham, 2007).

The overall levels of depressed symptoms differed by Race although all groups demonstrated their lowest levels at T2. Generally, White participants appeared to have lower levels than the other groups, although only significant findings were between White and Black and White and Hispanic participants as their means differed by the greatest amount. One study, which corroborated part of the results of the current study, found that Hispanic students were 30 percent more likely to be depressed than non-Hispanic peers (Fletcher, 2008).

College Attendance was also added into the model. This variable was chosen in accordance with the Life Course Theory discussed in Chapter 1, which emphasizes the importance of changes in social and environmental contexts in the development of an individual (Elder, 1998). Binge drinking and the experience of depressive symptoms are two areas, which are potentially influenced by changes in contextual variables associated with life stage transitions, and have been shown in the past to be influenced by college attendance in particular. Two year colleges were excluded as drinking is less likely to be

normative, perhaps in part because students are more likely to live at home while they attend. Results may have been somewhat different if students who were enrolled in a 2 year college or students who have ever attended college were included. When College Attendance was controlled for, group differences were found with those attending college having lower levels of depressive symptoms at all three time points. This is in keeping with past research, which has found that depressive symptoms are associated with a decreased chance of attending college (Fletcher, 2008; Needham, 2009). Additionally, higher educational attainment has also been found to be protective against depression (Bjelland, et al., 2008; Miech & Shanahan, 2000; Topitzes et al., 2009).

Depressive symptoms during participants' early 20s (T2) and late 20s/early 30s (T3) with depressive symptoms during 9th and 10th grade of high school (T1) as a covariate were also examined. There were significant general effects of medium effect size, indicating that depressive symptoms at T1 are related to later depressive symptoms. More specifically, depressive symptoms at T1 are related to both T2 and T3 individually. Similarly, other studies have found depressive symptoms tend to either continue over time (Fleming et al., 2008) or are recurrent (Birmaher et al., 1996).

Heavy Drinking Over Time

The above analysis was repeated with the two heavy drinking variables (Binge Drinking and Drunkenness) entered into the analysis individually as the dependent variable. Generally, the two heavy drinking variables produced the same results as each other. As such, the two measures will be referred to as "heavy drinking measures" when they lead to the same conclusion. The two measures will only be referred to separately on the few occasions where they differed. There was a significant change in the scores of

both heavy drinking measures across time, each with a medium effect size, the largest to be reported in this study. The heavy drinking measures were more sensitive to changes over time than the reduced CES-D measure. This is unsurprising as drinking is likely to increase as a participant goes through certain milestones such as entering the legal drinking age or attending college, whereas there are not such obvious external milestones that would likely influence depressive symptoms. The difference in heavy drinking between the first two time periods was greater than the second two, suggesting that levels of heavy drinking increase more steeply between early high school and participant's early 20s and then begin to level off as participants reach their late 20s and early 30s.

The levels of heavy drinking differed by gender, with males demonstrating higher levels of heavy drinking at all three time points. Heavy drinking also progressed over time differently for males and females. Both Males and Females had the lowest frequencies of heavy drinking at T1 with apparently similar means. Both genders increased their frequency of heavy drinking at T2, when they were in their early 20s, but at a steeper slope for males. The frequency of heavy drinking for both genders leveled off somewhat at T3, when participants are in the late 20s and early 30s. This is in line with past studies, which have consistently shown higher levels of alcohol consumption, higher trajectories, and greater prevalence of abuse/dependency among men than women (Dawson, et al., 2008; Palmer et al., 2009; Flemming et al., 2008; Kumpulainen, 2000).

The addition of Race as a control variable impacted the change over time of Binge Drinking, although not Drunkenness**,** since different trajectories of drinking exist between Racial groups for the Binge Drinking measure. For all groups, Binge Drinking was at the lowest levels during 9th and 10th grade of high school (T1). Additionally, Race is also

generally related to heavy drinking. Not all groups showed significant differences but White and Black and White and Asian participants did, with White participants engaging in more frequent heavy drinking than the other two groups. Hispanic participants also binge drank significantly more than Black participants. This is generally in line with past research, which has shown that Caucasian students drank more than Asian American, African American, and Hispanic/Latino students (Fromme, Corbin, & Kruse, 2008; Watt & Rogers, 2007).

Full time attendance of a 4-year college or university when the participants would potentially be a junior or senior in college (if they had followed a traditional college trajectory after high school) had a significant impact on the change over time of heavy drinking from 9th and 10th grade in high school through late 20s/early 30s. As suggested in the study by Crosnoe and Riegle-Crumb (2007), differences in drinking trajectories are related to academic trajectories, starting in the high school years with students of higher academic standing (those who are college bound), drinking less during this time period but more as they enter a college environment. In this sample, it appears that those that did not attend college started off drinking heavily with more frequently than those who did during the high school years (T1). During T2, when participants are potentially juniors or seniors in college, the means reversed, with those attending college drinking more. During participants' late 20s/early 30s (T3) it appears that those who had attended college had a greater decrease in frequency of binge drinking than those who had not attended, although the college attendees' mean still appeared to remain higher. This is unsurprising given that the transition from high school to college is accompanied by a significant increase in alcohol use across the board (Fromme, Corbin, & Kruse, 2008;

Shulenberg and Maggs, 2002). Additionally, heavy drinking is more likely to be normative in high school for low achievers, who are also less likely to enter a college context in their transition to young adulthood. Since they are not entering a context with normative heavy drinking they may be less likely to increase their drinking (Crosnoe & Riegle-Crumb, 2007). College Attendance was also related to the average level of Drunkenness (across the three time points). This was, however, not true for the Binge Drinking measure.

Heavy drinking at potential college age (T2) and late 20s/early 30s (T3) was also examined, with heavy drinking during 9th and 10th grade of high school (T1) as a covariate. Levels of heavy drinking at T1 were generally related to later heavy drinking. More specifically, T1 was related to both T2 and T3 individually. There was also a change over time for the Drunkenness measure between T2 and T3 when controlled for by levels at T1. However, the effect size was trivial for this same relationship for the Binge Drinking measure.

Relationship Between Depressive Symptoms and Heavy Drinking

The main aim of the study was to examine the relationship between levels of either heavy drinking during 9th and 10th grade of high school (T1) and depressive symptoms concurrently (T1), 6 years later when participants were in their early 20s and potential juniors or seniors in college (T2) and 11 years later when in their late 20s and early 30s (T3) and vice versa. Up until now, the variables have been discussed separately based on the dependent variable for clarity sake. However, in order to gain a better understanding of how heavy drinking and depressive symptoms relate to one another, they will be discussed in conjunction.

First, in order to determine the impact of early heavy drinking on concurrent and later depressive symptoms, the two heavy drinking measures for participants in the 9th and 10th grade (T1) were entered separately as covariates into the analysis of depressive symptoms at T1, T2, and T3. The level of heavy drinking in high school did not have a significant effect on how depressive symptoms change over time. However, heavy drinking is generally related to depressive symptoms. Early heavy drinking is related to depressive symptoms concurrently and 6 years later when participants were of potential college age, but not 11 years later, once participants enter their late 20s/early 30s. The longitudinal relationship is present but only for the shorter time frame.

The opposite relationship was also examined. In order to determine the impact of early depressive symptoms on concurrent and later heavy drinking, the level of depressive symptoms of participants in the 9th and 10th grade (T1) were entered as a covariate into the analysis of heavy drinking at T1, T2, and T3. There was a relationship between depressive symptoms at T1 and the change over time of heavy drinking. This indicates that the level of depressive symptoms in high school has a significant effect on later the change over time of heavy drinking. However, depressive symptoms at T1, in general, were not related to the average binge drinking over the three time periods. However, the averages likely cancel each other out as depressive symptoms at T1 were positively associated with concurrent heavy drinking but negatively related to heavy drinking at T2.

Overall, depressive symptoms and heavy drinking were related, although in somewhat different ways depending on which measure served as the dependent variable. Other studies have consistently found that those drinking at heavier levels have higher

rates of depression (Dawson et al., 2008; Diego, Field, & Sanders, 2003; Flemming et al., 2008; Kandel et al., 1997; McCarty et al., 2009; Meririnee et al., 2010; Needham, 2007; Owens & Shippee, 2009; Paschall, Freisthler, & Lipton, 2005; Sihvola et al., 2008; Strandheim et al., 2009; Waller et al., 2006). Overall, these relationships are fairly consistent with past research. Both a literature review of 22 studies by Armstrong and Costello (2002) and a meta analysis by Connor, Pinquart, and Gamble (2009), as do many studies (i.e. Kandel, Huang, & Davies, 2001; Kessler et al., 1996) concluded that depression is associated with concurrent alcohol use and impairment. Additionally a study by Vida et al. (2009) found that those with co-occuring depression and alcohol use at time one, when they were 12 years old, had a reduction of symptoms over the next 12 years, but remained at greater risk for both depression and alcohol use than those without difficulties at time one.

Much past research has discussed the possible predictive direction of the effect of drinking and depression. Results from most of the studies, including this one, are correlational so any directional relationships between these two variables remain purely predictive, not causal. Additionally, unknown mediating or moderating variables may also influence the relationship. However, based on the consistency of the positive relationship of heavy drinking seems to predict concurrent and 6 year later depressive symptoms. Early depressive symptoms (T1), on the other hand, seemed to have the opposite of expected relationship with later binge drinking, with early depressive symptoms predicting lower levels of heavy drinking at T2. Past research has varied in their findings of causal directions. An *Addiction* commentary (2008) of longitudinal studies on substance abuse concluded that there are inconclusive results about the causal

direction between depression and heavy drinking over time. Owens and Shippee (2009) and Needham (2007) demonstrated the biderectionality of depression and alcohol use. Flemming et al. (2008), Sihvola et al. (2008), and Kumpulainen (2000) all found that depression tended to predict later increases in alcohol use. However, Meririnnee et al. (2010), found that excessive alcohol use negatively affects adolescent depression over time and Armstrong and Costello (2002) found evidence that adolescent substance use predicts adult depression.

Relationship Between Depressive Symptoms and Heavy Drinking with Demographic Variables

Several demographic variables were added to each analysis individually. First when the two heavy drinking measures for participants in the 9th and 10th grade (T1) were entered separately as covariates into the analysis of depressive symptoms at T1, T2, and T3, Gender was entered as a between subjects variable. Gender generally had a similar impact as when heavy drinking was not controlled for. However, correlational analysis shed some additional light on the effect of gender on the relationship between heavy drinking at T1 and depressive symptoms across the three time points. For both males and females, there was a significant positive relationship between heavy drinking at T1 and depressive symptoms during 9th and 10th grade of high school (T1) and during participants' early 20s when they would potentially be juniors and seniors in college (T2), but not during their late 20s/early 30s (T3).

Gender was also added as a between subject variable into the analysis of the effect of depressive symptoms of participants in the 9th and 10th grade (T1) (entered as a covariate) on heavy drinking at T1, T2, and T3. Again, Gender had a similar impact as

when depressive symptoms at T1 was not controlled for. However, correlational analysis for each demographic group, shed some light on the effect of gender on the relationship between depressive symptoms at T1 and heavy drinking across the three time points. For both males and females, there was a significant positive relationship between binge drinking at T1 and concurrent depressive symptoms. However, there was only a significant relationship between heavy drinking at T1 and later depressive symptoms at T2 for females. These findings are in line with the study by McCarty et al. (2009), which found that depression was positively related to later alcohol abuse or dependence for women but not for men. No significant correlation for either males or females was found at T3.

Overall, the current study found gender differences when predicting depressive symptoms from heavy drinking and vice versa. In past literature, somewhat contradictory gender differences in the interaction between alcohol use and depression have been found. A few studies found that males are more likely to be affected by this interaction than females with early depression predicting later drinking for males (Bryant, 2010; Kumpulainen, 2000). On the other hand, some studies found that females are more likely to be affected by the interaction between alcohol use and depression than boys (McCarty et al., 2009; Strandheim et al., 2009; Waller et al., 2006), which is more in line with the findings of present results. However, one of these studies also found that males are generally more likely to be heavier users by age 15 (Kumpulainen (2000), which is in line with the findings of this study. Finally, a study by Hussong, Hicks, Levy, and Curran (2001) found that, in general, gender did not influence relationship between drinking and affect.

Race was the next demographic variable to be entered into each analysis. First when the two heavy drinking measures for participants in the 9th and 10th grade (T1) were entered separately as covariates into the analysis of depressive symptoms at T1, T2, and T3, Race was entered as a between subjects variable. Generally, Race had a similar impact as when heavy drinking was not controlled for. Correlational analysis was also conducted separately for each Race, revealing group differences. For White, Black, Asian, and Hispanic participants there was a significant positive relationship between heavy drinking at T1 and concurrent depressive symptoms. For Hispanic participants only, there was also a correlation between heavy drinking at T1 and later depressive symptoms at T2. Heavy drinking at T1 was not related to depressive symptoms at T3 for any group. For Native American participants, no correlation was found between heavy drinking at T1 and depressive symptoms at any of the three time points. However, the small sample size of this group may have reduced the level of significance for this group.

Race was also added as a between subject variable into the analysis of the effect of depressive symptoms of participants in the 9th and 10th grade (T1) (entered as a covariate) on heavy drinking at T1, T2, and T3. Again, Race had similar interaction and between subject effects as when heavy drinking was not controlled for. The correlational analysis was conducted separately for each Race between heavy drinking at T1 and depressive symptoms at all three time points revealed some more specific group differences. For White, Black, Asian, and Hispanic participants there was a significant positive relationship between heavy drinking at T1 and concurrent depressive symptoms. However, the relationship between heavy drinking at T1 and depressive symptoms at T2 was only present for White participants. Additionally, the relationship of the two

variables reversed direction for this group; while greater heavy drinking at T1 was related to greater depressive symptoms at T1, it was related to lower depressive symptoms at T2. The level of depressive symptoms at T1 was not related to heavy drinking at T3 for any group. Again, for Native American participants, no correlation was found between depressive symptoms T1 and heavy drinking at any of the three time points. Few studies reported any racial differences in studies focusing on either depression or binge drinking. Future studies should include this variable as there are clear racial differences on the impact of depression on concurrent and later drinking and vice versa.

Finally, when the heavy drinking measures for participants in the 9th and 10th grade (T1) were entered as covariates into the analysis of depressive symptoms at T1, T2, and T3, College Attendance was entered as a between subjects variable. Generally, College Attendance had a similar impact as when heavy drinking was not controlled for: there is a between group difference with those who attend college, having lower levels of depressive symptoms at all three time points. Correlational analysis comparing the means of those who attended a 4 year college or university at T2, versus those who did not, revealed some differences in the interaction between early heavy drinking and concurrent and later depressive symptoms. For non-college attenders, there was a significant positive relationship between heavy drinking at T1 and depressive symptoms both concurrently and at T2. For college attenders, there was a significant positive concurrent relationship at T1 only.

College Attendance was also added as a between subject variable into the analysis of the effect of depressive symptoms of participants in the 9th and 10th grade (T1) (entered as a covariate) on heavy drinking at T1, T2, and T3. Again, generally, College

Attendance had a similar impact as when heavy drinking was not controlled for: there are different trajectories between college attenders and non-attenders. Those that did not attend college started off binge drinking more frequently than those who did during the high school years (T1). During the potential college age (T2) the means reversed, with those attending college drinking more. During participants' late 20s/early 30s (T3) it appears that those who had attended college had a greater decrease in frequency of binge drinking than those who had not attended, although the college attendees' mean still appeared to remain higher. Again, however, there were differences between the two heavy drinking measures for between subject effects, with the Drunkenness measure showing a meaningful significant effect whereas the Binge Drinking measure did not, indicating that College Attendance is related to the average level of Drunkenness (across the three time points), whereas Binge Drinking is not. However, correlational analysis comparing the means of those who attended a 4 year college or university at T2, versus those who did not, revealed some differences. For non-college attenders, depressive symptoms predicted concurrent and future heavy drinking and vice versa. For college attenders, the relationship between depressive symptoms and heavy drinking was only concurrent and not predictive.

Leaving high school is a major transitional life event. The decision to attend college or not, however, makes a large impact on the context and normative expectations that surround this transition. College attendance may potentially change the association between depression and alcohol use since those drinking more heavily due to depression may be drinking at similar levels to their non-depressed peers once college is entered and heavy drinking is more normative (Bryant, 2010; Needham, 2007). However, the

association of depression and heavy drinking did not emerge later in the life course as was suggested might occur by Gonzalez, Bradizza, & Collins (2009). Alternatively, studies have found that higher educational attainment is protective against depression so this association may have affected the results (Bjelland et al., 2008; Miech & Shanahan, 2000; Topitzes et al., 2009). Additionally, drinking in college is often engaged in for celebratory and social facilitation reasons. Hussong, Hicks, Levy, and Curran (2001) found that celebratory drinking increases positive affect in the future. Furthermore, those not entering college are likely to be engaging in more serious adult responsibilities, such as working and starting families at a young age, which may, in turn, affect their level of stress and depression and lead to a continued association between alcohol use and depressive symptoms.

Conclusions and Implications for Professional Practice

The Life Course model emphasizes the importance of changes in social and environmental contexts in the development of an individual (Elder, 1998). The data were examined longitudinally and encompasses 3 time periods, separated by potential major life events in the form of high school graduation, entering college, graduating college, and entering the work force, among others. Overall, depressive symptoms and heavy drinking were related both to changes over time, likely influenced by these life changes, and to each other. Depression and heavy drinking appears to be somewhat different in their manifestation and interaction depending on group membership and on specific developmental time periods.

In general, early heavy drinkers are more likely to have a higher number of depressive symptoms concurrently and 6 years later. Those with more early depressive

symptoms are more likely to be early heavy drinkers. However, they are less likely to be heavy drinkers 6 years down the road. Early depressive symptoms affect later trajectories in binge drinking Social contexts may influence this result. Drinking in general is more normative when participants are 3 to 4 years out of high school and potentially in college, particularly in a social and celebratory context, than during 9th and 10th grade of high school. While those without depressive symptoms at T1 drink with increasing frequency, those with higher levels of depressive symptoms may be more likely to socially withdrawal and avoid these social drinking situations.

However, there does not appear to be a relationship between early levels of either heavy drinking or depressive symptoms and levels of the other variable 11 years later. Perhaps too many life events occur in the intervening years that disrupt this relationship. Additionally, those with continuing difficulties with depressive symptoms and heavy drinking may have found treatment over the course of the 11 years and changed their behavior through such an intervention.

Those that attended a 4 year college or university followed a somewhat different trajectory in their interaction of depressive symptoms and heavy drinking, even before they actually attended college. Attending college is a major life event with implications for drinking. However, the differences in high school drinking levels between those that would and would not attend college 6 years later suggests that more abstract social structures or cultural expectations may also play a rule in drinking choices (Crosnoe & Riegle-Crumb, 2007). Additionally, college attendance seems to serve as a protective factor against both depression in general and the interaction of depression and heavy drinking. These findings suggest that college attendance may lead to better outcomes in

these realms than non-attendance. While heavier drinking in general is associated with college attendance, the results of this study do not suggest that this is automatically linked with more negative consequences, at least in the form of negative affect, either during or after college. However, it is also possible, that the association between depressive symptoms and heavy drinking disappears merely because heavy drinking is more normative in this context, basically covering up the association. The relationship does not re-emerge post-college, however, which would be the expected outcome if the increased likelihood of drinking in the college context were merely covering up the relationship. However, this relationship was also not present at T3 for those who did not attend college.

The current study also found both gender and racial/ethnic group differences when predicting depressive symptoms from heavy drinking and vice versa. While gender differences are well established in the literature for both depression and alcohol use, how gender differences affect their interaction is still somewhat limited and warrants further investigation. Differences in Racial groups between the interaction of depressive symptoms and heavy drinking was generally unreported in the literature. However, differences exist, and future research into the group differences across the two variables and their interaction is warranted.

These findings have implications for early treatment of depression and prevention/intervention of heavy drinking during the high school years. Both depressive symptoms and heavy drinking are problematic as they have a tendency to lead to poor outcomes. Furthermore, the presence of one may signal a concurrent problem with the other. Early screenings and interventions by school psychologists or school counselors

for both may help target those with difficulties in either areas and therefore reduce current and future problems. The association between depressive symptoms and heavy drinking continues over time in various ways, either in the change over time of heavy drinking based on early depressive symptoms or in the influence of later levels of depression based on early heavy drinking. While the influences do not extend to T3, a 6 year interaction effect is still significant and warrants attention. Those still showing an association between depressive symptoms and heavy drinking at T2 may also represent an important demographic for treatment by college mental health staff. Perhaps it is already in part because at risk students have access to the support and services of a college campus that those attending college have better outcomes.

Additionally, given that college attendance and, perhaps more generally, academic achievement orientation, appears to be protective against depressive symptoms, and possibly the interaction between depressive symptoms and heavy drinking, these findings strengthen the rationale to encourage and prepare students, particularly those at risk for depression, to attend college. For non-college attenders, depressive symptoms predicted concurrent and future heavy drinking and vice versa. For college attenders, the relationship between depressive symptoms and heavy drinking was only concurrent and not predictive. While these same individuals are somewhat more likely to drink later in life, the association between heavy drinking and depression seems to reverse and then disappear. The relationship did not re-appear as some researchers have predicted (Crosnoe & Riegle-Crumb, 2007). A longer longitudinal study would perhaps yield different results.

Future Research Needs

Further research into possible moderating or mediating variables that may affect the relation of depressive symptoms and heavy drinking may shed some light on the relationship and why college attendance impacted the results as they did. For example, past studies have found that the association is mediated by behavioral under control (i.e. conduct disorder and delinquency), family history of drinking or depression, childhood stressors (Jackson and Sher, 2003) and social isolation (Goodman and Huang, 2002). Childhood maltreatment was also a strong predictor of both adolescent binge drinking and depression, particularly when multiple co-occuring maltreatment was present (Shin, Edwards, & Heeren, 2009), as was exposure to violence (Taylor, & Kliewer, 2006). Conversely, family support was protective (Mason & Windel, 2001). Several school factors also related to adolescent drinking such as a culture of caring (Guilamo-Ramos, Jaccard, Turrisi, & Johansson, 2005) and peer alcohol use (Mason & Windel, 2001). Many of these variables are available in the Add Health data.

Future research using this sample but differentiating between groups of frequent and non-heavy drinkers and groups with high and low levels of depressive symptoms prior to running analysis will help further distill group differences and changes over time. The aggregate data used to assess changes over time and demographic group data may obscure important relationships between depression and heavy drinking among groups that begin with higher levels of either factor.

Since the current study was purposefully designed to be exploratory in nature, a natural consequence was the large number of results produced. While much valuable information was gained, interpreting this breadth of information is difficult and the

difference between finds of primary and secondary importance can become obscured. In the current study some of the questions could have been combined or eliminated. For example, examining the impact of the demographic variables on every research question was unnecessary as the effect remained the same. An alternative analytical route that might have mitigated these difficulties is to use a cross-validation study design. In such a design, half of the sample is used in an exploratory manner which can lead to a narrower focus and initial hypotheses. The more pertinent analyses can then be validated using the second half of the sample. Future studies may benefit from using this method.

Strengths and Limitations

The study used Add Health data, which is a large, nationally representative sample of adolescents and young adults. The study uses multistage, stratified cluster sampling, which accounts for large variations in sub-populations. The weighting of subjects makes the sample generalizable to adolescent and young adult populations. The longitudinal design allowed for the examination of depression, heavy drinking, and their interaction over three distinctive developmental periods. Additionally, the data set allows for examination of key covariates over all three time points.

However, there are limitations in using a pre-existing data set since the only data available is not chosen with the research questions of your study in mind. The Add Health study researchers chose the CES-D as their measure of depressive symptoms. This has a number of advantages, including its ease of use for collecting information on depressive symptoms on such a large sample and its prevalence in the community health literature, making results more easily comparable across studies. The CES-D is widely used as a screening tool. However, given the need to use a reduced version to ensure

longitudinal and between group measurement invariance, this last advantage is of less importance for this study. Additionally, the CES-D measures symptoms of only one-week duration, which may result in capturing more transient and temporary symptoms, rather than actual impairment. Furthermore, not all questions were asked at each time period. Since a different number of questions were available at each timeframe, an average of the questions was used to calculate each participant's depressive symptoms score. Since the scores ranged from 0 to 3 for each question, the total measure scores are a continuous variable with a fairly narrow range (between 0 and 3). This narrow range may limit the sensitivity of the scale to track change over time. Ideally, a more thorough screening interview of depressive symptoms with qualified professionals and that took a longer duration of symptoms into account would have been available. However using such a tool with such a large sample size would be exceedingly difficult.

The two heavy drinking measures chosen are based on retrospective recall over the course of an entire year so they may lack accuracy. However, again, any other method for collecting these data would be very difficult given the size of the sample and duration of data collection. Having a pre-formed measure available in the data set that targeted heavy drinking specifically would have alleviated the need to run the analysis twice using the two separate questions chosen.

While the Add Health study did strive to minimize bias in their data by ensuring confidentiality and privacy (through computer entry of sensitive items), some bias is inherent in self-report data. It has been found that adolescents have a greater probability of reporting drug and alcohol use through computer-assisted interviews, as were used in the Add Health data collection, when compared to written questionnaires (Supple,

Aquilino, & Wright, 1999). Still, rates of drinking as reported in the Add Health data were somewhat lower than other data sources (e.g. Monitoring the Future, Johnston, O'Malley, Bachman, & Schulenberg, 2009).

Additionally, there are some limitations based on the study design. Since the Add Health data utilized a school-based sample, absent adolescents or those not attending school are excluded. In particular, severe depression may hamper school attendance and continued enrollment, which could potentially eliminate an important group of students. Additionally, institutionalized adolescents are not included in the sample. The health risks and behaviors of those who were excluded may be unique, which would affect the generalizability of the study (Michaud, Delbos-Piot, & Narring, 1998).

Additionally, attrition, a threat to any longitudinal study, is also a limitation. However, sampling weights were used to compensate for non-response to individual survey items (Chantala, 2006). Furthermore, Add Health researchers investigated variations between responders and non-responders and found that the total bias for health and risk behavior measures was small relative to measure prevalence rates (Chantala, Kalsbeek, & Andraca, 2004

Table 1

Alcohol and Depression Literature Summary Chart

Study	Age or Grade	Participants	Study Type and time span	Major Findings Alcohol Use & Depression	Nonintegrated Findings (gender, substance use, depression)	Limitations
Fleming et al. (2008)	8th-11th grade	N=951	Longitudinal; latent growth modeling; Annual survey	Levels of depressive symptoms and alcohol use was associated for girls (Growth model parameter estimates coefficient: .268, p<.01) but not for boys (coefficient: .084). Increases in depression were associated with increases in alcohol use. Episodic relationships of co-occurring alcohol use and depressive symptoms. Initial levels of alcohol use did not predict increases in depression but the opposite was true, with high levels of depression predicting increased alcohol use.	Means for depressive symptoms were higher for girls than for boys at each time point. Correlations across adjacent time points ranged from r=.61 to r=.69 for girls and from r=.50 to r=.69 for boys. Depressive symptoms varied across time (highest at 8th and 11th grades). A high degree of stability was found across time in depressive symptoms in participants. Substance use increased steadily over time, but at a faster rate for boys.	All students drawn from 10 schools in one school district.

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Needham (2007)	T1: 7th-12th grades; T2: 18-26	N=10828 (Add Health Data)	Longitudinal; latent growth modeling	Association between depressive symptoms and binge drinking bi-directional (Females: intercept=.17, Slope=-.01, I(D)-->S(B)=-.02, I(B)-->S(D)=-.11, p<.001; Males: intercept=.16, Slope=.20, I(D)-->S(B)=-.01, I(B)-->S(D)=-.06, p<.001). Those more depressed at beginning to study had higher initial levels of use than non-depressed peers. However, were less likely to have increases in binge drinking. Those with higher levels of alcohol use at time 1 had faster decline in depressive symptoms than those who started with lower levels of substance use, although they still had higher levels of use at all three times.	Similar relationships for girls and boys. Decrease in depressive symptoms for those who drank more initially more pronounced for girls than boys.	Only explains associations, does not get at the whys.
Paschall, Freisthler, & Lipton (2005)	T1: 7th-12th grades; T2: 18-26	N=13892 (Add Health Data)	Longitudinal (1995-2002)	At T2, moderate drinkers had lower levels of depressive moods compared to lifetime abstainers, ex-drinkers, or infrequent drinkers and frequent heavy drinkers. Authors speculate because drinking is associated with reducing stress and anxiety and elevating positive mood. No sig difference between moderate drinkers, heavier moderate drinkers, and occasional drinkers. Lifetime abstainers less likely than moderate drinkers to report previous drinking problems (in 1995) and to be on meds for depression at T3.		Attrition of respondents. May not translate to similar results for older adults.

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Alcohol and Depression Literature Summary Chart

Study	Age or Grade	Participants	Study Type and time span	Major Findings Alcohol Use & Depression	Nonintegrated Findings (gender, substance use, depression)	Limitations
Conner, Pinquart, & Gamble (2009)	mean sample age of 21 years or older	74 studies	Meta-analysis of depression and substance use among those with AUDs.	Depression is associated with concurrent alcohol use and impairment (60.5% with above average depressive symptoms compared to 39.5% without). Depression also related to future alcohol use and impairment. (58 from clinical settings, 10 from community settings, 6 with subjects from both. Did not include studies that used a dichotomous cut off of symptoms into depressed versus non-depressed). Those with AUD had a modest decline in depressive symptoms over time- a stronger affect for older participants.	Depression also associated with earlier age of onset of an alcohol use disorder, and higher treatment participation.	comparing results across depression and alcohol use measures.
Shankman, Lewinsohn, Klein, Small, Seeley, & Altman (2009).	assessed 4 times at the average age of 16.6, 17.7, 24.6, 30.4	N=1,505 from a community sample.	longitudinal; 15 year		Substhreshold major depression and subthreshold alcohol use progressed into their corresponding full syndrome. For subthreshold depression, 35.3% progressed into the full scale depression during T2-T4. For subthreshold alcohol, 36.4% progressed. The effect escalated over time. Subthreshold conditions have predictive validity as they are precursors to the full syndrome disorder.	All from one state. Only assessed until age 30. Their definition of "subthreshold" was fairly arbitrary (the authors note this).

Table 1

Alcohol and Depression Literature Summary Chart

Study	Age or Grade	Participants	Study Type and time span	Major Findings Alcohol Use & Depression	Nonintegrated Findings (gender, substance use, depression)	Limitations
Kandel, Huang, & Davies (2001)	12 and older	N= 35,000 community sample	Correlational	Rates of major depression increases with recent use and dependence status. Rates of depression were twice as high for dependent alcohol users (14%) than for former users (8.1) or non-dependent last year users (6.8%) and even higher for that compared to those who had never used (3.7%).		The measures used were not diagnostic but probable or proxy indicators of diagnosis.
McCarty et al. (2009)	Young adults: ages 24, 27, and 30	N=776, community sample	longitudinal	Among women, depression at age 27 was positively related to alcohol abuse or dependence at age 30 (OR=3.11, 95% CI:1.29-7.54). At age 30, men and women had concurrent comorbidity between major depression and alcohol use disorders (men=.13, women=.19, $p<.05$) and for women only at age 27 (.21, $p<.05$). For females, comorbidity was more common and increased through young adulthood. It declined for males.		All participants from one city. Interviews conducted in person- may result in under-reporting alcohol use.
Sihvola et al. (2008)	14 years and 17.5 years	N=1545 adolescent twins	longitudinal-3.5 years	Early onset depressive disorders predicted frequent alcohol use (OR=2.02, 95% CI 1.04-3.92, P=0.037) and recurrent drunkenness (OR=1.83, 95% CI 1.18-2.85 P=0.007) 3 years later. These effects remained when baseline users adjusted for. This predictive association independent of shared familial influences.		

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Alcohol and Depression Literature Summary Chart

Study	Age or Grade	Participants	Study Type and time span	Major Findings Alcohol Use & Depression	Nonintegrated Findings (gender, substance use, depression)	Limitations
Meririnne et al. (2010)	adolescent	N=197	longitudinal-1 year	Excessive alcohol use (defined as weekly drunkenness) negatively affects the course of adolescent depression. Excessive alcohol use comorbid with depression predicts a greater likelihood of continued depression (remission of symptoms for depression is 80.2% for no/occasional users, 74.1%, OR=.86, 95% CI .061-1.23, P=0.411 for regular users, and 42.9% for excessive users OR=.43, 95% CI .24-.75, P=0.003).		Specific population
Vida et al. (2009)	12, 19, 25	N=219	Longitudinal-12 year span	Those with co-occurring depression and alcohol use at time one had a reduction of symptoms over time ($F(8, 210)=3.313$, $p<.001$), but remained at risk for both depression and alcohol use than those without difficulties at time one.		Very specific population (all had speech and/or language difficulties).
Owens & Shippee (2009)	9th-12th grade	N=1015	longitudinal. 9th grade at T1. 3 year span.	Depressed mood resulted in decreased short term drinking (concurrently) (10th $\beta=-.32$, $p<.05$; 11th $\beta=-.29$, $p<.05$; 12th=-.39, $p<.05$). In the other direction, however, they found that drinking tended to increase depression in the 10th and 12th grades (10th $\beta=.12$ $p<.05$; 12th $\beta=.14$, $p<.05$).	Differences in gender between short and long term association between depressed mood and increased drinking. Differences in the magnitude of affect by gender as well- drinking had negative effects on emotional well-being in 10th grade, but not until 12th grade for girls.	Specific population: one school district, only. Measured the number of days they drank, not the quantity

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Strandheim, Holmen, Coombes, & Bentzen (2009)	13-19 years	N=8983	correlational	Depressive symptoms highly associated with number of alcohol intoxications. In the total population 26.4% (p=.001) of the students with low depressive symptoms experienced more than 10 intoxications, compared to 38.6% (p=.001) of the high symptom group. Depressive symptoms among girls related to high numbers of intoxications- girls with symptoms of depression reported more frequent alcohol intoxications (age 13-15 OR=1.7, 95% CI:1.1-2.5, p=.015; age 16-19 OR=1.4, 95% CI:1.1-1.7, p=.001).	Gender difference not great for number of intoxications, but association with depressive symptoms only for gils	Conducted in Norway. Cannot determine causal direction
Gonzalez, Bradizza, & Collins (2009)	18-20 years	N=91 (all with past history of suicidal ideation)	correlational	Greater depression associated with drinking problems (B=.036 [.09], β=.38, p<.001) and drinking to cope (B=.011 [.03], β=.35, p<.001). Drinking to cope was also associated with heavy episodic drinking (B=.42 [.16], β=.28, p<.001), greater alcohol consumption (B=.17 [.05], β=.34, p<.001), and greater alcohol problems (B=1.06 [.30], β=.35, p<.001).		Specific population: one university and all with past suicidal ideation

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Armstrong & Costello (2002)		22 articles	literature review	Prevalence of depression increased from 5% among abstaining youth to 23.8% in youth with at least weekly alcohol use. Similar rates in 7 other studies. Concurrent comorbidity between SUD and depression: between 11.1% to 32.0% (median 18.8%). Depression was the second most common comorbid condition (following conduct disorder).		
Jackson & Sher (2003)	baseline age= 18.5	N=378	longitudinal, 11 years; state-trait model	Trait AUD and trait distress were correlated (r=.43). However, most association was found to be due to a third variable such as childhood stressors or behavioral under control.		
Kessler et al. (1996)	15-54	N=8098	Correlational	11 % of those with alcohol abuse had a major depressive episode.	For the vast majority of people with co-occurring addictive and mental health disorders, a mental health disorder was present before the addictive disorder.	Retrospective recall.

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Waller et al. (2006)	7th-12th grades	N=18922	correlational-Add Health Wave I	Those with greater substance use, had greater likelihood of depression. However, for males, there was not a great association between alcohol use, in particular, and depression. For females, those who drank were 2.5 times more likely to be depressed than abstainers (abstainers: OR=13.6, 95% CI:2.7-4.8; drinkers: OR=8.8, 95% CI:6.2-12.4; binge drinkers: OR=10.4, 95% CI:7.5-14.2).	At Wave 1, 12% of girls were depressed, 8% of boys (using CES-D with a cut point). Girs with risky behavior at greater risk for depressive symptoms than boys with similarly levels of risky behavior.	Different cut off points for males vs females in CES-D; cannot consider temporal order
Diego, Field, & Sanders (2003)	high school seniors	N=89	correlational	CES-D score accounted for a considerable among of variance in alcohol use. More depressed teens were more likely to drink (b=.015, t=2.19, p<.05, partial correlation=.204).	Low GPA also accounted for significant portion of variance in substance use.	Specific population: small N, one high school

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Hussong, Hicks, Levy, & Curran (2001)	college students: 18-20	N=74	Longitudinal: month long. Initial interviews and follow up freqent self-report	Greater weekend drinking predicted greater weekday negative affect (β=.13, t=.207). However, greater weekday drinking was not predictive of greater negative affect (β=.04, t=.91). Positive affect actually predicted greater weekday drinking. Those with fewer close and supportive friends were at greater risk for higher levels of drinking compared to peers following elevations in sadness (β=.16, t=8.01). These heavier drinking episodes then, in turn, predicted subsequent elevations in negative affect in the following week (weekday: β=.19, t=3.95; weekend: β=.47, t=11.91). Also, for those with social support, greater weekday drinking predicted greater positive affect on the weekends (β=-.99, t=-2.00).	Men had greater weekend drinking than women (β=.52, t=2.35), but not greater overall drinking (β=.22, t=1.74), however, in general they did not find gender differences that influenced relationship between drinking and affect β=.01, t=.14). Slight effect in which men showed association between weekend sadness and elevated weekday drinking (β=.30, t=9.25).	small N, one college
Kandel et al. (1997)	9 to 18 years	N=1285	Correlational	Frequency of alcohol use associated with increased risk for mood disorders. This association increased with increases in frequency of alcohol use from occasional to more regular use. For adolescents who drank weekly, 30.8% and 41.7% were diagnosed with an SUD- higher levels of drinking strongly associated with SUD diagnosis even at these young ages.		

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Kumpulainen (2000)	age 12, retest at age 15	N=1267	Longitudinal - 3 years	12 year old children with depression are at risk for later excessive alcohol use (2.4-fold increase in likelihood). Those with both depression and externalizing behavior were at an even greater use for later excessive alcohol use (7.4-fold increase in likelihood). Female heavy users scored higher on the CDI than non-heavy using females (RR=2.7, 95%, CL:1.6-4.5)	Boys who scored high on the CDI at age 12 were more likely to be heavy users at age 15 than girls who had high CDI scores at age 12. However, confidence limits for these findings were large Boys were also generally more likely to be heavier users by age 15.	Specific population: Finland. Only approximate clinical assessments due to paper and pencil questionnaires (no interview). No measure of alcohol use at T1.

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Sydnor (2009)	12-16 year olds at Wave 1 (used first 3 waves)	N=6836	longitudinal-Add Health, over 6 years	Adolescent with problematic alcohol use had higher levels of depression (38.28%) than those in the non-problematic alcohol use group (22.98%). Depressed adolescence were less susceptible to increases in alcohol use over time. Depressed adolescents less likely to have young adult problematic use than non-depressed adolescents (depressed: 49.89%; non-depressed: 55.35%). However, depressed young adults were more likely to have problematic drinking than non-depressed peers (depressed: 57.05%; non-depressed: 53.19%). Depressed adolescent males were less likely to have later alcohol related problems (Males: OR: .76, 95% CI:.59-.97, p<.05) For females this was not a significant predictor.; Females: (OR: .87, 95% CI:.70-1.08). However, depressed young adult males and females were more likely to be problematic drinkers (Males: (OR: 1.68, 95% CI:1.21-2.31, p<.01; Females: (OR: 1.26, 95% CI:1.00-1.58, p<.05.	Depressed adolescents 3 times as likely to become depressed young adults than non-depressed adolescents (depressed: 36.28%; non-depressed: 14.23%; OR: 2.97, 95%, CI:2.52-3.49, p<.001). Higher levels of depression among females (23%) than males (17%). Of those with problematic drinking at adolescents, the majority (71%) also did as young adults. High school graduates and college educated people less likely to be depressed (high school graduate: OR: .76, 95%, CI:.61-.94, p<.05); college graduate: OR: .50, 95%, CI:.39-.62, p<.001). However, college educated respondents were more than 3 times as likely to be problematic alcohol users (OR: 3.33, 95% CI:2.51-4.40, p<.001). High school graduates were also more likely than non-graduates to be problematic users (OR: 1.67, 95% CI:1.27-3.28, p<.001).	Perhaps too low a cut off for CES-D. Ended up with 26% of the adolescent sample and 1/5 of the young adult sample meeting criteria for depression. Adolescent rate in line with other studies, but higher than other studies for young adult depression levels.

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