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MENTAL HEALTH IMPAIRMENT AND
HUMAN CAPITAL ACQUISITION:
UNDERAGE DRINKING AS A PREDICTOR
OF CONCOMITANT ALCOHOL
DEPENDENCE AND POOR EDUCATIONAL
ATTAINMENT

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MENTAL HEALTH IMPAIRMENT AND HUMAN CAPITAL ACQUISITION: UNDERAGE
DRINKING AS A PREDICTOR OF CONCOMITANT ALCOHOL DEPENDENCE AND
POOR EDUCATIONAL ATTAINMENT

by

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A Dissertation
Submitted in Partial Fulfillment of the Requirements for the
Doctor of Philosophy Degree in Rehabilitation

Rehabilitation Institute
in the Graduate School
Southern Illinois University Carbondale
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DISSERTATION APPROVAL

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Fulfillment of the Requirements

for the Degree of

Doctor of Philosophy

in the field of Rehabilitation

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April 23, 2014

AN ABSTRACT OF THE DISSERTATION OF

EUCHAY N. HORSMAN, for the Doctor of Philosophy degree in REHABILITATION,
presented on APRIL 23, 2014, at Southern Illinois University Carbondale.

TITLE: MENTAL HEALTH IMPAIRMENT AND HUMAN CAPITAL ACQUISITION:
UNDERAGE DRINKING AS A PREDICTOR OF CONCOMITANT ALCOHOL
DEPENDENCE AND POOR EDUCATIONAL ATTAINMENT

MAJOR PROFESSOR: Dr. Carl R. Flowers

Underage drinking has featured prominently in both scholarly and conventional literature in recent decades as a major health and socio-economic concern in the United States. As new evidence emerges associating underage drinking with a host of negative outcomes for both the youth who drinks and society in general, a closer examination of the long-term effects of underage drinking is critical. This exploratory study was designed to examine predictor variables and their ramifications (1) using logistic regression to identify a model for underage drinking history (UDHISTORY) as a predictor of concomitant alcohol dependence and poor educational attainment (CADAPEA) among individuals aged 25 and above, and (2) obtain a better understanding of how demographic variables (age, gender, race/ethnicity) influence the prediction. The nature and strength of the effect(s) of these demographic variables on the prediction were also investigated. The *2010 National Survey on Drug Use and Health* data set *ICPSR 32722-0001* which is previously unexploited for this purpose was utilized in this study. The data analysis tool, SDA on SAMHSA's website and IBM SPSS were used for correlation analysis and logistic regression to test the hypothesis that currently legal age drinkers 25 years and older with UDHISTORY are more likely to experience CADAPEA than their counterparts without UDHISTORY.

When considered alone, UDHISTORY was a strong and statistically significant predictor of CADAPEA. The identified bivariate logistic regression model was statistically significant, χ^2

(1, $n = 60$) = 13.39, Adjusted Wald $F_{1, 60} = 13.39$, $p = 0.001 < .05$, accounting for 1.26% (Cox and Snell R square), 1.3% (Log Likelihood Pseudo R square), to 7.9% (Nagelkerke R square) of the variance in CADAPEA. However, adding demographic variables to the model made UDHISTORY a much stronger and more statistically significant predictor. The identified final multivariable logistic regression model was statistically significant, $\chi^2 (6, n = 55) = 170.43$, Adjusted Wald $F_{6, 55} = 26.04$, $p = 0.00 < .001$, accounting for 1.8% (Cox and Snell R square), 7.2% (Log Likelihood Pseudo R square) to 7.9% (Nagelkerke R square) of the variance in CADAPEA. The model also correctly classified 99.1% of cases.

Keywords: alcohol use disorders, mental health impairment, poor educational attainment, underage drinking, early onset drinking

DEDICATION

I dedicate this work to my late parents Mr. and Mrs. Alfred A. Nnadozie Nwokocha, my late friend Dr. Alice Wakonyo Mbugua, my mentor Dr. Irmo Marini and his family, and my brother, Dr. Alfred A. Nnadozie Jr. and his family.

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CHAPTER 1

INTRODUCTION

Underage drinking, which is defined as any consumption of alcoholic beverages before the legal drinking age of 21 (Alcohol Policy Information System [APIS], 2010), has been a societal concern for decades. At the same time, efforts have been made to curb, if not totally stop underage drinking in the United States (Johnston, O'Malley, Bachman, & Schulenberg, 2011; Komro & Toomey, 2002). Despite these efforts however, early onset, heavy, and hazardous drinking by youths continue to escalate (Yeide, 2009). According to the Center on Alcohol Marketing and Youth (CAMY), John Hopkins Bloomberg School of Public Health in a 2011 fact sheet, 4,750 adolescents not yet 16 years of age start drinking every day in the United States. The Substance Abuse and Mental Health Services Administration (SAMHSA) (2012), in a report on underage drinking initiation, indicated that youth initiation of alcohol use is most prevalent months in the months of June, July, and December, noting daily alcohol use initiations for each of these months to average more than 11,000 nationally. For the remaining months of the year, the daily average for initiation of underage alcohol use was reportedly 5,000 to 8,000 (SAMHSA, 2012).

Concerns over underage drinking stem from myriad of risks associated with the phenomenon. For example, according to SAMHSA (2012), underage drinking was responsible for nearly half (45.2%) of the 189,060 drug-related visits to the emergency room in 2010. The National Institute on Alcohol Abuse and Alcoholism (NIAAA) (n.d.) gave a similar report. The NIAAA (n.d.) reported that close to 200,000 youths visited the emergency room in 2008 due to illnesses and other complications from alcohol-related incidents. The NIAAA (n.d.) further noted that about 5,000 youths in the United States die each year from motor vehicle accidents,

homicides, alcohol poisoning, falls, burns, drowning, and suicides due to underage drinking. These numbers correspond to the record number of youths (70%) who reported having had at least one drink by age 18, and over 10 million of those under 20 years of age who reported that they had alcoholic beverages in 2009 alone (NIAAA, n.d.). The implications of these statistics include the fact that early onset drinking may result in both immediate and long-term impairments for youths who consume alcohol, people around them, and innocent by-standers (Tapert, Caldwell, & Burke, 2004, 2005).

When youths consume alcoholic beverages regularly or excessively, a chain of negative consequences may ensue both for them and for others NIAAA (2006). Underage drinking can result in physical injuries, mental health impairments, neurological disorders, and a host of negative socio-behavioral outcomes or death (Allen, 2002; Brown & Tapert, 2004; Brown, Tapert, Granholm, & Delis, 2000; Centers for Disease Control and Prevention [CDC], 2010; Foster, Vaughn, Foster, & Califano, 2003; International Center for Alcohol Policies [ICAP], 2012; NIAAA, n.d.; Norberg, Bierut & Grucza, 2009; SAMHSA, 2009; U.S. Department of Health and Human Services, Office of the Surgeon General [Surgeon General], 2007). Tapert et al. (2004, 2005) asserted that interruption in the youth's cognitive development could drastically mar his or her future given the fact that adolescence is the period when youths prepare for adulthood. Moreover, mental health and neurological impairments could interrupt a youth's normal developmental processes including the chance of hindering his or her educational activities, resulting in poor educational attainment (PEA) and consequently in poor human capital acquisition (HCA) (Hingson, Edwards, Heeren, & Rosenbloom, 2009).

Human capital acquisition (also referred to as human capital accumulation) has been defined as the attainment of academic and/or vocational education in preparation for future

employment (Kimenyi, Mwanbu & Manda, 2006; Martínez & Fernández, 2010; van der Merwe, 2010; Olaniyan & Okemakinde, 2008). In mental health economics as well as in vocational rehabilitation of individuals with mental health disabilities, the potential contribution of individuals to the labor market is valued in the same way as their mental health is linked to gainful employment and economic wellbeing (Boardman, 2003; Currie & Stabile, 2009). In this direction, Currie and Stabile (2009) for example, investigated the effect of common childhood mental health problems on the educational attainment of affected children.

The concept of human capital and consequently HCA has been crucial to debates about welfare, health care, retirement and particularly to education in relation to youths. Although the idea existed earlier, it was made popular by Mincer and Becker of the Chicago School of Economics, dating back to an article by Mincer in 1958. Technological innovation during the late 19th and early 20th centuries made educational attainment (particularly formal education) more important in the United States because of the need for skilled labor during the same period (Goldin & Katz, 1999). At the same time, a rush to higher education swept through the nation in a wave only likened to a similar move toward secondary education, which led to increased formalized schooling across the country.

Background to the Problem

The Surgeon General, Kenneth Muritsugu, in 2007 issued a *Call to Action To Prevent and Reduce Underage Drinking*, declaring that there is "... new, disturbing research which indicates that the developing adolescent brain may be particularly susceptible to long-term negative consequences from alcohol use" (pp. V-VI). The Surgeon General (2007) drew data from approximately two decades of investigation into underage drinking spanning medical and disease concerns, behavioral, psychosocial, neurological, economic, and other civil implications

of underage drinking. Several studies of underage drinking lend support to these concerns with reports of mental health, neurological, socioeconomic, civil and behavioral problems associated with the phenomenon. Despite these known results, underage drinking remains highly prevalent today as it has for nearly two decades (CDC, 2010; Rhode, Lewinsohn & Seeley, 1996; SAMHSA, 2010).

Alcohol's interference with the yet developing adolescent central nervous system (CNS) and related brain development is one of the critical negative immediate and possible life-long consequences of underage drinking (ICAP, 2005; NIH, 2005; the U. S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention [OJJDP], 2012). Youth alcohol consumption has been found to hinder normal development of the central nervous system (CNS), hence interfering with the yet growing youth's brain and causing neurological damage (Allen, Rivier & Lee, 2011; CDC, 2010; De Bellis et al., 2000; Gilpin & Koob, 2008; Lovinger, 2008; NIAAA 2006/2009; OJJDP, 2012). In turn, abnormal functioning of the CNS and brain growth together with the resultant negative neurological activities affects memory and cognition thereby interrupting educational and other adult life preparation processes the youth needs to achieve and pass through at this stage of life (Barr, Schwandt, Newman, & Higley, 2004; CDC, 2010; Gilpin & Koob, 2008; Hiller-Sturmhöfel & Swartzwelder, n.d.; NIAAA, 2009). Specifically, normal healthy functioning of both the CNS and neurological processes are necessary for learning, forming lifelong memories of self and environments, and for discerning appropriate and inappropriate behaviors towards self and others (Crews, He & Hodges, 2007; DeSimone & Wolaver, 2005; Lovinger, 2008; NIAAA, 2005/ 2009).

Underage drinking has been found to be associated with the initiation of use of other substances of abuse given alcohol's reputation as the gateway drug (Brown & Munson, 1987;

Grant & Dawson, 1997; Kirby & Barry, 2012; OJJDP, 2012). Progression to alcohol use disorders (alcohol abuse and alcohol dependence) which meet the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision [DSM-IV-TR], 2000 criteria for mental health impairments is another threat of underage drinking (American Psychiatric Association [APA], 2000; Grant & Dawson, 1997; NIAAA, 2009). Early onset of alcohol use may result in alcohol dependence in youth and young adulthood, or later in life (Grant & Dawson, 1997; NIAAA, 2009). Alcohol dependence has been found to correlate with other mental health conditions such as major depressive episodes, suicidal ideation, severe mental illness, and psychological distress (Allen et al., 2011; Dawson et al., 2007; De Bellis et al., 2000; Grant & Dawson, 1997; NIAAA, 2009). The NIAAA (2009) concluded that underage drinking is likely to lead to excessive use of alcohol that can pose severe economic burdens on both the individual and society in general.

Some indirect economic costs of underage drinking include physical, mental, and neurological disabilities, loss of quality of life, productivity loss, and death (Allen et al., 2011; Bouchery, Harwood, Sacks, Simon & Brewer, 2011; CDC, 2010, 2011; Goldman, Oroszi & Ducci, 2006; McCusker, Basquille, Khwaja, Murray-Lyon, & Catalan, 2002; Miller, Levy, Spicer, & Taylor, 2006; New York State Office of Alcoholism and Substance Abuse Services, [OASIS] 2009; OJJDP, 2006; Schuckit, 2000). Miller et al. (2006) studied the cost of underage drinking to society in 2001 and concluded that the cost of underage drinking was higher than the tax revenue it generated that year. Miller et al. (2006) estimated the cost of underage drinking to society at close to \$70 billion for the year 2001 with violence and motor vehicle accidents being the most costly. Six years later, Bouchery, et al. (2011) found that underage drinking had an 11.0% share of the \$223.5 billion expended on excessive drinking in the United States in 2006.

Underage drinking, according to these authors, also had the lion's share when calculating the 57.6% loss in productivity for the year (Bouchery et al., 2011). Recently, the OJJDP (2012) reported that underage drinking cost society \$1 per drink for a total of \$68 billion in 2007.

Statement of the Problem

Although numerous consequences of underage drinking have been documented, literature specifically exploring concomitant alcohol dependence and poor educational attainment among persons who started drinking before the legal drinking age of 21 is lacking. In turn, alcohol dependence sometimes called alcoholism or overindulgence in the use of alcohol by people of all ages and at all stages in life, have been identified as a leading cause of permanent disabilities and death (CDC, 2010; Goldman et al., 2006; OJJDP, 2006). Also, alcohol dependence has been linked to poor or lacking educational attainment (Conti, Berndt, & Frank, 2006; Cunradi, Greiner, Ragland & Fisher, 2005; Frone, 2011; Patussi, Mezzani, & Scafato, 2005) which subsequently negatively impacts the underage drinker's employment and career options.

Purpose of the Study

The purpose of this study is to use correlation and regression analyses to examine the relationships between underage drinking, alcohol dependence and poor educational attainment based on the 2010 National Survey on Drug Use and Health data set ICPSR 32722-0001. In particular, this extant data set is used in the study to examine whether and how underage drinking history predicted concomitant alcohol dependence and poor educational attainment. Furthermore, whether demographic factors (age, gender, and race/ethnicity) had any influence on the prediction is investigated.

Research Questions:

The terms underage drinker/drinking as described in the definition of terms section are used to refer to respondents in the study, who, though 25 years and older, were of legal drinking age as at the time of the survey, but may have, at some time in their lives, had a history of underage drinking (*underage drinking history [UDHISTORY]*). Thus, for purposes of convenience and clarity, a structure is adopted whereby individuals who currently drink are classified as follows:

- a) Currently Underage Drinker (CUD) or CURRENTLY UD.
- b) Currently Legal Age Drinker (CLAD) without UDHISTORY
- c) Currently Legal Age Drinker (CLAD) with UDHISTORY

Although all these three categories are of interest and could be analyzed under this structure, the main focus of this study was on the third category, namely, CLAD with UDHISTORY that is the sub-population of currently legal age drinkers with history of underage drinking. Correlation and logistic regression analyses are used to address the following research questions:

1. Are there statistically significant correlations between UDHISTORY and concomitant alcohol dependence and poor educational attainment (CADAPEA) in relation to age, gender, and race/ethnicity?
2. Do currently legal age drinkers (CLADs) with UDHISTORY have higher probability of alcohol dependence than CLADs without underage drinking history?
3. Do CLADs with UDHISTORY have a higher probability of poor educational attainment than CLADs without underage drinking history?

4. Do CLADs with underage drinking history (UDHISTORY) have a higher probability of concomitant alcohol dependence and poor educational attainment (CADAPEA) than CLADs without underage drinking history?
5. Are there statistically significant demographic (age, gender, race/ethnicity) differences among individuals specified in research questions 2, 3, and 4 above?

Research Hypotheses

In line with the research questions stated above, the study was also guided by the following hypotheses.

1. There are statistically significant correlations between UDHISTORY and CADAPEA in relation to age, gender, and race/ethnicity.

H₀₁: There are no statistically significant correlations between UDHISTORY and CADAPEA in relation to age, gender, and race/ethnicity.

2. CLADs with UDHISTORY have significantly higher probability of alcohol dependence than CLADs without UDHISTORY.

H₀₂: There is no statistically significant difference in probability of alcohol dependence between CLADs with UDHISTORY and CLADs without UDHISTORY.

3. CLADs with UDHISTORY have significantly higher probability of poor educational attainment than CLADs without UDHISTORY.

H₀₃: There is no statistically significant difference in probability of poor educational attainment between CLADs with UDHISTORY and CLADs without UDHISTORY.

4. CLADs with UDHISTORY have significantly higher probability of concomitant alcohol dependence and poor educational attainment (CADAPEA) than CLADs without UDHISTORY.

H₀₄: There is no statistically significant difference in probability of CADAPEA between CLADs with UDHISTORY and CLADs without UDHISTORY.

5. There are statistically significant demographic (age, gender, race/ethnicity) differences among CLADS with underage drinking history in research questions 2, 3, and 4 above.

H₀₅: There are no statistically significant demographic differences among CLADs with underage drinking history in research questions 2, 3, and 4 above.

Significance of the Problem

Enormous amounts of resources and efforts have been spent as hypotheses are advanced debating the links between underage drinking, alcohol dependence (AD), and educational attainment (EA) given the fact that the relationship between alcohol dependence and poor educational attainment (PEA) is not clear-cut (Conti et al., 2006; Cunradi et al., 2005; Frone, 2011; Patussi et al., 2005). Staff, Patrick, Loken, and Maggs (2008) point out three main differing viewpoints regarding this phenomenon. First, from human capital theory, educational attainment is expected to be directly and negatively predictable by underage drinking. Some research results (Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Bonomo, Bowes, Coffey, Carlin, & Patton, 2004; Gotham, Sher, & Wood, 2003; Hansell & White, 1991; Kandel, Davies, Karus, & Yamaguchi 1986; Lynskey & Hall, 2000; Mensch & Kandel, 1988; Moffitt, Caspi, Harrington, & Milne, 2002; Newcomb, 1987; Newcomb & Bentler, 1985, 1988; NIAAA, 2004/2005; Schulenberg, Maggs, & O'Malley, 2003; Spear, 2000; Tanner, Davis, & O'Grady, 1999; Tapert et al., 2004/2005) have supported this view. Essentially, this line of thought suggests that heavy alcohol use in adolescence could increase the likelihood of alcohol dependence in late youth and young adulthood thereby negatively impacting educational attainment in particular and human capital acquisition in general. In turn, this can lead to

underdeveloped job skills and lack of experience for the workforce (Bachman et al., 1997; Lynskey & Hall, 2000; NIAAA, 2004; Schulenberg et al., 2003; Tapert et al., 2004, 2005).

The second viewpoint is that some of the findings regarding the negative effects of heavy alcohol use on school success, and long-term educational and/or job skills attainment may not be genuine (Chatterji, 2006; Dee & Evans, 2003; Duncan, Featherman, & Duncan, 1972; Koch & Ribar, 2001; NIAAA, 2006). A crucial aspect of this viewpoint is low school commitment and the notion that academic failures increase the risk of heavy alcohol use (Chatterji, 2006; Dee & Evans, 2003, Duncan et al., 1972; Koch & Ribar, 2001; NIAAA, 2006).

The third view is that the relationship between alcohol consumption and educational attainment may be conditional (Berkman & Kawachi, 2000; Corcoran, 1995; Duncan et al., 1972; Fagan & Pabon, 1990; Murray, O'Connell, Schmid, & Perry, 1987; NIAAA, 2006; Rehm et al., 2004; Schoon, 2006; Schoon et al., 2002; Tapert et al., 2004/ 2005; Wills, Sandy, Yaeger, & Shinar, 2001; Wills & Yaeger, 2003; Zucker & Harford, 1983). This view is based on the fact that factors such as environment, personal characteristics, social and economic environment may moderate the long-term impact of heavy alcohol use on educational attainment.

All three viewpoints are well founded, and all three are discussed and empirically considered in the present research. Since neither AD nor PEA is a positive attribute and both may directly or indirectly be linked to UD, the joint or concomitant occurrence of AD and PEA may have different implications for rehabilitation counseling efforts in this regard and as such a detailed study of how UD can predict this concomitant alcohol dependence and poor educational attainment (hereafter labeled CADAPEA) is necessary and as well the role of demographic factors in the prediction process is noteworthy. Moreover, it is important to note that instances where individuals have AD and PEA concurrently with co-occurring mental health impairment,

one key factor in successful rehabilitation is employment. The important role employment plays in successful vocational rehabilitation emphasizes educational training and skills acquisition. Thus, from the human capital perspective, when the issue of health (in this case, mental health - alcohol dependence) and education (poor educational attainment) are suitably regarded in the calculation of human capital acquisition, key information regarding the long-term costs of underage drinking can be obtained (Grossman, 2008; Frone, 2011; Mullahy & Sindelar, 1989), and this consequently warrants an in depth study of such a model of relationship between underage drinking, alcohol dependence, and poor educational attainment.

Given the foregoing, the present study has been focused on drawing attention to a neutral view on underage drinking, alcohol dependence, and poor educational attainment, away from causation but focused on different, individual situations of concomitant alcohol dependence and poor educational attainment among individuals with histories of underage drinking for the purpose of informing both policy and intervention efforts. It is also hoped that the study provides additional information that would lead to more knowledge about the role of demographic factors on underage drinking in predicting alcohol dependence and educational attainment. These aims of the study fit the Surgeon General, Moritsugu's (2007) recommendation to inform the public, given the that "an informed public is an essential part of an overall plan to prevent and reduce underage drinking and to change the culture that supports it" (p. 43).

Summary

The community of people with mental health impairments (alcohol dependence in particular) and those with concomitant alcohol dependence and poor educational attainment is a different one that requires further study. Despite research in this area of mental health

impairment in recent years, there are still gaps in the literature that need to be filled if treatment outcomes for this unique group are to be enhanced. Rehabilitation professionals and researchers need to know more on how the particular phenomenon of underage drinking affects this group and the role demographic factors such as age, gender and ethnic background play in the process. Such knowledge will help throw more light on prevention, intervention, and rehabilitation counseling and management.

Limitations and Delimitations

Limitations. This study inherited certain limitations of the data set in addition to those limitations inherent to studies using extant data. Research Triangle International (RTI International) (2012) identified three limitations to the 2010 National Survey on Drug Use and Health (NSDUH). First among these limitations is the fact that the data was partially collected through self-reports. The implications of, and concerns over self-reported data in a survey include the fact that the accuracy of such data is dependent on the accuracy with which the reporter remembers and is willing to honestly report facts (Embree & Whitehead, 1993). It is generally believed that exaggerations, as well as half-truths, cannot be totally avoided in self-reports (Del Boca & Noll, 2000, Lintonen, Ahlstrom, & Metso, 2004), though Smith, McCarthy, and Goldman (1995) found the opposite to be the case in their study. Smith et al., (1995) concluded that young adolescents can be trusted with providing reliable and valid information on their alcohol consumption.

In an effort to increase reliability of self-reported information in the 2010 NSDUH, RTI International (2012) reported adopting established and commonly used techniques for maximizing accuracy of information given by respondents in the study. Those methods included increased privacy by using audio computer-assisted self-interviewing (ACASI) and assuring

participants of confidentiality of their information. In addition to confidentiality measures, RTI International also adopted data assessment methods that improved the reliability of the data collected (Del Boca & Noll, 2000) for the 2010 NSDUH. Through re-interviewing of some respondents within approximately two weeks of the initial interviews, RTI International collected a second set of data with which to validate the initial data collected. A comparison of the first and second interviews was then carried out to check for consistency and reliability of the responses given.

Second, the exclusion of certain critical populations was documented as a limitation of the survey. RTI International recognizes the fact that leaving out certain parts of the population limits the data in the sense that any differences in the characteristics of the omitted population in relation to the study variables might render estimations of the general population based on 2010 NSDUH inaccurate. The third and final concern RTI International expressed with regards to limitations to the survey is the fact that the survey collected and reported data as at the period of the survey. Given that snap shots are limited to momentary realities and as such, may not provide the true picture of the study phenomenon, any variations or changes in the population immediately following the study would not be captured. Finally, generalizability of study results will be limited to the included populations. Excluding certain pockets of the population from the survey limits the generalizability of study results to the omitted populations.

Delimitations. The study is delimited to the NSUDH study year 2010. Also, this study is delimited by the selection and omission of particular variables. More so, the study was initially delimited to respondents who fall within the age range 16-75 years as at the time of the study. This age bracket was based on the fact that 16 is the minimum school leaving age in the United States (Oreopoulos, 2009) and 75 is the NSDUH maximum survey age (RTI

International, 2012). However, in order to eliminate the issue of possible extensions in terms of late completion of high school, the study is delimited to respondents who fall within the age range 25-75 years as at the period of the survey. The study would have been further delimited by such data analysis techniques as correlation given the fact that correlation does not prove causation. In this regard however, the logistic regression carried out subsequent to the correlation analyses circumvented this limitation.

Definition of Terms

The following are definitions taken from the codebook to the dataset as well as from the literature.

A drink: A drink is defined by SAMHSA (2009) as a can or bottle of beer, a glass of wine, a wine cooler, a mixed drink with liquor in it, or a shot of liquor.

Alcohol: Alcohol has been called many names including ethyl alcohol, grain alcohol, and ethanol (the Dictionary, 1997). Ethanol, described as colorless, volatile, and flammable, C_2H_5OH , is the byproduct of carbohydrates fermented with yeast and consumed in beverages (the Dictionary, 1997).

Alcohol abuse: A respondent in the NSDUH 2010 survey was required to meet one or more of the set of alcohol abuse criteria listed below within the past year to be considered as having alcohol use disorder (alcohol abuse). (1) Serious problems at home, work, or school caused by using alcohol, such as a) neglecting their children, b) missing work or school, c) doing a poor job at work or school, and d) losing a job or dropping out of school; (2) Used alcohol regularly and then did something that might have put you in physical danger; (3) Use of alcohol caused you to do things that repeatedly got you in trouble with the law; and (4) Problems with

family or friends that were probably caused by using alcohol and continued to use alcohol even though you thought using alcohol caused these problems (SAMHSA, 2012).

Alcohol dependence (AD): Respondents to the questions that measured alcohol dependence must have met at least three out of seven criteria for determining alcohol dependence in order to be categorized as having alcohol dependence. The criteria included: (1) time spent obtaining, using, and recovering from the effects of drinking; (2) drinking frequency and inability to control quantity drank; (3) higher tolerance for alcohol; (4) lost control over the substance; (5) health problems have not deterred the person from alcohol consumption; (6) abandoned all other pursuits of life for alcohol; (7) at least two simultaneous occurrences of alcohol withdrawal symptoms twenty-four hours or longer in duration following reduction or cessation of use (SAMHSA, 2009).

Alcohol use disorders: Alcohol abuse and alcohol dependence (DSM-IV-TR, 2000).

Alcohol withdrawal symptoms: Criteria A and B alcohol withdrawal happen when withdrawal symptom follows either reduction in use or complete discontinuance of heavy and prolonged alcohol use. Two or more of the symptoms on the list of alcohol withdrawal symptoms must be present in order to correctly identify a case as an alcohol withdrawal case. The symptoms are: (1) Automatic hyperactivity (e.g., sweating or pulse rate greater than 100); (2) increased hand tremor; (3) insomnia; (4) psychomotor agitation; (5) anxiety; (6) nausea or vomiting; (7) and rarely, grand mal seizures or transient visual, tactile, or auditory hallucinations or illusions (DSM-IV-TR, 2000, p. 215). For Criterion C withdrawal, a person's symptoms must not have been caused by other medical or general conditions; for example, use of sedative, hypnotic, or anxiolytic withdrawal or generalized anxiety disorder (DSM-IV-TR, Criterion D, p.

215). A person's symptoms must have caused him or her substantial distress and functional disruption that warranted clinical diagnosis (DSM-IV-TR, 2000).

Any mental illness (AMI): Based on the data set, AMI is defined among adults currently having or at any time in the past year having had a diagnosable mental, behavioral, or emotional disorder (excluding developmental and substance use disorders) of sufficient duration to meet diagnostic criteria specified within the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 1994). Adults who had a diagnosable mental, behavioral, or emotional disorder in the past year, regardless of their level of functional impairment, were defined as having AMI (SAMHSA, 2012).

Binge drinking (use): Five or more drinks on the same occasion (i.e., at the same time or within a couple of hours of each other) on at least 1 day in the past 30 days (SAMHSA, 2009).

CADAPEA: Concomitant Alcohol Dependence and Poor Educational Attainment.

CLAD: Currently Legal Age Drinking or currently legal age drinker.

CUD: Currently Underage Drinking or currently underage drinker.

Excessive drinking: The CDC (2011) described excessive drinking as drinking that exposes the drinker and others to such risks as death, chronic diseases, and injuries. This category of drinking includes binge and heavy drinking, underage drinking, and drinking while pregnant, among others (CDC, 2011).

Hazardous drinking: Recurrent use of alcohol in physically dangerous situations, e.g., while driving, operating a machinery (Proudfoot, Baillie, & Teeson, 2006).

Heavy drinking: Drinking five or more servings of alcoholic beverages on the same occasion on each of 5 or more days in the past 30 days (SAMHSA, 2009).

Human capital: According to Walker (2012), Baker and Mincer "... defined human capital narrowly, essentially as years of schooling" (para. 3). Furthermore, Becker (2008) defined human capital as the expenditures (investments) people make on education, training, medical care, and so on toward future career goals.

Human capital acquisition: The attainment of academic and other training (in preparation for work) "as a productive investment in human capital" (Olaniyan & Okemakinde, 2008, p. 158).

Human capital theory: Human capital theory is a concept which proposes that higher education is an investment that equips the individual for higher productivity with the desired outcome being that employers would recognize and reward the individual accordingly (van der Merwe, 2010).

Mental health impairments: For the purposes of this study, the term mental health impairments is defined as alcohol use disorders (alcohol abuse and alcohol dependence), depression (major depressive episodes), suicidal ideations, serious mental illness, any mental illness, delinquent behaviours characteristic of mental health impairments (Loy, 2009; SAMHSA, 2012).

Neurological disorders: These are diseases that occur in the central and peripheral nervous systems from the spinal cord to the brain, cranial and peripheral nerves, nerve roots, autonomic nervous system, neuromuscular junction, and muscles (World Health Organization (WHO) Expert Committee on Problems Related to Alcohol Consumption, 2007).

PEA: Poor educational attainment, defined for the purpose of this study as having less than high school education.

School leaving age: This is the minimum age at which a student can legally opt to leave school. In the United States, “the compulsory school leaving age restricts the minimum length of time students must spend in school before having the legal option to leave” (Oreopoulos, 2009). The minimum school leaving age in some states of the United States is 16 years of age (Oreopoulos, 2009).

Serious mental illness: The Substance Abuse and Mental Health Services Administration, (2009) defined serious mental illness as symptomatic of persons aged 18 or older who currently or at any time in the past year have had a diagnosable mental, behavioral, or emotional disorder (excluding developmental and substance use disorders) of sufficient duration to meet diagnostic criteria specified within DSM-IV (APA, 1994). These symptoms must have also resulted in severe impaired functioning that limited one or more major life activities (SAMHSA, 2011).

Underage drinker: For the purpose of this study, the term underage drinker is used to describe anyone under the legal drinking age of 21 who consumes alcoholic beverages.

Underage drinking: Any consumption of alcoholic drinks before the legal drinking age of 21 (APIS, 2010).

Underage drinking history (UDHISTORY): The major predictor variable in the study. Respondents in the study are those who reported having a history of underage drinking.

Youth: Youth as used in this study refers to children, adolescents, and young people under the age of 21 (U. S. Department of Health and Human Services, 2007).

CHAPTER 2

LITERATURE REVIEW

Introduction

In this chapter, a review of the literature is presented beginning with a look at alcohol consumption in general. Benefits of drinking as well as problems associated with excessive drinking, alcoholism or alcohol use disorders (AUDs) are explored. The literature on underage drinking (UD) is reviewed, specifically looking at the statistics, prevalence, and current issues and concerns. The literature on alcohol dependence (AD) and its prevalence, current issues, and concerns over AD are discussed. What constitutes poor educational attainment (PEA) is investigated and the prevalence of PEA among persons who have a history of UD is noted. Whether there are any relationships between UD and AD, UD and PEA, and UD and the unique case of concomitant AD and PEA are also explored. The effects of demographic variables (such as gender, race/ethnicity) on UD's ability to predict AD, PEA, and concomitant AD and PEA are noted and reported. The chapter summary highlights critical issues in the literature including summaries and conclusions of select studies and recommendations of the authors reviewed, as well as implications for rehabilitation.

Alcohol consumption in general. Known commonly as alcohol, the intoxicating substance in alcoholic beverages has other labels including ethanol, ethyl alcohol, and grain alcohol among others (Joesten, Hogg, & Castellion, 2006; Medical-dictionary [n.d.]; Random House Webster's College Dictionary, 1997). The chemical compound described as C_2H_5OH , flammable, volatile, and colorless, is obtained through the fermentation of carbohydrates with yeast and is consumed in beverages globally referred to as alcohol, alcoholic beverages, or drinks (Joesten et al., 2006; Zakhari, 2005), and the level of alcohol content, targeted consumer groups,

brand names and trademarks symbols differentiate the types, methods and avenues of consumption.

Purportedly the enjoyment of alcoholic beverages has been a part of western civilization dating back to prehistoric times (Dudley, 2005; Measham, 2008; The Economist, 2001; Zakhari, 2005). Zakhari (2005) noted that ethanol, as a chemical, has existed from the beginning of history and most likely has been misused starting from about the same time. Dudley (2005) as well as Measham (2008) traced alcohol use and alcoholism to the medieval era. Dudley (2004) cited reviews of the literature on human use of ethanol from the Paleolithic period when farming and the making of wines and brewing of beer may have begun. Winemaking, brewing, and consuming alcoholic beverages have all been parts of American culture right from the start of the country (Hanson, 2013). Hanson (2013) cited work, which suggested that apples were initially introduced in the U.S. by John Chapman, (nicknamed Johnny Appleseed) for the purpose of making alcoholic cider. History and presence notwithstanding, alcohol has also been a controversial commodity and beverage in the country (Musto, 1996).

Concerns over excessive drinking have been the focus of societal actions and proposals for change from the beginnings of the country as well (Hester & Miller, 2003; Peel, 1993; The Temperance Movement, 2013; Thombs, 2006). According to Musto (1996), American society has gone through turbulent criminal and political periods over the issue and substance of alcohol manufacturing and consumption. From the waves of temperance and the prohibition movements of the 19th and 20th centuries to laws and public health efforts today, the arguments for and against alcoholic beverages consumption have been vigorous (Peel, 1993; The Temperance Movement, 2013).

Despite alcohol's history and reputation in the United States, drinking, alcohol abuse and alcohol dependence are widespread in the U.S. today (Hester & Miller, 2003; Schuckit, 2000; Thombs, 2006). The National Institute of Health (NIH) (2005) reported that alcohol consumption has been part of American lifestyle since the inception of the country. For decades, concerns have been raised about alcohol consumption, especially with regards to the quantities consumed by individuals on single occasions (Fellbaum, 1998; Lewis, 1956; Martinic & Measham, 2008; Measham, 2008; Miller, 1995).

As more is known about alcohol's interactions with the body and specific correlations between alcohol and certain ailments are discovered, universal attention has been focused on alcohol use in general as well as on such particulars as the demographics regarding who consumes it, how much, in what pattern, and for how long (Compton, Thomas, Stinson, & Grant, 2007; Fellbaum, 1998; Lewis, 1956; Martinic & Measham, 2008; Measham, 2008; Miller, 1995). Compton et al. (2007) analyzed two national surveys (the National Longitudinal Alcohol Epidemiologic Survey and the National Epidemiologic Survey on Alcohol and Related Conditions [NESARC]) conducted a decade apart and reported that the 12-month prevalence rates for adult alcohol abuse and dependence rose from 7.41% in the early 1990s to 8.46% ten years later. In another study using the National Comorbidity Survey Replication (NCS-R) conducted in the early 2000s on adults aged 18 years and older, Compton et al., (2007) found a 12-month abuse and dependence prevalence rate of 3.1% and a lifetime prevalence rate of 13.2%. The sample size for NCS-R survey was 5,692 (Compton et al., 2007). According to Compton et al. (2007), rate differences between NCS-R and NESARC could have been as a result of the differences in survey methodologies and definitions. However, it is clear that the

use, misuse, abuse of, and dependence on alcohol present considerable challenges for health care and other socioeconomic systems (Compton et al., 2007).

Studies of alcohol in the past decade and beyond (see for example, Bachman et al., 1997, 2008; CDC, 2011; Cook & Moore, 1993; Compton et al., 2007; Grant et al., 2006; Grant & Dawson, 1997; Koch & Ribar, 2001; Renna, 2007) have looked into issues of excessive alcohol consumption, heavy and binge drinking, alcohol abuse and dependence (alcoholism) in the general population. Roughly two-thirds of the adult population 18 years of age or older reported that they had at least one drink in the previous year. Sixteen percent of the same population reported averaging more than one drink per day, which falls into the category of heavy drinking for women. For men of legal drinking age, the limit for heavy drinking is two or more drinks a day (Glenn, Huber, Keferl, Wright-Bell, & Lane, 2010; Schuckit, 2000). In an updated analysis of the 2002 National Survey of Drug Use and Health, the United States Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention (OJJDP) (2012) found that close to half of the adult population in the survey (46%) reported not drinking at all. Thirty-one percent reported that they were drinking moderately (OJJDP, 2012). The bulk of excessive, heavy, binge, and hazardous drinking is done by a smaller percentage of adult drinkers together with underage drinkers whose alcohol consumption has become a serious health concern (CDC, 2010; NIAAA, 2006; Report to Congress on the Prevention and Reduction of Underage Drinking 2011, [2011, May]; U.S. Department of Health and Human Services [DHHS], Office of the Surgeon General, 2007).

Positive effects of alcoholic beverages consumption. From all accounts, it seems safe to conclude that alcohol consumption has not always resulted in negative outcomes for all who drink. Some studies and reports concluded that there are positive health outcomes from drinking

small to moderate quantities of alcohol (Coate, 1993; Harvard University School of Public Health, 2014; Jackson, Scragg, & Beaglehole, 1991; Klatsky, Armstrong, & Friedman, 1990; Kloner & Rezkalla, 2007; Konnopka & König, 2009; Lipton, 1994; Peel, 1993; Mukamal et al., 2003). These authors reported positive correlations between drinking small to moderate quantities of alcohol with reduced coronary heart disease, and concluded that there were lowered risks of coronary heart disease and heart attacks resulting in improved quality of life for the individuals. Konnopka and König (2009) further supported the positive health outcomes theory with a study of the health and economic consequences of moderate alcohol consumption in Germany 2002.

The purpose of the Germany 2002 study was to establish both the negative and positive effects of moderate drinking on mortality, years of potential life (YPL), quality-adjusted life-years (QALYs), and public costs. The researchers reached mixed conclusions with the findings that the elderly realized a positive effect of moderate drinking in terms of gained lives, YPL, and QALYs, however, the cost of moderate alcohol consumption on society increased overall. Konnopka and König (2009) concluded that there are still inherent risks to moderate drinking especially by underage drinkers.

Similarly, Mukamal et al. (2003) studied 38,077 male health professionals 40 to 75 years old with neither cardiovascular disease nor cancer at base line, over a period of 12 years. Mukamal et al. (2003) wanted to find out whether there is a relationship between drinking and myocardial infarction and whether frequency and type of drink (beer, red wine, white wine, and liquor) played any part in the outcome. Mukamal et al. (2003) concluded that, with moderate increase in quantity of alcohol consumed, some men realized a lowered risk of myocardial infarction regardless of type of alcohol consumed and whether or not taken with a meal. Harvard

University School of Public Health (2014) in *The Nutrition Source*, a website by the school, discussed the “shifting benefits and risks” of moderate use of alcohol including research findings that moderate drinking can be beneficial for some individuals from around middle age and older. However, the benefits are said to be predominantly for males who do not have the disposition to become alcohol dependent. For females, the benefits are not as clear cut.

Others (MacDonald & Shields, 2001; Peele & Brodsky, 2000), took the positive effects of moderate drinking concept further to include socioeconomic advantages. For example, Peele and Brodsky (2000) are of the opinion that moderate drinking reduces stress, increases relaxation and a person’s inclination to be sociable. MacDonald and Shields (2001) concur with Peel and Brodsky’s (2000) opinion, adding that collegial sharing of drinks outside working hours can prove to be positive for a young team member who is seen by his superiors as motivated, committed, and networking when engaged in this behavior. Overall, researchers of alcohol and drinking caution the drinker against potential risks that in some cases could outweigh the benefits (Harvard University School of Public Health, 2014; Konnopka & König, 2009; Mukamal et al., 2003).

Knowing what constitutes a drink for the many types and categories of alcoholic concentrations in drinks is necessary for a good understanding of moderate and excessive or problematic drinking. The colloquial drink, according to SAMHSA (2008), describes the act of frequent consumption of alcoholic beverages and perhaps in large quantities or too frequently. Several authors and entities (CDC, 2013; Dufour, 1999; ICAP, 2012; NIAAA, 2005; SAMHSA, 2009) have used the expression *a drink* to convey the concept of a unit of measure per serving of alcoholic beverages. The established measurement for a standard drink is as follows: A 12 ounce can or bottle of beer or wine cooler; an eight to nine ounce glass of malt liquor; a five

ounce glass of table wine; and a shot (one and a half ounces) of 80-proof spirits also referred to as (hard liquor – whisky, gin, rum, vodka, tequila, and so on) (CDC, 2013; Dufour, 1999; ICAP, 2012; NIAAA, 2005; SAMHSA, 2009). The alcohol content of different types and quantities of drinks listed above are about five percent in one drink of beer or wine cooler, about seven percent in malt liquor, about twelve percent in a glass of wine, and about forty percent in a shot of 80-proof spirits (Dufour, 1999; ICAP, 2012; NIAAA, 2005; SAMHSA, 2009). Even when units of measure are different as is the case in parts of Europe, these standards are approximately uniform (Williamson, Sham, & Ball, 2002). With the establishment of standards and measurements, excessive, binge, risky/hazardous, and other forms of problem drinking are easier to assess.

Problem drinking and negative effects of alcohol consumption. With established serving sizes, prescribed number of drinks per drinking occasion informs the drinker or assessor when the individual is drinking in excess (Batty, Lewars, Emslie, Gale, & Hunt, 2009). Approximately two drinks for men and one for women a day are considered moderate drinking levels which have been established as healthy for some (CDC, 2013; SAMHSA, 2009). For many decades, problem drinking has been labeled and presented from different perspectives including health, economics, psychosocial, behavioral, and civil or criminal justice views (Fellbaum, 1998; Lewis, 1956; Martinic & Measham, 2008; Measham, 2008; Miller, 1995). An example is Lewis' (1956) use of the term alcoholism to describe what he called excessive drinking as he lamented the scope of its destructive consequences. In her article *A History of Intoxication: Changing Attitudes to Drunkenness and Excess in the United Kingdom*, Measham (2008) discussed current societal actions and reactions to drinking and drunkenness as mixed – promoting these actions on the one hand, while proscribing them on the other. Measham cited

Rudgley's (1993) view that modern Western society's approach to drinking and the quantity consumed is far too indulgent and meaningless. In other words, people in modern societies drink for no good reason beyond self pleasure compared to older societies when people drank to intoxication during marked ceremonies and occasions only.

Martinic and Measham (2008) described problem drinking by youth as "extreme drinking" that goes beyond intoxication or heavy drinking and is more than mere drunkenness (p. 8). Other researchers (Brown & Tapert, 2004; CDC, 2010; Johnston, O'Malley, & Bachman, 2010; Staff et al., 2008) point out various negative outcomes of drinking in excess including diseases and other health complications, neurological damages and resultant cognitive deficits, educational and vocational implications. Patussi et al. (2005) concluded that alcohol use is the main cause of problems in the workplace, noting that drinking alone is responsible for more than 95% of the productivity loss American business sustains annually to the tune of over 80 billion dollars. Alcohol use disorders are prevalent in the United States despite the historical mixed feelings and differing conceptions of alcohol and alcoholism among mental health and other treatment professionals, law enforcement, and the general public (Hester & Miller, 2003; Schuckit, 2000; Thombs, 2006).

While alcohol is a social drink associated with both formal and informal celebrations and, in the case of the youth and young adults, excitement and "an expectation of pleasure," (Martinic & Measham, 2008, p. 2), the negative consequences (impaired-driving crashes, alcohol poisoning, brain injury, behavioral and other social problems, mental impairments, and death) are no longer accepted as normal parts of life (Hingson, Martinic & Measham, 2008; McCusker et al., 2002; Medina et al., 2008; NIAAA, 2006; OJJDP, 2012; SAMHSA, 2009; Schuckit, 2000). In the report *Drinking in America: Myths, Realities, and Prevention Policy*, the

OJJDP reported that “more than 75,000 deaths are attributable to alcohol consumption each year” (OJJDP, 2006, p. 1).

Approximately 79,000 deaths in the United States each year result from excessive alcohol use, according to the (CDC, 2010). The CDC also reported 2.3 million years of potential life lost (YPLL) annually, about 30 lost years for each death are consequential to excessive drinking. The CDC states that excessive drinking was responsible for almost two million hospitalizations and millions of emergency room visits in 2005, ranking it third among leading lifestyle-related causes of death in the country. Goldman et al. (2006) used the disability adjusted life years (DALYs) to measure the effects of alcohol consumption on lifespan in comparison to other substances of abuse and terminal diseases. The authors found that “On a population basis, alcoholism alone subtracts an average of 4.2 DALYs per person” (p. 401). By the same token, hazardous or harmful drinking was blamed for the majority of serious injuries, which sometimes led to death, emergency room visits, and hospitalizations in both the United States and Great Britain (McCusker et al., 2002; Schuckit, 2000).

The NIAAA (2004) reported that heavy drinking can cause minor, temporary symptoms of brain injury as well as permanent damages that last the rest of the individual’s lifetime. Wernicke-Korsakoff Syndrome was an example given of conditions that render the individual incapable of self-care and which can be a direct effect of alcohol use. People who have Wernicke’s encephalopathy may experience mental disorientation, paralyzed eye nerves that impede and alter eye movement, and inability to walk. Wernicke’s encephalopathy patients almost always develop Korsakoff’s psychosis as well (New York, Office of Alcoholism and Substance Abuse Services, 2009; Mumenthaler & Mattle, 2006).

Characterizations and Prevalence of Underage Drinking

Underage drinking, which is defined as any consumption of alcoholic drinks before the legal drinking age of 21 (APIS, 2010), has been a societal concern for decades. For decades as well, efforts have been made to curb if not totally stop underage drinking in the United States (Johnston et al., 2011; Komro & Toomey, 2002). Despite the efforts, early onset, heavy, and hazardous drinking continues to escalate (Yeide, 2009). Underage drinking has considerable implications beyond the moral, behavioral, and physical health problems often cited as reasons for prevention efforts. In a report on binge drinking, the Child Trends Data Bank (2010) concluded that alcohol use among youth has been associated with a wide variety of risky behaviors and poor outcomes – greater chances of alcohol use disorders in adulthood, neurological disorders, and initiation of use of and dependence on illicit drugs. A literature review on relevant characterizations of underage drinking is provided below. In addition, various accounts of general prevalence of the underage drinking phenomenon are provided before discussing the demographic factors affecting underage drinking.

Age at onset of drinking. According to the last updated ICAP (August 2013) table, the average international minimum age to legally purchase and consume alcoholic beverages on or off premises is 18 years, with the lowest and uppermost limits being 16 and 21 respectively. The WHO (2004) defined on-premises purchase and consumption as those that happen in such places as bars, pubs, cafes and restaurants. Off-premise purchases generally are made at wine shops, supermarkets, gas stations, and grocery stores (WHO, 2004). The United States is among ten countries in the uppermost limits with a minimum legal age of 21 years for both on- and off-premises purchase and consumption of alcoholic beverages (ICAP, 2013). Despite the established legal drinking age and guidelines for purchasing and handling alcohol underage

exposure to alcohol and underage drinking is a currently societal concern in the United States and globally (ICAP, 2013; Johnston, O'Malley, Bachmann, & Schulenberg, 2013; WHO, 2004).

Though the prevalence rate is said to have declined in the United States over the past couple of decades, UD remains an urgent concern (Johnston et al., 2013) with age of onset of heavy and binge drinking getting younger, and hazardous drinking becoming more common than ever before (CDC, 2010; McCusker et al., 2002; SAMHSA, 2009; Schuckit, 2000). For example, SAMHSA (2012), in *Results from the 2008 National Survey on Drug Use and Health: National Findings*, reported that up to 26% of 12 to 20 year old youths said they had been drinking alcoholic beverages within one month of the survey, with approximately 17% of those practicing binge drinking and about 6% of the same population engaged in heavy drinking. National Institute on Alcohol Abuse and Alcoholism (2006) reported that UD is no longer limited to college students in fraternity houses and at football games, but starts much earlier as children start to experiment with alcohol much younger these days. In a 2007 call for action against underage drinking, then Surgeon General Kenneth Moritsugu identified alcohol as the substance most abused by American youth, and noted that adolescents and older youths aged 12 to 20 favored drinking over tobacco and illicit drugs use.

Several factors associated with early onset drinking make it a present, urgent concern (Dewit, Adlaf, Offord, & Ogborne, 2000; Hingson, Heeren, & Winter, 2006; Kuperman, Chan, & Kramer, 2005). Early onset drinking, which is defined as drinking before the age of 14 (Donovan & Molina, 2011) or 15 (Dewit et al., 2000) affects the adolescent's development academically, behaviorally, socially, and increases their chances of lifetime alcohol dependence (Dewit et al., 2000, Donovan & Molina, 2011, Hingson, Heeren, Zakocs, 2001). Donovan and Molina (2011) concluded that starting drinking prior to 14 years of age invariably leads to

adolescence delinquency and other negative adolescent behaviors. Behavior problems could result in such irrational behaviors as driving while drunk or riding in a car with a drunk driver, fighting, or engaging in other activities with adverse consequences, which could result in sustaining permanent injuries such as traumatic brain injury and other forms of permanent disabilities (CDC, 2004; Donovan & Molina, 2011; Hingson, Heeren, Levenson, Jamanka, & Voas, 2002; Hingson, Heeren, Jamanka, Howland, 2000). Other researchers (De Bellis et al., 2000) reported neurological, psychological, and mental health implications of early onset drinking.

A recent SAMHSA report based on the National Survey on Drug Use and Health (NSDUH) points out that individuals who begin drinking alcohol before the age of 15 are up to seven times more likely to develop problems associated with alcohol use than those who start drinking after the legal age of 21 (SAMHSA, 2013; National Clearing House for Alcohol and Drug Information, 2010). Another report on the SAMHSA Health Information Network [SHIN] (2008) cited Moritsugu's (2007) assertion that research has shown that adolescents who start drinking before their 15th birthday risk increasing the likelihood of developing alcohol-related problems as they grow up, based on new research which suggest that alcohol may be harmful to the yet developing young brain (NIH, 2007). A 2007 report by the NIH based on the National Epidemiologic Survey on Alcohol and Related Conditions found that underage drinking is associated with alcohol dependence in the future, and that youths who start drinking prior to their 15th birthday are four times more likely to develop alcohol dependence during their lifetime than those who start drinking at age 21.

Factors influencing underage drinking

Policy makers and researchers alike have explored the issue of underage drinking and have sought to find out why adolescents drink, looking at race/ethnicity including genes (Burk et al., 2011; CAMY, 2014; Pemberton, Colliver, Robbins, & Gfroerer, 2008; Sigman, 2011; “Teenage Drinking,” [n.d.]; Wills et al., 2001; Yeh, Chiang, & Huang, 2006), gender (Bonnie & O’Connell, 2004; Borsari, Murphy, & Barnett, 2007; Farmer Huselid & Cooper, 1992; Hoffmann, 2006; Lewis, 2007; Pemberton et al., 2008; Schulte, Ramo, & Brown, 2009; Yeh et al., 2006), and family and environmental influences (Bonnie & O’Connell, 2004; Donovan, 2004; Masten, Faden, Zucker, & Spear, 2009; Pemberton et al., 2008; Wiles et al., 2007; Wills et al., 2001; Zucker, 2006). Flewelling, Pascall and Ringwalt (2004) suggest that reliable data on factors that influence underage drinking including demographic factors, incidence of use and other helpful information are critical in determining needs and planning for intervention. Flewelling et al. (2004) caution that demographic tendencies are not to be considered for causation purposes but should be used only for guiding effective treatment and intervention.

Race/ethnicity. Much of the literature discussed age of initial experimenting, race and ethnicity, genetics, mental health statuses, personality traits, family and peer influence, and gender (Borsari et al., 2007; CAMY, 2014; Pemberton et al., 2008; “Teenage Drinking,” [n.d.]; Wills et al., 2001; Yeh et al., 2006). For example, in the “Teenage Drinking” (n.d.) article, reference is made that individuals of American Indian and Native Alaskan racial/ethnic groups have a higher tendency to develop alcohol dependence than members of other racial/ethnic groups. Genetic predisposition influences are said to quadruple the risk of underage drinking for the youth (“Teenage Drinking,” n.d.). Sigman (2011) presents the view on genetic influence from yet another angle – biosciences and medicine. Citing what he refers to as a *new generation*

of evidence gathered from both medical and other branches of the sciences including neurophysiology, genetics, neuropharmacology, molecular neurobiology, forensic pathology, toxicology, hepatology, teratology, epidemiology and developmental psychobiology, Sigman (2011) suggests the fact that the adolescent brain is not mature until about the age of 25, and as such, the yet growing brain is susceptible to alcohol's neurophysiological, brain-altering effects from early onset of drinking. Borsari et al. (2007) found that racial/ethnic identity played a role in not only whether first year college students drank, but also on the volume and frequency of drinking. Wechsler, Lee, Nelson, and Kuo (2002) reported that underage college student did not drink as often as their older colleagues but drank excessively when they did drink.

The Center on Alcohol Marketing and Youth (CAMY), Bloomberg School of Public Health, Johns Hopkins University (2014) reported that among people who drink in the general population, average age of drinking initiation has been dropping. According to CAMY (2014), in 1965, the average age of initiation of alcohol consumption across all age groups was 17.6 years. By 1999 the average had dropped to 15.9 years; and for youth 12-20 years of age, the average age of initiation in 2000 was 14 years CAMY, 2014. In the same report, statistics are given of the prevalence of drinking initiation by race which indicates that 33.7%, 28.4%, and 28.2% of Latino, White, and African American youths respectively initiated drinking before their 13th birthdays (CAMY, 2014). For 12-20 years old, the race/ethnicity data indicates that youths reported heavy drinking as follows: 21.4 percent for White, 20.3 percent for American Indians and Alaskan Natives, 17.2 percent for Latinos, 10.3 percent for African Americans, and 7.9 percent for Asian Americans.

Based on findings of the 2002-2006 National Surveys on Drug Use and Health, Pemberton et al. (2008) report findings of demographic differences similar to those reported by

CAMY (2014). Pemberton et al. (2008) compared non-Hispanic Whites to Blacks or Asians and found that 7.5 percent White compared to 4.7 Black and 3.2 percent Asian adolescents 12 to 14 years of age had higher incidences of binge and heavy drinking as well as current drinking.

When viewed among all races, White youths are second to American Indians or Alaska Natives with 8.1 percent prevalence rate, while the reported rate for Hispanics is 4.3 percent (Pemberton et al., 2008). The trend was similar for 15 to 17 year and the 18 to 20 year old groups within which White youths continued to lead in binge drinking, heavy drinking, and current drinking with the only notable difference among youth of mixed racial backgrounds (Pemberton et al., 2008).

In a combined race, gender and age comparison, CAMY (2014) noted no difference in reported alcohol consumptions of girls 12 to 14 years across three ethnic groups (Hispanic, Non-Hispanic White, and African American), within ethnic group gender differences whereby girls reported higher rates of past 30 days alcohol consumption, and Hispanic girls reporting the highest rate. Assessment of heavy drinking showed that non-Hispanic white males between the ages of 18 and 20 rated higher at 13 percent than non-Hispanic females of the same age cohort (CAMY, 2014). For Hispanic and African American males, the rates are 14.9 percent and 8.9 percent higher prevalence rates than females respectively. Similarly, senior high-school-aged males were reported to have consumed more beer (one-half) than their female counterparts (one-third) within 30 days of the survey (CAMY, 2014).

Gender. Yeh et al. (2006) found reasonable differences between boys and girls as to the types of relationships that had reasonable effects on their attitudes towards drinking. According to Yeh et al. (2006), normal peer relationships encouraged girls more so than boys to drink. For boys, the greatest factors were the desire to feel defiant and to be seen or known as the deviant

male (Yeh et al., 2006). Furthermore, Bonnie and O'Connell (2004) found differences in adolescent males and females in the perceptions of the advantages and disadvantages of drinking. According to Bonnie and O'Connell (2004), males see higher numbers of drinking occasions as favorable given positive relational outcomes while for women, the primary purpose of alcohol use is psychotherapy. Similarly, Pemberton et al. (2008) reported that underage drinkers drink larger quantities per drinking occasion noting that up to 92% of underage drinking (specifically by 12-14 year olds) is binge drinking with the males consuming five to nine drinks and females reporting up to 4 drinks. Schulte et al., (2009) found no statistically significant differences between males and females generally, but noted socio-physiological differences in terms of maturation rate, alcohol expectancies, and gender role perceptions. Borsari et al., (2007) as well as Hoffmann (2006) concurred on the physiological differences, and reported that dissimilarities in male and female physiques are a major variance as well as reason for drinking.

Family and environment. Masten et al. (2008) suggest that alcohol use and alcohol use disorders can be predicted at a young age. According to Masten et al. (2008) underage drinking risk factors are: familial – with family influences ranging from a history of family use and abuse of alcohol to one or both parents' psychosocial disposition and behavior. For example, parental depression, poor parenting, antisocial behavior, child neglect and/or maltreatment, among others, had an impact on whether or not the adolescent initiated and/or continued drinking (Masten et al., 2008). In addition, prenatal exposure to alcohol, poor self-regulation, antisocial and risk-taking behavior, learning disabilities, attention and self-control difficulties, impulsivity, and smoking were also factors (Masten et al., 2008).

Bonnie and O'Connell (2004) focused on developmental and environmental factors including the fact that the adolescent stage of life is a period of changes marked by a quest for

autonomy. The authors identify underage drinking as a form of risk taking that is part of this stage in the lifespan. Bonnie and O'Connell (2004) also highlighted the impact of early and late puberty and the corresponding appearances of physical maturation or the lack thereof that can be deceiving to both the youth and those around them. Newman and Newman (2003) highlight these changes in early adolescence and provide a framework from which to understand them better. For example, while early maturing girls experience psychological difficulties that could lead them to drinking, for boys, late maturation is the challenge (Bonnie & O'Connell, 2004). From the cognitive and psychosocial development perspective, several researchers (Bonnie & O'Connell, 2004; Donovan, 2004; Newman & Newman, 2003; Wills et al., 2001; Zucker, 2006) pointed out two major psychosocial developmental processes that though positive, can also markedly work against the adolescent in terms of the decision to commence alcohol use. First are the issues of the adolescents' need for peer conformity and at the same time susceptibility to peer pressure; and, the second is the fact that this is also the stage when they strive to gain autonomy from their parents (Bonnie & O'Connell, 2004; Donovan, 2004; Newman & Newman, 2003; Wills et al., 2001; Zucker, 2006).

Prevalence of underage drinking. Several studies of underage drinking have reported mental health, neurological, socioeconomic, civil and behavioral problems associated with the habit, yet underage drinking remains highly prevalent today as it has been for nearly two decades (CDC, 2010; Rhode et al., 1996; SAMHSA, 2010). As has been mentioned earlier, both scholarly and mainstream literature have presented numerous examinations of the phenomenon from health, civil, economic, and other perspectives (CDC, 2010; Grant & Dawson, 1997, Komro & Toomey, 2002; Martin & Winters, 1998). From a health perspective, research has shown that underage drinking can cause serious health problems including neurological and

mental health impairments (CDC, 2010; Martin & Winters, 1998; McGue, Iacono, Legrand, Malop Resne, & Elkins, 2001; Medina et al., 2008; Moritsugu, 2007; NIAAA, 2006; OASAS, 2009; Patussi et al., 2005; Roberts, Roberts, & Xing, 2007; Swahn, Bossarte, & Sullivent, 2008; (WHO, 2007). From civil and economic perspectives, underage drinking has been shown to be costly both to the individual adolescent and his or her family and to society in general (NIAAA, 2006; OASIS, 2009; OJJDP, 2006; Patussi et al., 2005; SAMHSA, 2009).

The Department of Health and Human Services (2006) enumerated health risks associated with underage drinking, presented statistics on underage drinking, and suggested reasons why adolescents drink. The NIAAA (2006) found that nearly half of adolescents in 8th grade have had at least one drink, over 20% reported that they have been drunk before, and nearly a third of 12th grade students engage in binge drinking. The CDC (2010) made similar observations noting that 12 to 20 year old youth favor alcohol over tobacco and illicit drugs and more often use and abuse alcohol than they do tobacco and illicit drugs. According to the CDC, 11% of all alcohol consumption in the United States is done by the 12 to 20 age group who, per drinking occasion, consume more drinks than the adults who drink.

The United States Department of Health and Human Services, Substance Abuse and Mental Health Services Administration (2012) reported that underage drinking was responsible for nearly half (45.2%) of the 189,060 drug-related visits to the emergency room in 2010. The NIAAA (2013) reported that close to 200,000 youth visited the emergency room in 2008 because of alcohol-related incidents. The NIAAA (2013) further reported that approximately 5,000 youths in the United States die each year from motor vehicle accidents, homicides, alcohol poisoning, falls, burns, drowning, and suicides due to underage drinking. These numbers are possible given the fact that 70% of youths reportedly had had at least one drink by age 18, with

over 10 million of those less than 20 years of age reporting having had alcoholic beverages in 2009 alone (NIAAA, n.d.). The implications of these statistics include the fact that early onset of drinking may result in both immediate and long-term impairments for the youth who drinks (Tapert et al., 2004/2005).

Underage drinking continues to be a public concern in the United States. According to the (CAMY, 2011), 4,750 adolescents not yet 16 years of age start drinking every day in the United States. In a fact sheet compiled from various sources, CAMY (2011) reported that among 12 to 17 year olds, 13 was the average age at which adolescents took their first drinks and 91% of the binge drinking (consuming five or more drinks on the same occasion or within two hours or each other on at least 1 day in the past 30 days [SAMHSA, 2009]) by adolescents was done by 12 to 14 year olds. The Center on Alcohol Marketing and Youth (2011) also reported that about 10 million or 26.3% of youth between the ages of 12 and 20 reported having had a drink within a month of the study. Within this group, approximately six and half million or 17.0% practiced binge drinking while two million or 5.1% drank heavily. Heavy drinking is defined as the consumption of five or more drinks on the same occasion five or more days in the past 30 days (SAMHSA, 2009).

Komro and Toomey's (2002) description of underage drinking as persistent with an accelerated rate of onset starting from age 10 to about age 13 was corroborated by CAMRY's (2011) report. The age range 12 to 14 years of age continues to be observed as a high risk period of both onset of drinking and hazardous drinking. In 2008, the WHO carried out a Global Survey on Alcohol and Health to assess the five-year trend of underage drinking. According to the WHO (2011) 73 countries participated in the study. Youth alcohol consumption had increased in 71% of the participating countries. Zhong and Schwartz (2009) raised the concern

that the recording of underage drinking as liquor law arrests, disorderly conduct, or drunkenness might distort evidence of the prevalence of underage drinking.

Immediate and long-term effects of underage drinking. Researchers (Colpe, Epstein, Barker, & Gfroerer, 2009; Grant et al., 2006; Grant & Dawson, 1997; Johnson, O'Malley, Bachman, & Schulenberg, 2010) have found that prolonged use of alcohol including underage drinking have lifelong effects on both physical and mental health. Moritsugu pointed out the physiological consequences of underage drinking ranging from disabling medical problems to death by alcohol poisoning, and indicated that alcohol consumption considerably influences suicide, among other negative consequences (U.S. Department of Health and Human Services [DHHS], Office of the Surgeon General, 2007).

Alcohol has been found to interfere with the yet developing central nervous system hence brain development (NIH, 2005; ICAP, 2005) of underage drinkers. Underage alcohol consumption has also been implicated in neurological damage that affect memory and cognition thereby interrupting academic and other adult life preparation processes the youth needs to achieve and pass through at this stage of life (Barr et al., 2004; CDC, 2010; Gilpin & Koob, 2008; NIAAA, 2009). Other implications of underage drinking include the fact that it has been associated with the initiation of use of other substances (Brown & Munson, 1987; Grant & Dawson, 1997). To the above list of difficulties likely to result from underage drinking, the NIAAA (2009) added excessive drinking in later adolescence and young adulthood and other behavioral and physical health problems in adulthood.

Some outcomes of underage drinking include heavy economic and civil burdens, physical, mental, and neurological health problems, disabilities, and death (Allen et al., 2011; CDC, 2010; Goldman et al., 2006; McCusker et al., 2002; OASIS, 2009; OJJDP, 2012; Schuckit,

2000). Youth alcohol consumption has been found to hinder normal development of the central nervous system (CNS), hence interfering with the yet growing youth's brain and causing neurological damage (Allen et al., 2011; CDC, 2010; De Bellis et al., 2000; Gilpin & Koob, 2008; Lovinger, 2008; NIAAA 2006; 2009). In turn, abnormal functioning of the CNS and brain growth together with the resultant negative neurological activities has effects on memory and cognition. Normal functioning of both the CNS and neurological processes are necessary for learning and for discerning appropriate and inappropriate behaviors towards self and others (Crews, et al., He & Hodges, 2007; DeSimone & Wolaver, 2005; Lovinger, 2008; NIAAA, 2005, 2009). Also, underage drinking has been implicated in the initiation of use of other drugs of abuse (Brown & Munson, 1987; Grant & Dawson, 1997).

The Drug Abuse Warning Network (The DAWN Report) (2011), reported that underage drinking was responsible for one third (36.2% or 157,624) of drug-related visits to the emergency room in 2005. There were more emergency room visits by underage drinkers in 2009 even though percentagewise, drinking related incidents were 2.2 percent lower in 2009 than in 2005 (The DAWN Report, 2011). Other statistics in the report include the share of 12 to 20 year-olds in alcohol only emergency room visits between 2005 and 2009. In 2005, 110,121 patients 12 to 20 years of age visited the emergency room as a result of alcohol only-related incidents, while 137,512 youth of the same age visited the emergency room on account of alcohol-related illnesses in 2009 (The DAWN Report, 2011).

The presence of alcohol in a young person's blood stream produces immediate effects that may render the youth mentally and physically incapacitated (Balodis, Potenza, & Olmstead, 2009; CDC, 2010; Goldman et al., 2006). In this impaired state of mind and body, the youth is exposed to the risk of hurting him- or herself and others unintentionally, being hurt without

recourse, being taken advantage of, or getting him- or herself killed (Grant & Dawson, 1997; Hiller-Sturmhöfel & Swartzwelder, 2005; ICAP, 2012; NIAAA, 2006; U.S. Department of Justice, Office of Juvenile Justice and Delinquency Prevention [OJJDP], 2006; Surgeon General, 2007). Recent studies have shown that high blood alcohol level (BAL) in the youth could lead to such immediate consequences as visual impairment, loss of motor coordination, and slowed reflexes (CDC, 2010; ICAP, 2012; Norberg et al., 2009; SAMHSA, 2012; Surgeon General, 2007). Other deficits reported by the same studies include cognitive deficits resulting in loss of memory, poor reasoning and judgment, lack of inhibition; psychological impairments such as confused state of mind or being, feeling edgy and nervous (fearful and yet eager); and numerous physical consequences in the form of queasiness, vomiting, heightened blood pressure, dropped heart rate, slowed breathing, coma, and possibly death. Earlier studies reported the same or similar findings including symptoms such as fainting spells, callousness, anger and irritability, and insomnia (Engs, Hanson & Diebold, 1997; Garcia, 2005; Harford, Wechsler, & Muthén, 2003; Hingson, Heeren, Zakocs, Kopstein & Wechsler, 2002; NIH, 2005; Schuckit, 2000).

According to Garcia (2005), from the time an individual's blood alcohol level (BAL) reaches approximately 0.03, the immediate physical, neurological, mental, and psychological reaction can be the same as the feeling of euphoria. Garcia (2005) also reports that in this state of mind, the drinker feels an exaggerated sense of well-being. Consequently, self-confidence rises and with it a feeling of invincibility – the notion that the person could do anything including activities that under normal circumstances he or she would not have considered appropriate or safe (Eaton, Davis, Barrios, Brener & Noonan, 2007; Eaton, et al., 2008; Garcia, 2005; ICAP, 2012). When intoxicated, an adolescent may engage in unsafe, unplanned sexual activities which

may result in exposure to the risk of contracting sexually transmitted diseases including HIV/AIDS (King, Nguyen, Kosterman, Bailey, Hawkins, 2012).

Intoxicated adolescents may also commit aggressive and other civil delinquent, disorderly acts, and use other substances of abuse they would not have used when sober (Donovan, 2004; Fergusson & Lynskey, 1996; Hingson & Zha, 2009; OJJDP, 2006; SAMHSA, 2010; Surgeon General, 2007). Additionally, an individual with a BAL of 0.03 and above may lose fine motor skills and experience shorter attention spans than normal (Eaton et al., 2007; Eaton et al., 2008; Garcia, 2005; ICAP, 2012). Other immediate risks associated with underage drinking stem from such threats to the drinker's health and well-being as alcohol poisoning and drowning (Hingson et al., 2002; NIH, 2005; NIAAA, 2009). Some of these negative corollaries may directly lead to death while some have subsequent life-changing, long-term effects that, more often than not, shape the individual's quality of life negatively (NIAAA, 2009; Schuckit, 2000).

Long-term consequences of underage drinking are as damaging and sometimes more profoundly harmful than some short-term effects (Hiller-Sturmhöfel & Swartzwelder, 2005; ICAP, 2012; OJJDP, 2006; NIAAA, 2009). While immediate outcomes of underage drinking (e.g., death or injuries) can be seen and reckoned with as they occur, delayed physical, neurological and mental ramifications of early onset drinking may endure for the lifetime (CDC, 2010; Gilpin & Koob, 2008; Foster et al., 2003; Hiller-Sturmhöfel & Swartzwelder, 2005; Hingson & Zha, 2009; ICAP, 2012; National Highway Traffic Safety Administration [NHTSA], 2001; Norberg et al., 2009; OJJDP, 2006; SAMHSA, 2011). Long-term effects of early onset drinking may also include subsequent outcomes such as unplanned pregnancies, contracting diseases such as HIV/AIDS and other sexually transmitted diseases which may complicate

adulthood (Galson, 2009; Hingson & Zha, 2009, Hingson, Heeren, Winter & Wechsler, 2003; King et al., 2012).

Lasting physical consequences of underage drinking of alcoholic beverages may include varying forms and levels of physical impairments including damage to the liver, the lungs, muscles, sexual organs, the heart, the brain, stomach, and esophagus (Hiller-Sturmhöfel & Swartzwelder, 2005; ICAP, 2012; Vaillant, 1996). Engs and Aldo-Benson (1995) suggested that heavy use of alcohol over time undermines the body's ability to fight viruses and bacteria that may cause infections. Health complications such as liver damage and cirrhosis of the liver – the end stage condition of the diseased liver after it has progressively developed scars – have been associated with prolonged alcohol use (Punnoose, Lynn, & Golub, 2012; Vaillant, 1996; Verrill, Markham, & Templeton et al., 2009). Cirrhosis of the liver is an end state liver disease that affects liver function (Punnoose et al., 2012). According to Phunnoose et al., (2012), cirrhosis of the liver may result from prolonged exposure and excessive use of alcohol.

Other long-term consequences of underage drinking may include experiences of sexual violence such as rape. The emotional, psychological, and cognitive ramifications of such a personal violation as rape for both the villain and the victim have been linked to social dysfunction (Balodis, Potenza, & Olmstead, 2009; Eaton et al., 2007; SAMHSA, 2010). Balodis, Potenza, and Olmstead (2009) in a discussion of social problems related to binge drinking among college students included unsafe sexual activities on the part of those drinking and “second-hand” consequences for even those students who do not drink including sexual harassment by their intoxicated colleagues (p. 2). Eaton et al. (2007) found a correlation between early onset drinking and dating violence among high school students. The United States Department of Health and Human Services (DHHS) and SAMHSA’s National Clearing House

for Alcohol and Drug Information (2010) listed “sexual and physical abuse” among the “dangers of underage drinking” (p. 2), and reported underage drinking as highly influential in risky sexual behavior among adolescents.

The NIAAA (2004) reported that heavy drinking can cause minor, temporary symptoms of brain injury as well as permanent damages that last the rest of the individual’s life time. Wernicke-Korsakoff Syndrome was an example given of conditions that render the individual incapable of self-care and which can be a direct effect of alcohol use. People who have Wernicke’s encephalopathy may experience mental disorientation, paralyzed eye nerves which impede and alter eye movement, and inability to walk (Thomson, Guerrini, & Marshall, 2009). Wernicke’s encephalopathy patients almost always develop Korsakoff’s psychosis as well (New York, Office of Alcoholism and Substance Abuse Services, 2009). Wernicke-Korsakoff syndrome, which is sometimes referred to as Korsakoff psychosis, alcoholic encephalopathy, encephalopathy – alcoholic, or Wernicke’s disease occurs in patients with brain damage due to vitamin B1 (thiamine) deficiency (MedlinePlus, 2014). Vitamin B1 deficiency is commonly experienced by individuals with alcohol dependency (Kumar, 2010).

Other researchers (Colpe, Epstein, Barker, & Gfroerer, 2009; Grant et al., 2006; Grant & Dawson, 1997; Johnson et al., 2010; Lewis, 1956) have found that prolonged use of alcohol including underage drinking have lifelong effects on both physical and mental health. Underage drinking has been linked to alcohol use disorders as well as other mental health impairments later in life (Grant et al., 2006; Roberts et al., 2007; Sacco, Bucholz, & Spitznagel, 2009). In a longitudinal study of 808 children first surveyed at the age of 10 and followed through to age 21, Guo, Collins, Hill, and Hawkins (2000) found that early onset use of alcohol correlated with alcohol use disorders at age 21. In other words, adolescents who started drinking in elementary

or middle school developed alcohol abuse and alcohol dependence before they reached the legal age of drinking. Close to half the number of people with alcohol use disorders are said to have acquired the disorder in their middle to late teen years and those with earlier onset of alcohol use disorders are more susceptible to pronounced alcohol-related difficulties as well as other mental health impairments (Martin & Winters, 1998). Johnson, Cloninger, Roache, Bordnick, and Ruiz (2000) tested the hypothesis that “age of onset represents a continuum of disease, and that greater severity of psychopathology is associated with lower ages of onset” (p. 17) on a sample made up of 253 male and female applicants for alcohol treatment stratified by age of onset. Johnson et al. (2000) found that participants with earlier ages of onset had more pathologies than those with later ages of onset.

Characterizations and Prevalence of Alcohol Dependence

Alcohol dependence (AD) is one of alcohol use disorders (AUDs) noted by the APA in the DSM-IV-TR as mental health impairments (APA, 2000). Sometimes referred to as alcoholism, excessive drinking, extreme drinking, substance dependence on alcohol, among other terms, alcohol dependence has been identified as a costly disorder that affects the entire body (CDC, 2013; Fellbaum, 1998; Gilpin & Koob, 2008; Johnson, 2010; Lewis, 1956; Measham, 2008; Martinic & Measham, 2008; Mayo Clinic, 2012; Miller, 1995; NIAAA, 2012; National Institute on Drug Abuse [NIDA], 2012).

By whatever name, alcohol dependence is medically recognized as a chronic disease that up until recently was known to last for the rest of the person’s life (NIAAA, 2007). According to the NIAAA (2007), an average episode of alcohol dependence can last three to four years and up to 70% or more of individuals with alcohol dependence experience an episode. Manifestations of alcohol dependence include an intense thirst for a drink that can be controlling and

unquenchable, inability to set and adhere to drinking limits, higher tolerance marked by need for increased consumptions to reach satisfaction, reaction to abrupt stop or decreased amount of drinking that leads to physical withdrawal symptoms including indigestion, sweating, shaking, and feelings of anxiety, and sometimes depression (APA, 2000; Bucknam, 2007; CDC, 2013; Mayo Clinic, 2012; NIAAA, 2007; Skinner & Allen, 1982). Enoch and Goldman (2002) identified alcohol dependence as a psychiatric disorder that often co-occurs with other psychiatric diseases and substances of abuse. According to Enoch and Goldman (2002), alcohol dependence can be inherited. Enoch and Goldman (2002) also found a prevalence rate of up to 14% and morbidity and mortality estimated at 100,000 annually.

Alcohol dependence has several ramifications for drinkers, people close to them, and the general public including loss of social favors, a major consequence of alcohol dependence (Skinner & Allen, 1982). According to Skinner and Allen (1982), increased drinking leads the individual to withdraw from both casual, friendly obligations and such critical engagements as treatment appointments. Alcoholism has been associated with direct violence (e.g., domestic violence, public fights, rapes, and other acts of violence), and indirect violence when the drinker drives drunk and causes motor vehicle accidents that hurt or kill others (Hingson et al., 2002a).

Prevalence of alcohol dependence. Majority of the statistics on alcohol dependence is reported as alcohol use disorder along with alcohol abuse, making it difficult to pinpoint the prevalence rates of alcohol dependence alone (see for example, Gilpin & Koob, 2008; Grant, 1997; Hasin, Stinson, Ogburn, & Grant, 2007; NIAAA, 2007). However, some studies have reported the prevalence of alcohol dependence from which a reasonable estimate can be obtained. For example, Hasin et al. (2007) employed the *2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions* to convey the findings of prevalence, correlates,

psychiatric comorbidity, and treatment of DSM-IV alcohol abuse and dependence in the United States. Hasin et al. (2007) found 12.5 % lifetime prevalence of alcohol dependence and 3.8% 12-month prevalence. Demographically, Hasin et al. (2007) reported finding men, Whites, Native Americans, younger singles and people who make less money to have statistically significant prevalence rates of alcohol dependence. Others (Enoch & Goldman, 2002; Grant, 1997; Knight et al., 2002; SAMHSA, 2004) have also reported similar prevalence rates of alcohol dependence by demography. Enoch and Goldman (2002) reported an estimated prevalence rate of up to 14% while Knight et al. (2002) based on a survey of 14,000 college students from 119 schools nationwide reported a 12-month prevalence rate of 6%.

According to SAMHSA (2012), based on the 2010 NSDUH, 17.9 million or 7.0 percent of the general population of youths and adults 12 years of age and older were identified as having alcohol abuse or dependence in 2010. In the same report, SAMHSA stated that the prevalence rate of alcohol dependence in 2010 was 7.7 percent lower than in 2002. The NIAAA (2007) estimated that 18 million people in the United States have alcohol use disorders – alcohol abuse and alcohol dependence.

Alcohol dependence as a mental health and disabling condition. Alcohol use disorders (AUDs) which include alcohol abuse and alcohol dependence meet the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision [DSM-IV-TR], 2000 criteria for mental health impairments (APA, 2000; Grant & Dawson, 1997; NIAAA, 2009). Alcohol abuse and alcohol dependence have been found to correlate with other mental health conditions such as major depressive episodes, suicidal ideation, serious mental illness, and psychological distress (Allen et al., 2011; Dawson et al., 2007; De Bellis et al., 2000; NIDA, 2010). Furthermore, AUDs are regarded as maladaptive behavior patterns with alcohol

consumption marked by symptoms that result in clinically noteworthy impairment or distress (Edwards, Gross, Keller, & Moser, 1976; Edwards, Li, & Lee, 2002; Swahn et al., 2008; Swendsen et al., 1998). These behaviors are also associated with numerous psychological, social, economic and health implications including psychiatric co-morbidity (Edwards et al., 1976; Swahn et al., 2008; Swendsen et al., 1998).

In a study of 171 male veterans with alcohol dependence in an alcohol treatment program, Schuckit, Irwin, and Brown (1990), a majority of the men reported anxiety symptoms associated with drinking or withdrawal from drinking. Schuckit et al. (1990) interviewed participants in person to be able to capture accurate accounts of anxiety symptoms and syndromes in the study participants. Many reported experiencing other symptoms such as palpitations and shortness of breath, and a smaller number reported having episodes of panic attacks with a couple of them reporting multiple panic attacks in a three-week period (Schuckit et al., 1990). Similarly, Swendsen et al. (1998) found that people who had alcohol use impairments (alcohol abuse and alcohol dependence) generally experienced two- to three-fold increased risk of anxiety and depressive disorders. Research on adolescents with AUDs found clinical syndromes including considering, planning, attempting, and completing suicide (SAMHSA, 2011, Tapert et al., 2001). Alcohol use among adolescents has been associated with considering, planning, attempting, and completing suicide (SAMHSA, 2011; Sher & Zalsman, 2005; Swahn et al., 2008; The Child Trends Data Bank report, 2010). For example, SAMHSA in the SHIN report presented the results of a study of 8th grade females who drank heavily. Thirty-seven percent of the students attempted suicide, compared to 11 percent of those who did not drink (SAMHSA, 2011).

Relationship between alcohol dependence and underage drinking. There is evidence linking early onset drinking to alcohol use disorders (AUDs) and specifically to alcohol dependence (Brown & Munson, 1987; Grant & Dawson, 1997; NIAAA, 2009). Various scholars and government agencies (CDC, 2010; DHHS, 2006; Hickey, Harpster, & Stewart, 2001; Stueve & O'Donnell, 2005; Swahn, 2008; The Child Trends Data Bank report, 2010; OJJDP, 2006) have focused their studies on the problem of UD over the years, and have reported the consequences of UD. Most of these studies and reports have indicated relationship(s) between UD and mental health impairments (MHI). Underage drinking has been linked to alcohol use disorders (AUDs) as well as other mental health impairments (MHI) later in life (Grant et al., 2006; Kessler et al., 2005; Roberts et al., 2007; Sacco, Bucholz, & Spitznagel, 2009).

In a longitudinal study of 808 children first surveyed at the age of 10 and followed through to age 21, Guo et al. (2000) found that early onset use of alcohol correlated with AUDs at the age of 21. Adolescents who started drinking in elementary or middle school developed alcohol abuse and dependence before they reached the legal age of drinking. Close to half the number of people with AUDs are said to have acquired the disorder in their middle to late teen years and those with earlier onset of AUDs are more susceptible to pronounced alcohol-related difficulties as well as other MHIs (Martin & Winters, 1998). Johnson et al. (2000) tested their hypotheses that age of onset of drinking is characteristic of a range of diseases, and that psychopathological conditions or remarkable severity are correlated with age of onset. Cloninger et al. (2000) used a sample of 253 male and female applicants for alcohol treatment stratified by age of onset. Cloninger et al. found that earlier age of onset is associated with “relatively greater psychopathology [which can be translated to dependence] than those of later onset” (p. 18).

Brown and Munson (1987) conducted a meta-analysis of studies which found that anxiety-neuroticism and depression are among psychosocial problems frequently associated with drinking excessively and alcohol-related problems among college students. Grant and Dawson (1997) related the results of a study, which showed that after adjusting for the other model covariates, age at onset of alcohol use remained a major contributor to the development of alcohol abuse and alcoholism. Grant and Dawson (1997) concluded that the odds of lifetime alcohol dependence were reduced by 14% with each increasing year of age at first use, and the odds of lifetime alcohol abuse were reduced 8% with each increasing year that drinking onset was delayed.

Dawson et al. (2007) used data from the 2001 to 2002 National Epidemiologic Survey on Alcohol and Related Conditions to estimate the effect of age at first drink in modulating the association between stress and average daily volume of alcohol consumption in a sample of 26,946 past-year drinkers. Dawson et al. (2007) found that even after controlling for confounders, early onset drinking (drinking at or before the age of 14) increased the association between the number of stressors and average daily consumption of alcohol by 8%. According to SAMHSA (2009) 10 million or 26% of youth 12 to 20 years old reported drinking alcohol in the month prior to the survey. About seven million (17%) engaged in binge drinking, and two million or 6% reported heavy drinking (SAMHSA, 2009). The survey findings also include differences in outcome based on age at onset of drinking – for example, age at first use of alcohol was associated with alcohol use disorders among individuals 18 years or older who first tried alcohol before they were 14 years old (SAMHSA, 2009). In the same report, SAMHSA stated that 17% of those who first used alcohol before their 14th birthday developed alcohol dependence or abuse compared to only 3.9% of those who first used alcohol at 18 or older.

Adults aged 21 or older who started using alcohol before age 21 were more likely to be diagnosed with alcohol abuse or dependence than adults who had their first drink at age 21 or later –15% vs. 9% respectively (SAMHSA, 2009). Elevated rates psychiatric co-occurrence were found among at-risk drinkers (those who consume more than the average daily volume) compared to moderate drinkers and abstainers aged 18-64 (Bott, Meyer, Rumpf, Hapke, 2005; Dawson, 2011; NIAAA, n.d.; Williamson, Sham, & Ball, 2002).

Characterizations and Prevalence of Poor Educational Attainment

Given that educational attainment is measured by the level of education the individual completed, the literature on what constitutes poor educational attainment in general is reviewed and factors contributing to poor educational attainment are noted. The role of educational attainment in the calculation of human capital acquisition will also be highlighted.

Poor educational attainment as poor human capital acquisition. Human capital theory proposes that attainment of a higher level of education is an investment that equips the individual for higher productivity with the desired outcome being that employment (van der Merwe, 2010). Walker (2012) cited Becker and Mincer's definition of human capital, which focused specifically on education, and targeting the number of years a person invested in schooling. This is in line with the definition of human capital as the expenditures (investments) people make on education, training, and other related activities in preparation for future employment (Becker, 2008; Kimenyi et al., 2006; Martínez & Fernández, 2010; van der Merwe, 2010; Olaniyan & Okemakinde, 2008). Human capital acquisition therefore is the actual attainment (acquisition) of formal and informal education and training during a person's youth and young adulthood for the purpose of gainful employment in adulthood (Olaniyan & Okemakinde, 2008).

Becker (2008) named “education, training, and health ... the most important investments in human capital” (para. 3). Yet these are three areas of a youth’s life that early onset drinking most often severely affects. Neurological damage associated with underage drinking has been studied over time (Crews et al, 2007; De Bellis et al., 2000; Dee & Evans, 2003; Gilpin & Koob, 2008; Hiller-Sturmhöfel & Swartzwelder, 2005; Surgeon General, 2007; Zeigler, Wang, Yoast et al., 2005) and have been found to be a threat to a youth’s normal developmental process. Though some studies (e.g., Dee & Evans, 2003) reported not finding statistically significant correlations between underage drinking and poor educational achievement, several other studies (see for example, Cook & Moore, 1994, 1999; SAMHSA, 2010; Staff et al., 2008) found negative correlations between UD and PEA. Underage alcohol use is associated with brain damage and neurocognitive deficits, with implications for intellectual development and learning and educational attainment (CDC, 2010; Gilpin & Koob, 2008; NIAAA, 2009). As was defined above, human capital acquisition in the form of attainment of academic and/or vocational training in preparation for future employment (van der Merwe, 2010; Olaniyan & Okemakinde, 2008) is a crucial part of development. Brown et al. (2000) reported that heavy drinking at an early age may disrupt brain development and function. Recent research on early and late adolescent drinking (see for example, CDC, 2010; SAMHSA, 2010; Squelia et al., 2009) corroborate Brown et al. (2000) and verify reports of earlier findings (e.g., Freund, 1973) while advancing understanding of the effects of underage drinking on the developing brain.

Characterizations and Prevalence of Concomitant Alcohol Dependence and Poor Educational Attainment

As noted earlier in the introductory chapter, the relationship between alcohol dependence (AD) and poor educational attainment (PEA) is not a clear-cut one. In the literature, PEA is

represented particularly by failure in school, and reduced educational attainment is found to be correlated with teenage alcohol use (Cook & Moore, 1993; Williamson et al., 2002; Yamada et al., 1996). In similar research effort, others (Bachman et al. 1997, 2008; Koch & Ribar, 2001; Renna, 2007) found associations between heavy alcohol use in adolescence and lower enrollment in educational activities beyond high school, reduced earnings, and heightened job instability in young adulthood. However as Staff et al. (2008) noted, viewpoints differ on the nature of the relationship between heavy use of alcohol and lowered educational activities of youths. As introduced in the statement of problem section, from the point of view of human capital theory, educational attainment is expected to be directly and negatively predictable by underage alcohol use. For example Lynskey and Hall (2000) and Chapman, Laird, Ifill and KewalRamani (2011) perceived heavy alcohol use as robbing the youths of their study and homework as well as teacher-helping time. Moreover Spear (2000), (NIAAA, 2004), Tapert and Brown (1999), and Tapert et al. (2004/2005) assert that heavy alcohol use in adolescence may reduce educational attainment by affecting brain structure, brain functioning, and neuropsychological performance.

Other reports of negative effects of heavy alcohol use highlight possible reduction of long-term educational attainment through its impact on such intervening variables as increased likelihood of motor vehicle accidents, physical and mental health problems, and violence (Bachman et al., 1997; Hansell & White, 1991; Hingson et al., 2002; Kandel, et al., 1986; Mensch & Kandel, 1988; Newcomb, 1987; Newcomb & Bentler, 1985, 1988, Yamaguchi & Kandel, 1985). Other intervening variables listed in the literature include hurried adoption of spousal and parental roles (Newcomb & Bentler, 1988), increased likelihood of injury, criminal justice involvement, and adjustment problems (Moffitt et al., 2002; Tanner et al., 1999), impediment of developmentally appropriate task completion (Gotham et al., 2003), and

premature transitions to the labor force (Schulenberg et al., 2003). Eventually, heavy alcohol use in adolescence could increase the likelihood of alcohol dependence in adulthood (Bonomo et al., 2004), which in turn could lead to poor educational attainment in particular and poor human capital acquisition in general, due to underdeveloped job skills and lacking experience in the workforce.

The second line of thought is that some of these findings regarding the negative effects of heavy alcohol use on school success, and long-term educational and/or job skills attainment may not be genuine and therefore spurious (Chatterji, 2006; Dee & Evans, 2003; Duncan et al., 1972; Koch & Ribar, 2001). Differences between heavy drinkers and other youths with respect to early educational promise, coupled with certain childhood and adolescent factors may be responsible for any observed correlation between teenage alcohol use and educational attainment (Duncan et al., 1972). Some reasons to support this point of view include the fact that factors such as the youth's schooling intentions and prior achievements do have powerful effects on their postsecondary attainment (Duncan et al., 1972). Moreover, it may be the other way around that low school commitment and academic failure do increase the risk of heavy adolescent drinking (NIAAA, 2006). Koch and Ribar (2001), Dee and Evans (2003), and Chatterji (2006), proposed that preexisting and unobserved differences between students in prior achievements may be responsible for the relationship between heavy alcohol use and educational attainment.

The third line of thought is that the relationship between alcohol consumption and educational attainment may be conditional (Fagan & Pabon, 1990). Factors such as environmental, and social and economic background may moderate the long-term impact of heavy alcohol use on educational attainment (NIAAA, 2006). In this regard, authors (for example Berkman & Kawachi, 2000; Rehm et al., 2004; Tapert et al., 2004, 2005) suggest that

the existence and the seriousness of substance use–related consequences may be moderated by environmental and personal characteristics. As such, differences in substance use–related impairment cannot be exclusively explained by characteristics of the agent itself; in this case, alcohol (Rehm et al., 2004). For instance, Wills and Yaeger (2003) suggest that disadvantaged youth may be affected more negatively by heavy drinking in adolescence compared to counterparts with greater safeguard resources. From the social perspective, research findings such as Duncan et al. (1972), Schoon et al. (2002), Bynner and Joshi (2002), Bynner and Parsons (2002), and Schoon (2006) show that social origins have powerful effects on child and adolescent school performance, completed schooling by adulthood, and adult labor market success. However, from the economic perspective, Wills et al. (2007) conversely found that economic disadvantage in childhood is not a consistent predictor of heavy alcohol use in adolescence. Furthermore, Bachman et al. (1991), Zucker and Harford (1983), and Murray et al. (1987) show that teenage drinking is positively correlated with parents' education.

Concomitant Alcohol Dependence and Poor Educational Attainment as a Special Case for Vocational Rehabilitation Counseling

Concomitant mental health impairment and poor educational attainment is a unique case that could have special implications for rehabilitation professionals. Alcohol dependence which is sometimes called alcoholism, excessive drinking, or overuse of or overindulgence in the use of alcohol by people of all ages and at all stages in life, have been identified as leading causes of poor or lacking educational attainment (Conti et al., 2006; Cunradi, Greiner, Ragland & Fisher, 2005; Frone, 2011; Patussi & Mezzani, 2005), permanent disabilities and death (CDC, 2010; Goldman, Oroszi, & Ducci, 2006; OJJDP, 2012). In a study based on the data from the 1992 National Longitudinal Alcohol Epidemiologic Survey, Grant and Dawson (1997) looked at how

age at onset of use of alcohol affected lifelong alcohol use disorders in United States adult populations 18 years and older ordered by gender and race.

Grant and Dawson (1997) found that among those who drank, age at onset of drinking indicated whether a person had lifetime alcohol use disorders or not. For instance, the prevalence of lifetime alcohol dependence decreased steadily as the age at onset of use increased (Grant & Dawson, 1997). Guo et al. (2000) in a longitudinal study of 808 children first surveyed at the age of 10 and followed through to age 21 wanted to see if there was any correlation between drinking in adolescence and alcohol abuse or dependence (AAD) at age 21. Guo et al. (2000) compared two groups of students – AAD and non-AAD using a form of Latent Transition Analysis (LTS) to organize alcohol use statuses. The statuses were “nonuse, initiation only, current use only, heavy episodic drinking” (p.799). Latent transition analysis was then used to assess possible passages between statuses from elementary school to high school among both groups. The resulting data showed that 54% of the AAD group drank heavily on occasions compared to 33% of the non-AAD group who were just initiating heavy drinking in high school. These findings of correlation between early onset use and alcohol use disorders at age 21 corroborated earlier study results which concluded that adolescents who started drinking in elementary or middle school were likely to develop alcohol abuse and alcohol dependence before they reached the legal drinking age. Some researchers, (e.g., Martin & Winters, 1998) suggested that close to half the number of people with alcohol use disorders acquired the condition in their middle to late teen years and those with earlier onset are more susceptible to pronounced alcohol-related difficulties as well as other mental health impairments.

Roberts et al. (2007) studied co-morbidity of substance use and other psychiatric disorders among adolescents and found that there is strong evidence associating substance use

disorders and other psychiatric disorders. Using a probability sample of 4,175 youths aged 11–17, Roberts et al. (2007) sought to specify risks of co-morbidity for different substance use disorders and whether greater co-morbidity is associated with dependence through an assessment using the NIMH DISC-IV and self-administered questionnaires. Upon further examination using multivariable models, Robert et al. found alcohol and mood disorders to be highly co-morbid. Furthermore, several recent studies (see for example, Blomeyer et al., 2011; Buchmann et al., 2009; Zernicke, et al., 2010), have found early onset of drinking to be highly correlated with youth, young adult, and adulthood problems with alcohol-related pathologies as well as other mental illness symptoms. Blomeyer et al. (2011) looked at the relationship between stressful life events (SLE) and early onset use of alcohol and found that the combination of early onset drinking and SLE were associated with high levels of alcohol consumption.

Relationship between CADAPEA and underage drinking. Underage drinking (UD) can be a common factor in cases of alcohol dependence (AD) and poor educational attainment (PEA). In the absence of literature investigating concomitant AD and PEA, such a concept might sound far-fetched. However, in reviewing the scant of literature available, it is found that underage drinkers (both current and older drinkers with history of underage drinking) have a greater risk of experiencing alcohol dependence concomitant with poor educational attainment (Fletcher, 2008; McLeod, Uemura & Rohrman, 2012). With the National Longitudinal Study of Adolescent Health, Fletcher (2008) looked at the effect of “depression during high school and educational attainment,” as well as possible relationships between the student and various factors that influence depression, including treatment (p. 126). Fletcher (2008) reported a relationship between adolescent depression and educational attainment, specifically in terms of high school dropouts, continuation to college, and the kind of college the youth attended. Similarly, McLeod

et al. (2012) noted a gap in the literature on mental health and educational attainment in the sense that comprehensive studies of the various factors affecting educational attainment were lacking. McLeod et al. (2012) sought to close the gap using the National Longitudinal Study of Adolescent Health with a sample size of (N = 6,315) to look at the relationships between mental and behavior problems and educational attainment – as measured by high school GPA and the level of education attained. McLeod et al. (2012) concluded that cases involving more than one negative factor, and especially those involving students' use of substances (including alcohol), had more impact on the student's academic endeavors.

From the human capital perspective, when health (in this case, mental health) is considered as a viable component of the human capital accumulation process, a more comprehensive understanding of the economic costs of UD will be obtained (Grossman, 2008; Frone, 2011; Mullahy & Sindelar, 1989). Consequently, in-depth and focused knowledge of the patterns of relationships between UD, AD, and PEA is particularly important.

Regular or excessive drinking by youths may result in long-term negative consequences including AD and PEA (NIAAA, 2006). Underage drinking can result in physical injuries, mental health impairments, neurological disorders, and a host of negative socio-behavioral outcomes or death (Brown & Tapert, 2004; Brown et al., 2000; CDC, 2010; Foster et al., 2003; ICAP, 2012; NIAAA, n.d.; Norberg et al., 2009; SAMHSA, 2009; Surgeon General, 2007). Mental health and neurological impairments could interrupt a youth's normal development processes including hindering his or her educational attainment (Hingson et al., 2009).

Summary

Based on the literature reviewed, it seems safe to conclude that alcohol as a beverage is a universal drink that has been used and misused at every turn in human history (Dudley, 2004,

2005; Leigh & Lee, 2008; Measham, 2008; Zakhari, 2005). Alcohol consumption has been seen in positive light by some, especially when identified with appropriate age, purpose, and function and when consumed in moderation (Coate, 1993; Harvard University School of Public Health, 2014; Jackson et al., 1991; Klatsky et al., 1990; Konnopka & König, 2009; Lipton, 1994; Peel, 1993; Mukamal et al., 2003). There seems to have been unanimous agreement across the literature reviewed as to when drinking becomes problematic though the term used to define the problem or problematic drinking may depend on the perspective(s) and goal(s) of the individual or group(s) dealing with the situation(s) at the times (Fellbaum, 1998; Lewis, 1956; Martinic & Measham, 2008; Measham, 2008; Miller, 1995).

In the United States, underage drinking has been a prominent item on public health agendas in recent decades as a serious health concern (CDC, 2010; DHHS, Office of the Surgeon General, 2007; Eshbaugh, 2008; NIAAA, 2006; SAMHSA, 2004, 2009). Indications of correlations between underage drinking, alcohol use disorders, and other mental health impairments were found in the literature reviewed (CDC, 2010; Grant & Dawson, 1997; McCusker et al., 2002; SAMHSA, 2009; Schuckit, 2000). There seemed to be consensus that underage drinking and alcohol dependence interfered with the youth's educational attainment among other things. From the vocational rehabilitation counseling perspective, a study such as this can be visionary to inform prevention, research and education, and treatment efforts.

CHAPTER 3

METHODOLOGY

A model-building approach was used to carry out the current study. The approach was based on a Logistic regression modeling of extant data used to explain concomitant alcohol dependence and poor educational attainment (CADAPEA) with underage drinking history (UDHISTORY) as a main predictor variable augmented by the demographic factors age, gender and race/ethnicity. Some other relevant variables addressing personal and social factors such as drinking habit and marital status were also considered.

Survey and Data Collection

Upon identification of the 2010 NSDUH data set as the data source for this study, permission was sought from both SAMHSA (SAMHDA) and RTI International for use of the data set for this study. It was discovered that no written permission is needed to use NSDUH public use data files. An online agreement that the user would adhere to the conditions for use of the data files was all that was required. The 2010 NSDUH data files were downloaded from SAMHSA website: <http://www.icpsr.umich.edu/icpsrweb/SAMHDA/studies/32722>. These data files are available for use with various data analysis tools including SPSS and SAMHSA's online data analysis tool SDA. Data analyses for this study were carried out using both SPSS and SDA.

RTI International was contacted for documentation of the internal review board process and human subjects protection approval(s) for the 2010 NSDUH. According to an RTI International (2012) publication (see Appendix A) and personal communication with RTI International staff, the Office for Human Research Protections (OHRP) of the DHHS granted a Federal-Wide Assurance (FWA #3331) to the institute to independently review and approve studies conducted by the same (Dr. Kathryn Downey, email communication, January 14, 2014).

The detailed statement regarding IRB documentation of RTI International's studies of which the 2010 NSDUH is one, can be found at the institute's regulatory affairs website, the address of which is also provided in Appendix A to this study. In addition, specific documentation of the IRB approval for the 2010 NSDUH is included in the report *2010 National Survey on Drug Use and Health: Data Collection Final Report* (SAMHSA, 2011).

With the data set secured and appropriateness of the data set for the current study verified, permission to conduct the present study using the 2010 National Survey on Drug Use and Health data set ICPSR 32722-0001 was sought and obtained from the Human Subjects Committee, Southern Illinois University Carbondale prior to proceeding with the data analysis.

The National Survey on Drug Use and Health (NSDUH) is a series of general population surveys aimed at generating data on national drug and alcohol use and mental health. The NSDUH surveys are designed and carried out by Research Triangle Institute (RTI International) as the primary investigator under contract with Substance Abuse and Mental Health Services Administration, Department of Health and Human Services. According to SAMHSA (2012) the 2010 survey was the 30th in the series formerly known as National Household Survey on Drug Abuse (NHSDA). The 2010 NSDUH was also a continuation of the expanded annual surveys initiated in 1999 which enabled the generation of estimated national as well as individual state data for all states plus the District of Columbia for the survey population.

Population

The target population for the 2010 NSDUH included individuals 12 years of age and older who were civilians living in the United States, and not in institutions. The 2010 NSDUH survey was designed to gauge the extent of substance use and mental health disorders among the youth and adults living in the country at the time of the study. According to SAMHSA (2012a),

it was estimated that the population studied (12 years and older) represented 98 percent of the youth and adult population living in the country as at the time of the study. SAMHSA (2012) cautioned that substance use and rate of mental health disorders might be different in the subpopulations not included in the survey. In those subpopulations were service men and women on active duty, incarcerated individuals, mental health patients in institutions, and homeless persons.

Implications of these omissions in the survey according to SAMHSA (2012) included the fact that military personnel, for example, tend to drink more heavily compared to civilian populations. Military personnel on active duty may have had experiences with alcohol and substance use that were considerably different from those of the survey population due to exposure to combat and associated stressors. Some other examples SAMHSA (2012) were omitted subpopulations whose mental health and substance use information could be very different from those of the survey population who were institutionalized individuals with substance abuse or mental illnesses in greater numbers than the survey population, and homeless persons without shelter accommodations. Further information on the survey target population is provided in Appendix B section B.1 of the report, *Results from the 2010 National Survey on Drug Use and Health: Mental Health Findings* (SAMHSA, 2011).

Sampling Procedure

According to SAMHSA (2011), sampling design and procedures for the 2010 survey followed the pattern of 2005-2009 designs. As a result, the main study in the 2010 survey was designed as a subsample of a study that spans several years. Details of the sampling design and procedures for the 2010 NSDUH can be found in Exhibit 2.1, together with Table 2.1 of the

report *National Survey on Drug Use and Health, 2010 Methodological Resources* (SAMHSA, 2011).

With regard to the current study, design considerations included determining sample size and ensuring adequate group sizes (Hosmer & Lemeshow, 2000; O'Connell & Amico, 2010). O'Connell and Amico (2010) listed five reasons why the determination of adequate sample size necessary for reliable estimation of model coefficients in a logistic regression can be challenging. The reasons include: (1) rareness of the event which has to do with the base rate or response probability within the population being studied, (2) possibility of difference in sample size between the two categories of the dichotomous criterion variable, (3) when there are few observations per covariate pattern, (4) the nature and type of covariates included in the model, whether continuous or categorical, and (5) the expected frequency of events per covariate. Also there is the issue of case to variable ratio, which influences the number of covariate patterns and the likelihood of small numbers of cases in the categories of the criterion variable. According to Hosmer and Lemeshow (2000), the recommended sample size of the criterion (outcome) variable's smallest group should be at least as large as $10(k + 1)$, where k is the number of predictors in the model.

In this study, there were $k = 9$ predictors, and as such the required minimum number of cases in the smaller category of each dichotomous criterion variable was $10(9+1) = 136$ cases. The smaller dichotomy groups for each criterion variable were as follows: AD = 1 had 2,232 cases, PEA = 1 had 24,957 cases and CADAPEA = 1 had 665 cases. As such, the minimum requirements were met. The final models had for only 10 AD predictors and 230 cases, PEA only 10 predictors and 230 cases, and CADAPEA only 10 predictors and 230 cases, in their

smaller dichotomy groups respectively and as such they all met Hosmer and Lemeshow's (2000) minimum sample size requirement.

Sample. The initial sample size for the 2010 NSDUH was 67,804 interviewees systematically drawn from stratified sampling frames nationwide (SAMHSA, 2011). This sample is representative of the mainland United States, Alaska, and Hawaii through a year-round, nationwide screening of 147,608 addresses (SAMHSA, 2011). Included in the survey were individuals living in households, civilian quarters on military bases, non-institutional housing such as group homes, college dormitories, homeless shelters, and long-term hotel dwellings – individuals without permanent residential arrangements at the time of the survey (SAMHSA, 2011). From the survey data, the sample size for this study is 19,240 (about 33% of 57,873, the 2010 NSDUH final sample size) was drawn based on the study criteria of using individuals aged 25 to 75 years.

Measures

According to SAMHSA (2011), the 2010 NSDUH computer assisted interviewing instrumentation (CAI) included questions that were designed to measure alcohol and illicit drug dependence and abuse. For these substances, dependence and abuse questions were based on the criteria in the DSM-IV (APA, 1994). Further information on the measurement, instruments and criteria used for measuring alcohol abuse and dependence can be found in Appendix B, subsections B.4.1 and B.4.2 of *Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings* (SAMHSA, 2011). Demographic questionnaires were the primary sources of information on such variables as educational attainment, race, age and gender of respondents.

Reliability and validity of measures. Substance Abuse and Mental Health Services Administration (2010) in the report *Reliability of Key Measures in the National Survey on Drug Use and Health* provided detailed information on the reliability and validity of the measures used in the National Survey on Drug Use and Health series. This publication may be downloaded from <http://www.oas.samhsa.gov>. Hard copies may be obtained from <http://www.oas.samhsa.gov/copies.cfm>, or by calling SAMHSA's Health Information Network at 1-877-SAMHSA-7 (1-877-726-4727) (English and Español).

Variables

In Table 1 immediately below, variables used in the study are listed along with their descriptions and types. Detailed descriptions of each variable, function(s) in the study, as well as attributes are also provided in this section.

Table 1 Variables Considered in the study

Name	Description	Type of Variable
ALCTRY	Age at Onset of Drinking (12-75)	Predictor (IV), Interval
ALCDAYS	# Days Had One or More Drinks Past 30 Days (1-30)	Predictor, Interval (Categorical)
ALCREC	Recency of Alcohol use (1-3) (1 = less or equal to 30 days, 2 = more than 30 days but \leq 12 months, 3 = more than 12 months)	Predictor (IV), Ordinal (Categorical)
ALDAYPWK	# Days per Week Drank Alcohol in Past 12 Months (1-7)	Predictor, Interval
AGE	Current Age (difference between DOB and 2010)	Demographic (IV), Interval
BINGEDRK	Binge Drinking (1 = Yes, 0 = No)	Control, Nominal (Dichotomous)
CADAPEA	Concomitant AD & PEA (1 = Yes, 0 = No)	Main Criterion (DV), Nominal (Dichotomous)
CATAG7	Age Category of respondents 12-75 years old (1-7) categories	Demographic, Ordinal (Categorical)

Table 1 (continued)

Name	Description	Type of Variable
CLAD	Currently Legal Age Drinking (0 = Current Age < 21, 1 = Current Age ≥ 21)	Filter, Nominal (Dichotomous)
CUD	Currently Underage Drinking (1 = Current Age < 21, 0 = Current Age ≥ 21)	Filter, Nominal (Dichotomous)
DEPNALC (AD)	Alcohol Dependence in the Past Year (1 = Yes, 0 = No)	Antecedent Criterion (DV), Nominal (Dichotomous)
DOB	Date of Birth	Filter, Nominal (Categorical)
DR5DAY	# Days had Five or More Drinks Past 30 Days (1-30)	Predictor, Interval (Categorical)
EDUCCAT2	Level of Educational Attainment (1-5)	Antecedent Criterion, Ordinal (Categorical)
GENDERx	Gender (0 = Female, 1 = Male)	Demographic, Nominal (Dichotomous)
UDHISTORY	Underage Drinking History (ALCTRY < 21 = 1, ALCTRY > 21 = 0)	Predictor, Nominal (Dichotomous)
HVYDRK	Heavy Drinking (1 = Yes, 0 = No)	Control, Nominal (Dichotomous)
IRMARIT	Imputation Revised Marital Status (1 = Married, 2 = Widowed, 3 = Divorced / Separated, 4 = Never been married)	Demographic, Nominal (Categorical)
IRSEX	Imputation Revised Gender (1 = Male, 2 = Female)	Demographic, Nominal (Dichotomous)
LOPUD	Length of Period Underage Drinking (years) (1-20)	Predictor (IV), Interval
MARISTAT1	Marital Status – Married (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
MARISTAT2	Marital Status – Widowed (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
MARISTAT3	Marital Status – Divorced/Separated (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
MARISTAT4	Marital Status – Never been married (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
NEWRACE2	Race/Ethnicity (1-7)	Demographic, Nominal (Categorical)
NODR30A	Number of drinks per day (1-90)	Control, Interval
PEA	Poor Educational Attainment (1 = Yes, 0 = No)	Antecedent Criterion, Nominal (Dichotomous)

Table 1 (continued)

Name	Description	Type of Variable
RACE-ASIAN	Race/Ethnicity – non-Hispanic Asian (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
RACE-BLACK	Race/Ethnicity – non-Hispanic Black (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
RACE-HISPANIC	Race/Ethnicity – Hispanic (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
RACER-MIXED	Race/Ethnicity – non-Hispanic Mixed (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
RACE-NATIVE	Race/Ethnicity – non-Hispanic Native American (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
RACE-PACIFIC	Race/Ethnicity – Non-Hispanic Pacific Islander (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)
RACE-WHITE	Race/Ethnicity – non-Hispanic White (1 = Yes, 0 = No)	Demographic, Nominal (Dichotomous)

Predictor (independent) variables. The main predictor variable included in this study is derived from the NSDUH dataset variable measuring age at onset of drinking (*ALCTRY*), which determines underage drinking. This variable gives rise to the variable used to indicate underage drinking history (*UDHISTORY*). Also a variable measuring the duration of the history, that is, the length of period underage drinking (*LOPUD*) is derived. Then there are some core demographic variables (gender, current age, race/ethnicity). Some other potential predictor variables addressing the respondents' personal and social factors such as marital status and drinking habits as well as information as to whether or not the respondent was still drinking at the time of the survey.

Age at onset of drinking (ALCTRY). The primary dataset key variable from which the main predictor variable in this study is derived, is age at onset of drinking, that is, age at first drink of alcoholic beverages. This variable is represented in the survey data by the variable label *ALCTRY*, which is a continuous scale variable with values ranging from 1 to 75 years.

Underage drinking history (UDHISTORY). This is the main predictor variable indicating whether or not a respondent can be classified as underage drinking history. It was derived as a dichotomization of the variable ALCTRY into two categories (1 = Yes, ALCTRY < 21) and (0 = No, ALCTRY ≥ 21).

Length of period underage drinking (LOPUD). This is the variable measuring the duration of the history of underage drinking. For CUD respondents, it is computed as the difference between the current age and the age at onset of drinking while for CLAD respondents it is computed as the difference between the legal drinking age 21 and the age at onset of drinking.

Core demographic variables. Some core demographic variables are included in this study to determine their influence on the main predictor variable in the prediction process. Specifically, current age (age at time of survey), gender, and race/ethnicity are included as the main demographic variables. Also the variable marital status was later considered for inclusion in the study based on the frequency of social and environmental factors in the literature on underage drinking, alcohol dependence, and poor educational attainment.

Current age (CATAG7- age at time of survey in categorical form). The variable label in the survey data is CATAG7 with seven categories as follows: (1) 12-13 Years Old, (2) 14-15 Years Old, (3) 16-17 Years Old, (4) 18-20 Years Old, (5) 21-25 Years Old, (6) 26-34 Years Old, and (7) 35 or Older.

Current age (AGE – age at time of survey in non-categorical form). Age in this form is a derived continuous scale variable with values ranging from 12 to 75 years.

Gender. In the survey data, gender with the variable label IRSEX is a dichotomous nominal variable, coded 1 for male and 2 for female.

Race and ethnicity. According to SAMHSA (2011), the Office of Management and Budget (OMB) established the guidelines to be followed when collecting and reporting data on the race and ethnicity of survey participants. Those guidelines were followed for the collection of the 2010 NSDUH data. As a result of OMB's guidelines, respondents in the survey had the choice to report more than one racial background with a designated category provided. The variable label is NEWRACE2 and the race/ethnicity variable is nominal with seven levels. The seven categories are as follows: (1) Non-Hispanic White, (2) Non-Hispanic Black/African American, (3) Non-Hispanic Native American/Alaska Native, (4) Non-Hispanic Native Hawaiian/Other Pacific Islander, (5) Non-Hispanic Asian, (6) Non-Hispanic more than one race, and (7) Hispanic (RTI International, 2012).

Marital status. The original variable label is IRMARIT. This variable is nominal with 4 categories: (1) Married, (2) Widowed, (3) Divorced or Separated, and (4) Never married.

Other relevant predictor variables. A few other predictor variables were necessary to measure respondents' drinking behaviors and habits. Those variables are:

Recency of alcohol consumption (ALCREC). This a categorical ordinal variable used in the survey data set to measure the recency of alcohol consumption and it takes values ranging as follows: 1 = within the past 30 days, 2 = more than 30 days ago but within the past 12 months, and 3 = more than 12 months ago.

Alcohol days (ALCDAYS). This is a continuous scale variable used in the survey data set to measure the number of days the respondent had one or more drinks in the past 30 days, and as such takes values from 1 to 30.

Alcohol days per week (ALDAYPWK). This is a continuous scale variable used in the survey data set to measure the number of days per week the respondent consumed alcohol in the past 12 months, and as such takes values from 1 to 7.

Number of drinks per day (NODR30A). This is a continuous scale variable used in the survey data set to measure the usual number of drinks per day the respondent consumed in past 30 days and it takes values from 1 to 90.

Binge drinking (BINGEDRK). According to SAMHSA (2012), this is the consumption of five or more servings of alcoholic beverages on any one occasion or within two hours of drinking occasions at least one day within a 30-day period.

Heavy Drinking (HVYDRK2). This variable depicts the behavior of consuming five or more drinks on the same occasion (or within two hours of two drinking occasions) on each drinking occasion, five or more days within 30 days of the survey.

Marital Status (IRMARIT). The nominal variable had an original variable label IRMARIT, which means that it is imputation revised variable. Marital status was one of the variables added to the study during computation to enable an investigation of broader demographic influences on UDHISTORY in the prediction of CADAPEA. The respondent had a choice of Married, Widowed, Divorced, Separated, or Never married.

Criterion (Dependent) variables. The main criterion variable in this study is CADAPEA, which represents concomitant alcohol dependence and poor educational attainment. Prior to predicting this variable, the variables AD (alcohol dependence) and PEA (poor educational attainment) are studied and predicted separately each as an antecedent to CADAPEA.

Alcohol dependence (AD). This variable is derived from DEPNDALC as a nominal dichotomous variable with values (0 = No, 1 = Yes). For the purpose of this study, DEPNDALC is the main mental health impairment variable representing alcohol dependence in dataset. In the 2010 NSDUH survey data set, DEPNDALC is a dichotomous nominal variable with 1 = Yes if the respondent reported a positive response to three or more of seven alcohol dependence criteria and 2 = No/Unknown (Otherwise). Thus for the this study, AD is 1 = Yes when the respondent meets at least three of seven DSM-IV alcohol dependence criteria listed under the definition of terms section in Chapter 1, otherwise AD is 0 = No.

Poor educational attainment (PEA). This variable is derived as a nominal dichotomous (0 = No, 1 = Yes) variable from EDUCCAT2, the educational attainment variable in the survey dataset which represents the overall level of education attained by the respondent, and is based upon two other variables in the dataset, namely IREDUC2 (imputation recoded educational attainment) and AGE2 (age first use of any psychotherapeutics, with values from 1 to 17). The variable IREDUC2 is categorical ordinal with categories as follows; 1 = Fifth grade or less, 2 = Sixth grade, 3 = Seventh grade, 4 = Eighth grade, 5 = Ninth grade, 6 = Tenth grade, 7 = Eleventh grade, 8 = Twelfth grade, 9 = Freshman/13th year, 10 = Sophomore/14th year or Junior/15th year, 11 = Senior/16th year or Grad/Prof School (or higher).

Level of educational attainment (EDUCCAT2) is a categorical ordinal variable with five levels as follows:(1) Less than high school ($IREDUC2 \leq 7$ and $AGE2 \geq 7$) meaning that the respondent is 18 years of age or older with an 11th grade or lower education level; (2) High school graduate ($IREDUC2 = 8$ and $AGE2 \geq 7$) meaning that the respondent is 18 years of age or older and did complete high school; (3) Some college ($IREDUC2 = 9-10$ and $AGE2 \geq 7$) meaning that respondents in this category are 18 years or older and have 13 to 15 years of

education equivalent to freshman, sophomore, or junior in college; (4) College graduate (IREduc2 = 11 and AGE2 \geq 7) meaning that the respondent is 18 years or older and a college graduate; (5) – 12 to 17 year olds (AGE2 \leq 6) meaning that respondent is less than 18 years of age. Thus, PEA with two categories (1 = yes, Poor Educational Attainment, 0 = No, not Poor Educational Attainment) takes the value 1 if EDUCCAT2 = 1, and the value 0 if EDUCCAT2 = 2, 3, or 4.

Concomitant alcohol dependence and poor educational attainment (CADAPEA). This variable representing concomitant alcohol dependence and poor educational attainment is constructed from AD = 1 and PEA = 1. Thus CADAPEA is a dichotomous variable with values 0 = No, absence of concomitant alcohol dependence and poor educational attainment and 1 = Yes, presence of concomitant alcohol dependence and poor educational attainment.

Data Analysis Methods

Correlation analysis and regression analyses are used to address the research questions. The fifth research question is addressed using t-test for independent groups, or Chi-square statistics depending on the variables involved. SAMHDA's online software SDA as well as *the IBM Statistical Package for the Social Science (SPSS)* are used for data analysis. An alpha level of .05 is used in determining statistical significance.

Healy (2009) defines a statistically significant result as one in which the *p*-value for obtaining that result is less than the alpha level, which for a specified alpha level is formally written as $p < \alpha$. Norman and Streiner (2008) define the alpha level as the probability of rejecting the null hypothesis when it is true and is usually set at 0.05 (5%), the most widely used value and especially in this area of research as was observed in the literature reviewed. A *p*-value

is also defined as the probability of observing an effect given that the null hypothesis is true (Devore, 2011).

Coolidge (2012) provides a less technical definition for statistical significance as the probability that an effect is not likely due to chance alone. In this light for example, the effect of underage drinking on alcohol dependence would be considered statistically significant if evidence from the survey data shows that age at onset of drinking is a statistically significant predictor of alcohol dependence and as such the prediction is not merely a result of chance. However, Sirkin (2005) points out that in general, a statistically significant effect does not necessarily mean an important or meaningful effect rather it means that the effect is unlikely due to chance alone.

Correlation analysis. A correlation analysis in which measures of association are used to study the relationship(s) between the main variables of the study – underage drinking, mental health impairment, and educational attainment was adopted for the proposed study (Freeman & Young, 2009; Hinkle, Wiersma & Jurs, 1998; Vogt & Johnson, 2011). A measure of association is a statistic that shows the degree of relationship between two or more variables in a single number. According to Vogt and Johnson (2011), there are two types of measures of association determined by the basis. One type is based on how the statistic departs from statistical independence, for example, *phi*; and the other is based on how much prediction error is reduced, example, *lambda*. There are yet other measures of association including Pearson's correlation coefficient (Freeman & Young, 2009; Hinkle et al., 1998; Vogt & Johnson, 2011).

Regression analysis. Researchers employ regression analysis as a statistical tool to study relationships between variables. In any given study, the objective could be to find out what effect one variable has on another. Using the variables of this study for example, one could

be looking to see what effect underage drinking history has on educational attainment.

Regression analysis not only allows for the identification of relationship(s) but also guides the researcher in estimating the extent of the relationships and quantitatively to determine the significance of the relationship statistically (Sykes, 1993). In this study logistic regression (for binary outcomes) and linear regression (for continuous outcomes) will be utilized accordingly where appropriate.

Logistic regression. Logistic regression analysis is ideal for studying relationships between a binary dependent variable and one or more categorical or continuous predictor variables (Hosmer & Lemeshow, 2000; Howell, 2007; Palei & Das 2009). To determine the adequacy of the model fit, the Hosmer-Lemeshow statistic, which tests for goodness of fit for logistic regression models, was used (Hosmer & Lemeshow, 2000). The Hosmer-Lemeshow statistic enables the user to predict group membership and obtain the results of the analysis as odds ratios. The statistic also leads to better understanding of the nature of the relationships as well as the strength of the relationships between the variables. Using the study variables to illustrate, a further question could be: Does underage drinking history put an individual at a higher probability of low educational attainment than that of alcohol dependence?

Assumptions of logistic regression. In order to obtain reliable estimation in logistic regression, it is assumed that the independent variables are not highly correlated and that the sample size is large enough to allow sufficient numbers in both categories of the dependent variable. The more the number of independent variables, the larger the sample size required for logistic regression. To obtain a reasonable power of the Hosmer-Lemeshow test, a sample size of 400 and above is required (Agresti, 1996; Aiken & West, 1991; Bewick, Cheek, & Ball, 2005).

Linear regression. Linear regression is a statistical approach that enables one to further examine the nature of the relationships between the independent and dependent variables of a study (Cohen, Cohen, West, & Aiken, 2003; Draper & Smith, 1998). In any given study where linear regression analysis is used, linear regression enables the researcher to determine whether and how the independent variables can predict the dependent variable. Furthermore, linear regression enables the expression of the relationships between the independent variables and the dependent variable in the form of simple equations (Cohen et al., 2003; Draper & Smith, 1998; Howell, 2007).

Assumptions of linear regression. In using linear regression techniques, four basic assumptions about the variables are made. These assumptions are: linearity – that the relationship between the dependent variable and the independent variables is linear; independence – that errors in the independent variables are uncorrelated with each other; normality – that the dependent variable is normally distributed; and finally the assumption of homoscedasticity – that there is equal variance for each value of the independent variables (Cohen et al., 2003; Draper & Smith, 1998).

To answer the fifth research question about demographic differences, t-tests or will be utilized for continuous data while for categorical data a Chi-square test or the odds ratios of the logistic regression method will be used. The t-test is a test of statistical hypothesis whereby the test statistic obtained is in the form of the Student's t distribution, should the null hypothesis be sustained. T-tests are used most frequently to determine whether two sets of data differ statistically significantly from one another when the test statistic follows a normal distribution (Hinkle et al., 1998; Vogt & Johnson, 2011).

Summary of Assumptions, Advantages, and Limitations of the Methods

As is usually the case, the choice of methods of analysis as well as analysis tools in any study comes with certain assumptions. There are also advantages or merits to every method along with limitations. For this study, correlation analysis is one method of analysis chosen for the purposes of determining whether the variables of the study are statistically related, and if so which variables are correlated, the strength of the relationships as well as the direction of the relationship – that is, whether the variables are positively or negatively correlated (Cohen & Cohen, 1975; Howell, 2007; Pedhazur, 1982; Sykes, 1993). Limitations of correlation analysis include the fact that correlation does not mean or prove causation, detect confounding variables, or provide the same information about the data, as a scatter plot diagram for instance would render. Correlation analysis assumes independence of observations and that both independent and dependent variables are random. This assumption has to be met in order for a researcher to accurately use correlation analysis (Cohen & Cohen, 1975; Howell, 2007; Pedhazur, 1982; Sykes, 1993).

The use of linear regression has the advantage of being able to assess which independent variables can predict a dependent variable, if possible, and how. However, a primary limitation of linear regression is that it cannot handle dichotomous and categorical dependent variables (Agresti, 1996; Bewick et al., 2005; Palei, & Das, 2009).

Logistic regression offers a way to handle the dichotomous categorical form of the dependent variable, relaxes the assumptions of linear regression, and provides prediction of group membership with an odds ratio. Logistic regression is limited in three main areas as follows: Continuous dependent variables cannot be predicted using logistic regression; in order to obtain accurate estimates of parameters, logistic regression cannot be used with small sample

sizes; and, logistic regression can only be used for between subjects designs and not for within-subjects design (Agresti, 1996; Aiken & West, 1991; Bewick et al., 2005; Hosmer, & Lemeshow, 2000; Palei, & Das, 2009).

The above-mentioned limitations of the three main data analyses procedures planned for this study do not hold given that, the correlation analyses to be used for the study are intended for studying the relationships between variables of the study only. With regards to linear and logistic regression analyses, only procedures conducive to obtaining accurate results will be performed with each regression analysis type. That is to say that the choice of appropriate analyses will be determined by the nature of the variables being used. Furthermore, the sample for this study is large and therefore sample size limitation of logistic regression does not hold for this study.

Methodological Step 1. Operationalization of *Predictor (Independent) Variables*

Main predictor variable

The main predictor variable is the conceptual variable *Underage Drinking*, which is available in the survey data set from the variable *ALCTRY (Age at Onset of Drinking)* and represented by the construct variable *UDHISTORY (Underage Drinking History)*. Thus the variable *UDHISTORY* is constructed as a dichotomous version of the variable *ALCTRY* and is labeled as *UDHISTORY (1, 0)* with the value 1= Yes if $ALCTRY < 21$, and 0 = No if $ALCTRY \geq 21$.

Length of Period of Underage Drinking (LOPUD). The main predictor variable is augmented by this variable, which is constructed as the difference between the age at onset of drinking and the legal drinking age if the respondent is *CLAD*, while for *CUD* respondents, it is constructed as the difference between current age as at survey year and the age at onset of

drinking alcohol. Thus $LOPUD = AGE - ALCTRY$ if respondent is *CUD*, and $LOPUD = 21 - ALCTRY$ if respondent is *CLAD*.

Demographic predictor variables. Demographic predictor variables included in the present study include the following:

Age category (CATAG7). Table 2 below depicts the categories and frequency distribution of this variable.

Table 2 Age Category frequency counts in the survey data

Category	N	Percent
12-13 Years Old	5979	10.3%
14-15 Years Old	6174	10.7%
16-17 Years Old	6461	11.2%
18-20 Years Old	7634	13.2%
21-25 Years Old	11678	20.2%
26-34 Years Old	5904	10.2%
35 or Older	14043	24.3%
Totals	57873	100%

The non-categorical version of this variable is named *AGE* and computed as the difference between the survey year 2010 and the respondent's date of birth. For purposes of clarity and convenience the following variables *CUD* and *CLAD* are also created from the variable *AGE* for respondents who met the study criteria. Looking at the two variables with their value as was introduced in Chapter 1,

Currently underage drinking, CUD (1 = Yes if $AGE < 21$, 0 = No if $AGE \geq 21$):

Currently Legal age Drinking, CLAD (1 = Yes if $AGE \geq 21$, 0 = No if $AGE < 21$): it is easily seen here that the variable *CLAD* is the direct opposite of the variable *CUD*.

Gender (0 = Female, 1 = Male): This variable is a recode of the survey dataset variable for gender named *IRSEX* which is a dichotomous nominal variable originally coded 1 for male and 2 for female.

Race/ethnicity. This variable is represented in the survey dataset by *NEWRACE2*, which is a categorical nominal variable with 7 categories: Table 2 provides details of the variables along with frequency counts for each category.

Table 3 Race/Ethnicity Frequency Counts in the survey data

Race/Ethnicity	N	Percent
Non-Hispanic White	36,304	62.7%
Non-Hispanic Black	7,221	12.5%
Hispanic	9,255	16.0%
Non-Hispanic Asian	2,069	3.6%
Non-Hispanic Mixed Race	1,818	3.1%
Non-Hispanic Native American	903	1.6%
Non-Hispanic Pacific Islander	303	0.5%
Total	57,873	100%

Marital status. The table below provides details of this variable along with frequency counts for each category, as contained in the survey data set.

Table 4 Marital Status Frequency Counts in the survey data

Marital Status	N	Percent
Married	13,873	28.4%
Widowed	962	2.0%
Divorced/Separated	3,578	7.3%
Never Married	30,463	62.3%
Legitimate skip (≤ 14 years old)	8,997	
Total	57,873	100%

Methodological Step 2: Operationalization of Criterion (Dependent) Variables

Mental health impairment in terms of alcohol dependence

Alcohol dependence, AD (0, 1). The MHI variable in terms of alcohol dependence is the variable *DEPNDA LC*, which is dichotomous and nominal in its original form in the dataset. For the sake of convenience and in conformity with nomenclature used in this study, it is renamed *AD* with values 1 = Yes, and 0 = No, indicating whether or not a respondent is identified as being alcohol dependent respectively.

Poor human capital acquisition in terms of poor educational attainment

Poor educational attainment, PEA (0, 1)

The variable *EDUCCAT2* is the antecedent to the criterion variable for HCA in terms of overall level of *educational attainment*. *EDUCCAT2* was recoded into a categorical antecedent criterion variable *PEA* with two categories in terms of poor educational attainment as: (1 = Yes, Less than High School Education, 0 = No, High School or more).

Concomitant alcohol dependence and poor educational attainment

CADAPEA (0, 1). This a constructed variable from AD and PEA which represents the incidence of concomitant MHI in terms of alcohol dependence and poor HCA in terms of poor educational attainment giving rise to a dichotomous nominal variable, *CADAPEA* (1 = Yes, if both AD and PEA are yes, and 0 = No, if both AD and PEA are not yes).

Methodological Step 3: Data Screening and Preliminary/Residual Analyses

The criterion and predictor variables were screened using the SPSS statistical package for accuracy of data entry, missing values, outliers, normality, linearity, and homoscedasticity. Frequency tables were used to identify cases in which data may have been entered in error. Mean substitution was used to estimate missing values of the independent (predictor) and criterion variables prior to the regression analysis. Normality, linearity, and homoscedasticity of variables were examined using histograms, scatter plots of the residuals, and skewness; kurtosis statistics were used to check the assumptions of regression analysis.

After the preliminary statistical procedures, the variables were entered into the logistic regression model. Then, odds ratios $exp(B)$ were utilized to provide an estimate of the effect of the predictor variables on the probability of a successful target outcome of the criterion variable, in this case, the probabilities of alcohol dependence, poor educational attainment, and concomitant occurrence of both as posed in research questions 2, 3, and 4 respectively.

Any odds ratio greater than 1 indicated a greater likelihood (higher probability) of alcohol dependence, poor educational attainment, and concomitant alcohol dependence and poor educational attainment accordingly as posed in research questions 2, 3, and 4.

Analogously, any odds ratio less than 1 indicated less likelihood (lower probability) of alcohol dependence, poor educational attainment, or the concomitance of both, accordingly as posed in

research questions 2, 3, and 4. Similarly, any odds ratio equal to 1 was considered as indicating equal probability for either alcohol dependence, poor educational attainment, or the concomitance of both accordingly as posed in research questions 2, 3, and 4.

Finally residual analyses were carried out in order to examine whether any assumptions of the methods had been violated and may have caused problems to the regression models.

Methodological Step 4: Methods Used to Answer Specific Research Questions

As pointed out earlier, in each of the various analysis methods adopted for this research, the level of significance was set at $\alpha = .05$.

The first research question was answered using correlation analysis, which was appropriate for scrutinizing the strength, direction and significance of the bivariate relationship between the criterion variable and each of the predictor variables. The correlation analysis served as an important prelude to the regression analyses that were used for the other research questions since correlation does not substantiate cause-and-effect. Before calculating a correlation coefficient, the data was screened for outliers (which could cause misleading results) and for evidence of a relationship. Where the relationship between two variables was found to be non-linear, Pearson's r coefficient was not used. Instead Spearman's rho or Kendall's tau-b were used for variables with ordered categories. For dichotomous nominal variables, the statistics Phi, Chi-squares and log of odds-ratio were used for measuring association.

In order to answer research questions 2, 3, 4 and 5, the hypothesized relationships among variables were tested using logistic regression analysis which was appropriate for examining not only the predictive power of the predictor variables on the criterion variable but also the contribution of each predictor variable. Hosmer and Lemeshow's (2000) model building approach along with a hierarchical procedure that examines the incremental variance accounted

for by a set of predictor variables after sharing out the effects of the previously entered independent variables was adopted. Thus, the predictor variable or sets of variables were entered into the logistic regression analysis model in a predetermined order according to the logic or theory behind the hypothesized relations.

The result of the assessment between each criterion variable and each of the independent variables helped in identifying high inter-correlations and assisted in determining when and which variables are excluded from the logistic regression model. Also, individual cross-tabulations were run between each criterion variable and the remaining predictor variables. The direction of the relationships was inspected through evaluation of the (*B*) coefficient for each independent variable, and statistics were evaluated for measures of association.

Methodological Step 4.1: Research Question 1

1. Are there statistically significant correlations between UDHISTORY and CADAPEA in relation to age, gender, and race/ethnicity?

Hypothesis

H₁: *Underage drinking history, in relation to current age, gender, and race/ethnicity, correlates with concomitant alcohol dependence and poor educational attainment in a statistically significant way.*

Null Hypothesis

H₀₁: *There are no statistically significant correlations between these variables.*

Analysis Performed. Using SDA and SPSS Correlation Analysis software tools, correlation procedures were run to obtain a general bivariate correlation matrix of all variables involved this question. The output of the correlation procedure was analyzed to ascertain the patterns of correlation between the variables. The magnitudes and directions of the correlation

coefficients were noted. The significance of any correlation was judged by the pre-specified alpha value of 0.05 for a two-tailed test.

Methodological Step 4.2: Research Question 2 (with Question 5)

Do CLADs with UDHISTORY have statistically significant, higher probability of alcohol dependence than CLADs without UDHISTORY?

Are there demographic (age, gender, race/ethnicity) differences among individuals specified in the research question above?

Hypotheses

H₂: CLADs with UDHISTORY have significantly higher probability of alcohol dependence than CLADs without UDHISTORY.

H₅: There are statistically significant demographic (age, gender, race/ethnicity) differences among CLADs with underage drinking history in the research question above.

Null Hypotheses

H₀₂: There is no statistically significant difference in probability of alcohol dependence between CLADs with UDHISTORY and those without UDHISTORY.

H₀₅: There are no statistically significant demographic differences among CLADs with UDHISTORY in the research question above.

Analysis Performed: The answers to question 2 and the relevant part of question 5 were obtained at the same time by running three sets of regression to analyze the effects of the main predictor variable *UDHISTORY* (*Underage drinking history*) and the role of the independent demographic variables (*Current Age, Gender, Race/Ethnicity*) in the prediction process. These sets of regression were run for *Alcohol Dependence (AD)*. In each regression, *AD* was entered and then the predictor variables followed hierarchically. In the hierarchical manner,

UDHISTORY was entered first and its effect alone recorded and then the demographic and other relevant variables were entered singly and in sets to ascertain their effects.

Then, the odds ratio $\exp(B)$ was used to provide an estimate of the ability of *UDHISTORY* to predict the probability of high tendencies of MHI in terms of *AD*. Where the odds ratio was greater than 1, it indicated a greater likelihood (higher probability) of alcohol dependence in the given case. Analogously, an odds ratio less than 1 was indicative of less likelihood (lower probability) of alcohol dependence. Also odds ratios equal to 1 indicated equal probability for either (higher or lower tendency of probability) of alcohol dependence.

Similarly, the odds ratios $\exp(B)$ for each demographic variable was used to provide an estimate of the ability of the demographic variable to influence the predictor in each case. Furthermore odds ratios were used to ascertain whether or not there are demographic differences among currently legal age drinkers (CLADs) in this research question. For example odds ratio indicated whether the incidence of *Alcohol Dependence* was influenced by gender, whether and by how much the odds of *Alcohol Dependence* were higher or lower for males than for females. Odds ratio also indicated whether the incidence of *Alcohol Dependence* went up or down with *Current Age and Race/Ethnicity*. In this way, the answer to research question 5 in relevance to question 2 was provided.

Methodological Step 4.3: Research Question 3 (with Question 5)

Do CLADs with UDHISTORY have significantly higher probability of poor educational attainment than CLADs without UDHISTORY?

Are there demographic (age, gender, race/ethnicity) differences among individuals specified in the research question above?

Hypotheses

H₂: CLADs with UDHISTORY have significantly higher probability of PEA than CLADs without UDHISTORY.

H₅: There are statistically significant demographic (age, gender, race/ethnicity) differences among CLADs with UDHISTORY in the research question above.

Null Hypotheses

H₀₂: There is no statistically significant difference in probability of PEA between CLADs with underage drinking history and those without underage drinking history.

H₀₅: There are no statistically significant demographic differences among CLADs with underage drinking history in the research question above.

Analysis Performed: The answers to research question 3 and the relevant part of research question 5 were obtained at the same time by running three sets of regression equations to analyze the effects of the main predictor variable *UDHISTORY* (*Underage drinking history*) and the role of the independent demographic variables (*Current Age, Gender, Race/Ethnicity*) in the prediction process. These sets of equations were for *PEA*. In each equation, the criterion variable *PEA* was entered and then the predictor variables followed hierarchically in the regression procedure. In a hierarchical manner, *UDHISTORY* was entered first and its effect alone recorded and then the demographic and other relevant variables were entered singly and in sets to ascertain both their main and interaction effects.

Then, the odds ratios $exp(B)$ was used to provide an estimate of the ability of *UDHISTORY* to predict the probability of high tendencies of poor HCA in terms of *PEA*. An odds ratio greater than 1 indicated a greater likelihood (higher probability) of poor educational attainment in the given case. Analogously, an odds ratio less than 1 was indicative of less likelihood (lower probability) of poor educational attainment. Also an odds ratios equal to 1

indicated equal probability for either higher or lower tendency of probability of poor educational attainment.

Similarly, the odds ratios $exp(B)$ for each demographic variable was used to provide an estimate of the ability of the demographic variable to influence the predictor in each case. Furthermore odds ratios were used to ascertain whether or not there were demographic differences among currently legal age drinkers (CLADs) in this research question. For example the odds ratio indicated whether the incidence of *poor educational attainment* is influenced by gender, whether and by how much the odds of poor educational attainment are higher or lower for males than for females, meaning that there's a bigger or smaller chance of male drinkers to have poor educational attainment than female drinkers or vice versa. The odds ratio also indicated whether the incidence of *PEA* went up or down with *Current Age* and *Race/Ethnicity*.

Methodological Step 4.4: Research Question 4 (with Question 5)

Do CLADs with UDHISTORY have significantly higher probability of CADAPEA than CLADs without UDHISTORY?

Are there demographic (age, gender, race/ethnicity) differences among individuals specified in the research question above?

Hypotheses

H₄: *CLADs with UDHISTORY have significantly higher probability of CADAPEA than CLADs without UDHISTORY.*

H₅: *There are statistically significant demographic (age, gender, race/ethnicity) differences among CLADs with UDHISTORY in the research question above.*

Null Hypotheses

H₀₄: *There is no statistically significant difference in probability of CADAPEA between CLADS with UDHISTORY and those without UDHISTORY.*

H₀₅: *There are no such statistically significant demographic differences among CLADS with UDHISTORY in the research question above.*

Analysis Performed: The answers to question 4 and the relevant part of question 5 were obtained at the same time by running three sets of regression equations to analyze the effects of the main predictor variable *UDHISTORY* (*Underage drinking history*) and the role of the independent demographic variables (*Current Age, Gender, Race/Ethnicity*) in the prediction process. These sets of equations were for *CADAPEA* (*Concomitant Alcohol Dependence and Poor Educational Attainment*). In each equation, the criterion variable *CADAPEA* was entered and then the predictor variables followed hierarchically in the regression procedure.

In the hierarchical manner, *UDHISTORY* was entered first and its effect alone was recorded and then the demographic variables were entered singly and in sets to ascertain both their main and interaction effects. Then, the odds ratio $\exp(B)$ was used to provide an estimate of the ability of *UDHISTORY* to predict the probability of having *CADAPEA*. An odds ratio greater than 1 indicated a greater likelihood of concomitant alcohol dependence and poor educational attainment. Analogously, an odds ratio less than 1 was indicative of less likelihood (lower probability) of concomitant alcohol dependence and poor educational attainment. Also an odds ratios equal to 1 indicated equal probability for either higher or lower tendency of probability) of concomitant alcohol dependence and poor educational attainment.

Similarly, the odds ratio $\exp(B)$ for each demographic variable was used to provide an estimate of the ability of the demographic variable to influence the predictor. Furthermore odds

ratios were used to ascertain whether or not there are demographic differences among currently legal age drinkers (CLADs) in this research question. For example the odds ratio indicated whether the incidence of concomitant alcohol dependence and poor educational attainment is influenced by gender, whether and by how much the odds of concomitant alcohol dependence and poor educational attainment are higher or lower for males than for females. This would mean that there's a bigger or smaller chance of male drinkers to have concomitant alcohol dependence and poor educational attainment than female drinkers or vice versa. The odds ratio also indicates whether the incidence of concomitant alcohol dependence and poor educational attainment went up or down with *Current Age* and *Race/Ethnicity*.

CHAPTER 4

RESULTS

In this chapter, results of the data analyses performed are organized and presented starting with descriptive statistics of the variables and relevant demographic information.

Demographic Information

The first step toward data analysis for this study was examination of the frequencies of demographic variables included in this study. Descriptive statistics for those variables are as follows:

Current Age. A tabular view of the frequency counts for age categories in the survey overall was provided (see Table 1) in the previous chapter. Being that the present study is focused on the adult population 25 -75 years old, the re-categorized frequency distribution for the purposes of this study is presented here in Table 4 which shows that the 25-34 years age group were the most represented in the sample followed by the 35-44 years age group while the least represented was the 65 and older age group.

Table 5 Frequency distribution of Current Age used for the study

Label	<i>n</i>	Value	Percent
25-34 Years Old	7471	1	38.8%
35-44 Years Old	4886	2	25.4%
45-54 Years Old	3926	3	20.4%
55-64 Years Old	1886	4	9.8%
65 or Older	1071	5	5.6%
Total	19240		100%

Gender. The distribution of gender in the survey population was as follows: Male (N = 27798, 48%) and Female (N = 30075, 52%). In the study sample the gender distribution was similar: Male (n = 9019, 47%) and Female (n = 10221, 53%). This distribution shows that although there were more females than males, both genders were almost equally represented in the sample.

Race/Ethnicity. The frequency distribution of Race/Ethnicity used for the study is presented in the table below. This distribution is fairly similar to that of the survey data shown in Table 2 of the previous chapter. The non-Hispanic Whites by far outnumbered the other racial/ethnic groups. The least represented groups were the non-Hispanic Asians, Mixed races, Natives and Pacific Islanders.

Table 6 Frequency distribution of Race/Ethnicity used for the present study

Race/Ethnicity	<i>n</i>	Percent
Non-Hispanic White	13,430	69.8 %
Non-Hispanic Black	2,060	10.7 %
Hispanic	2,374	12.3 %
Non-Hispanic Asian	598	3.1 %
Non-Hispanic Mixed Race	445	2.3 %
Non-Hispanic Native American	263	1.4 %
Non-Hispanic Pacific Islander	70	.4 %
Total	19,240	100 %

Marital Status. The frequency distribution of Marital Status used for the study is presented in Table 6 below, which shows that more than half of the respondents in the sample

were married, more than 25% were never married, while the widowed (2.5%) were the least represented. Those who were either divorced or separated made up 15.5% of the sample.

Table 7 Frequency distribution of Marital Status used for the study

Marital Status	<i>n</i>	Percent
Married	10,468	54.4%
Widowed	490	2.5%
Divorced/Separated	2,977	15.5%
Never Married	5,305	27.6%
Total	19,240	100%

Result for Research Question 1

Does underage drinking history (UDHISTORY) in relation to current age, gender, and race/ethnicity correlate with concomitant alcohol dependence and poor educational attainment (CADAPEA) in a statistically significant manner?

This research question was addressed by running Chi-square cross tabulations that provided a variety of tests and measures of association between the dichotomous criterion variable CADAPEA and the main predictor variable UDHISTORY controlling for *Current age, Gender, and Race/ethnicity* based on the study criteria. The nature of the variables in terms of issues such as whether the categories are nominal or ordered determined the test statistics or measures used to summarize the strength and statistical significance of the observed relationships as shown in Table 7.

Since most of these variables were in dichotomous nominal form, the main statistic used was *phi*, which is a chi-square based nominal directional measure of association that divides the

chi-square statistic by the sample size and takes the square root of the result. This nominal directional measure indicated both the strength and significance of the relationship between CADAPEA and UDHISTORY in each cross tabulation. Usually the value of *phi* statistic could range from 0 to 1 indicating the proportional reduction in using UDHISTORY to predict CADAPEA. Low significance values ($p < 0.05$) would indicate that there was a relationship between the two variables.

Table 8 Correlation between CADAPEA and UDHISTORY in relation to demographics

Variables	Chi-square (Pearson's)	Phi	Significance (<i>p</i> -value)
Current Age (AGE-RECAT)	16.72	0.03	0.00*
25-34 years old	13.02	0.05	0.00*
35-44 years old	1.31	0.02	0.25
45-54 years old	0.51	0.01	0.48
55-65 years old	2.03	0.04	0.15
65 years or older	0.75	0.03	0.39
Current Age (AGE-RECAT2)	16.72	0.03	0.00*
25-34 years old	13.02	0.05	0.00*
35 years or older	4.44	0.02	0.04*
Gender	16.72	0.03	0.00*
Male	2.81	0.02	0.00*
Female	14.39	0.04	0.00*
Race/Ethnicity	16.72	0.03	0.00*
Non-Hispanic White	8.13	0.03	0.00*
Non-Hispanic Black	6.75	0.06	0.01*

Variables	Chi-square (Pearson's)	Phi	Significance (p-value)
Non-Hispanic Pacific Islander	0.23	0.06	0.65
Non-Hispanic Mixed	0.85	0.05	0.36
Non-Hispanic Asian	0.96	0.04	0.33
Hispanic	3.81	0.05	0.05

* Low significance values ($p < 0.05$) indicating a relationship

Correlation between concomitant alcohol dependence and poor educational attainment (CADAPEA) and underage drinking history (UDHISTORY) in relation to AGE. After controlling for AGE, there was an overall positive and statistically significant association between *concomitant alcohol dependence and poor educational attainment* (CADAPEA) and *underage drinking history* (UDHISTORY). However, on closer inspection of the re-categorized age variable AGE-RECAT used, it turned out that this association was statistically significant only for the age category 25-34 years perhaps due to its relatively large frequency. Upon collapsing the remaining smaller groups into one age group, positive and statistically significant associations were observed between CADAPEA and UDHISTORY in both categories of the new dichotomous age variable AGE-RECAT2. The association was stronger for the 25-34 years age category ($phi = 0.04, p < .05$) than for the 35 years and older age category ($phi = 0.02, p > .05$).

Correlation between concomitant alcohol dependence and poor educational attainment (CADAPEA) and underage drinking history (UDHISTORY) in relation to GENDER. The association between *concomitant alcohol dependence and poor educational attainment* (CADAPEA) and *underage drinking history* (UDHISTORY) remained positive and statistically significant after controlling for gender overall ($phi = 0.03, p < .05$). However, upon

reconsidering this overall result in specific detail, this association was statistically significant for females ($\phi = 0.04$, $p < .05$) but not for males ($\phi = 0.02$, $p > .05$).

Correlation between concomitant alcohol dependence and poor educational attainment (CADAPEA) and underage drinking history (UDHISTORY) in relation to RACE/ETHNICITY. Overall there was a positive and statistically significant association between CADAPEA and UDHISTORY after controlling for RACE/ETHNICITY ($\phi = 0.03$, $p < .05$). But singly, the association between CADAPEA and UDHISTORY was positive and statistically significant for only three groups: non-Hispanic White ($\phi = 0.03$, $p < .05$), non-Hispanic Black ($\phi = 0.06$, $p < .05$), and Hispanic ($\phi = 0.05$, $p < .05$). This result showed that the statistically significant association between CADAPEA and UDHISTORY was strongest for the non-Hispanic Blacks followed by the Hispanics. For the remaining four groups, the association between CADAPEA and UDHISTORY was positive but not statistically significant perhaps due to their relatively smaller frequencies in the sample.

Result for Research Question 2 with 5

Do CLADs with UDHISTORY have significantly higher probability of alcohol dependence than CLADs without UDHISTORY?

Are there demographic (age, gender, race/ethnicity) differences among individuals specified in the research question above?

Research question 2 was addressed by running logistic regressions of AD on the main predictor UDHISTORY alone and subsequently in relation to the demographic variables regarding the corresponding part of research question 5. A hierarchical modeling along with Hosmer and Lemeshow's (2000) model building approach was used.

In the first regression, only UDHISTORY was entered. In the second regression, four blocks of variables were entered, with UDHISTORY in the first block, the demographic variables in the second, third and fourth blocks. Four dummy vectors represented the categories of the age variable entered in the second block with the 25-34 years old category serving as a reference group. Gender was input in the third block. In the fourth block, the variables were race/ethnicity represented by six dummy vectors. Since the sub-sample size for Non-Hispanic White race was larger than the others, this group was used as reference vector to other race/ethnic groups and therefore was not entered as input in the analysis. The statistical analyses of the effects of these variables on the prediction of AD based on UDHISTORY gave the following results:

UDHISTORY as a lone predictor of AD. Results of the univariate logistic regression analysis showed that the association between UDHISTORY alone and AD was statistically significant $\chi^2(1, n = 19238) = 67.504, p < .001$. The odds ratio, $\exp(B)$ was 3.7 indicating that the odds of developing AD were 3.7 times higher among CLADs 25 years or older with underage drinking history as compared to their counterparts without underage drinking history. In other words, those having UDHISTORY were almost four times more likely to have AD than their counterparts without UDHISTORY. Based on this result, UDHISTORY was considered a statistically significant predictor of AD.

AGE difference in the prediction of alcohol dependence (AD) by underage drinking history UDHISTORY. The association between alcohol dependence (AD) and underage drinking history (UDHISTORY) was positive and statistically significant ($\phi = 0.06, p < .001$). After controlling for AGE, this association remained unchanged and statistically significant. However, when alcohol dependence was regressed on underage drinking history with AGE as a

continuous covariate predictor, the result, $\chi^2(2, n = 19236) = 158.45$, Adjusted Wald $F_{(2, 19236)} = 79.23$, $p < .001$, of the logistic regression showed a slight but statistically significant decrease in the effect of UDHISTORY on AD. The odds ratio of UDHISTORY decreased from 3.7 to 3.6. The log of odds ratio for AGE was a negative value indicating that controlling for underage drinking history, a negative association existed between AGE and AD. The odds ratio was 0.968 suggesting a very little decreasing or no effect of AGE on AD after taking into account the effect of underage drinking history. And upon using the re-categorized dichotomous age variable AGE-RECAT2, it was observed that the odds ratio was 0.56 indicating that, after taking into account the effect of underage drinking history, CLADs in the 35 years or older age category were about 2 times ($1/0.56 = 1.78$) less likely to have AD than CLADs in the 25-34 years old group.

Gender difference in the prediction of AD by underage drinking history

(UDHISTORY). The association between AD and underage drinking history was positive and statistically significant ($\phi = 0.06$, $p < .001$). After controlling for the overall effect of GENDER, this association remained overall unchanged and statistically significant. Also when alcohol dependence was regressed on underage drinking history with gender as a covariate, the result of the logistic regression model was statistically significant $\chi^2(2, n = 19236) = 118.47$, Adjusted Wald $F_{(2, 19236)} = 59.23$, $p < .001$. However, the odds ratio of underage drinking history decreased from 3.7 to 3.4. The odds ratio of GENDER was 1.67 indicating that, after taking into account the effect of underage drinking history, currently legal age drinking males aged 25 years or older were about 1.7 times more likely to have alcohol dependence than their female counterparts.

Race/Ethnicity differences in the prediction of AD by underage drinking history (UDHISTORY). The association between alcohol dependence (AD) and underage drinking history was positive and statistically significant ($\phi = 0.06, p < .001$). After controlling for RACE/ETHNICITY overall, this association remained unchanged and statistically significant. When alcohol dependence was regressed on underage drinking history together with the race/ethnicity dummy vectors using the non-Hispanic White group as a reference, the overall result of the multivariable logistic regression model was statistically significant $\chi^2 (2, n = 19236) = 118.47$, Adjusted Wald $F_{(2, 19236)} = 59.23, p < .001$. The odds ratio of underage drinking history increased from 3.7 to 3.9. All the racial groups showed positive associations with the exception of the non-Hispanic Asian group for which the log of odds ratio was negative but not statistically significant. Similarly, the association between AD and the non-Hispanic Pacific group was not statistically significant. Apart from these two groups, all other racial groups showed a statistically significant association with AD. The non-Hispanic Native group had the highest odds ratio 3.45 indicating that, after taking into account the effect of underage drinking history, non-Hispanic Natives who were CLADs aged 25 years or older were about 3.5 times more likely to have AD than their non-Hispanic White counterparts. The non-Hispanic mixed group had the second highest odds ratio 1.56 indicating that, after taking into account the effect of underage drinking history, non-Hispanic mixed races who were CLADs aged 25 years or older were about 1.6 times more likely to have AD than their non-Hispanic White counterparts. The non-Hispanic Black group had the third highest odds ratio 1.46 indicating that, after taking into account the effect of underage drinking history, non-Hispanic Blacks who were CLADs aged 25 years or older were about 1.5 times more likely to have AD than their non-Hispanic White counterparts. The Hispanic group had the fourth highest odds ratio 1.33 indicating that, after taking into

account the effect of underage drinking history, non-Hispanic Natives who were CLADs aged 25 years or older were about 1.3 times more likely to have AD than their non-Hispanic White counterparts.

Results for Research Question 3 with 5

Do CLADs with underage drinking history have statistically significant higher probability of PEA than CLADs without underage drinking history? Are there demographic (age, gender, race/ethnicity) differences among individuals specified in the research question above?

Research question 3 was addressed by regressing PEA on the main predictor underage drinking history alone and subsequently in relation to demographic variables regarding the corresponding part of research question 5. As with the previous research question, a hierarchical modeling along with Hosmer and Lemeshow's (2000) model building approach was used.

In the first regression, only underage drinking history was entered. In the second regression, four blocks of variables were entered, with underage drinking history in the first block, and the demographic variables in the second, third and fourth blocks. Four dummy vectors represented the categories of the age variable entered in the second block with the 25-34 years old category serving as a reference group. Gender was input in the third block. In the fourth block, the variables were race/ethnicity represented by six dummy vectors. Since the sub-sample size for Non-Hispanic White race was larger than the others, this group was used as a reference vector to other race/ethnic groups and therefore was not entered in the analysis. The statistical analyses of the effects of these variables on the prediction of poor educational attainment (PEA) based on underage drinking history gave the following results:

Underage drinking history (UDHISTORY) as a lone predictor of poor educational attainment (PEA). Results of the univariate logistic regression analysis showed that the

association between underage drinking history alone and PEA was negative and statistically significant $\chi^2(1, n = 19238) = 13.65, p < .001$, with log odds $B = -0.209$ and odds ratio, $\exp(B) = 0.812$ indicating that CLADs aged 25 years or older without underage drinking history were about 1.2 times ($1/0.812 = 1.23$) less likely to have PEA than their counterparts with underage drinking history. Based on this result, underage drinking history was considered a mild but statistically significant predictor of PEA.

AGE difference in the prediction of PEA by underage drinking history

(UDHISTORY). The association between PEA and UDHISTORY was negative and statistically significant ($\phi = -0.03, p < .001$). After controlling for AGE, this association remained negative and statistically significant ($\phi = -0.03, p < .001$). However, when PEA was regressed on underage drinking history with AGE as a continuous covariate predictor, the result, $\chi^2(2, n = 19236) = 18.32$, Adjusted Wald $F_{(2, 19236)} = 9.16, p < .001$, of the logistic regression showed the log odds ratio of UDHISTORY to be negative (-0.217) and the odds ratio was 0.815. The log of odds ratio for AGE was also negative (-0.004) indicating a negative association between AGE and PEA, and the odds ratio was 0.99 suggesting little or no effect of AGE on PEA, taking into account the effect of underage drinking history. But upon using the re-categorized dichotomous age variable AGE-RECAT2, it was observed that the odds ratio for age became 0.812 indicating that, after taking into account the effect of UDHISTORY, CLADs in the 35 years or older age category were about 1.2 times ($1/0.812 = 1.23$) less likely to have PEA than those in the 25-34 years old group.

Gender difference in the prediction of poor educational attainment (PEA) by underage drinking history (UDHISTORY). The association between poor educational attainment and underage drinking history was negative and statistically significant ($\phi = -0.03$,

$p < .001$). After controlling for the effect of GENDER, this association remained overall unchanged and statistically significant. Also when poor educational attainment was regressed on underage drinking history with GENDER as a covariate predictor, the result of the logistic regression model was statistically significant $\chi^2 (2, n = 19236) = 67.79$, Adjusted Wald $F_{(2, 19236)} = 33.89$, $p < .001$ and showed the log odds ratio of UDHISTORY to be negative (-0.259) and an odds ratio equal to 0.772 . But the log of odds ratio for GENDER was positive indicating a positive association between GENDER and PEA. The odds ratio for GENDER was 1.39 indicating that, taking into account the effect of UDHISTORY, male CLADs aged 25 years or older were about 1.4 times more likely to have PEA than their female counterparts.

Race/Ethnicity differences in the prediction of poor educational attainment (PEA) by underage drinking history (UDHISTORY). The association between PEA and UDHISTORY was negative and statistically significant ($\phi = -.03$, $p < .001$). After controlling for RACE/ETHNICITY, this association remained unchanged and statistically significant. When PEA was regressed on UDHISTORY together with the RACE/ETHNICITY dummy vectors using the non-Hispanic White group as a reference group, the overall result of the logistic regression model was statistically significant $\chi^2 (7, n = 19226) = 950.66$, Adjusted Wald $F_{(2, 19226)} = 135.77$, $p < .001$ and showed UDHISTORY to be not statistically significant ($t = -1.23$, $p = 0.226$) with negative log odds ratio (-0.072) and odds ratio 0.772 . All the racial groups showed positive association with PEA except for the non-Hispanic Asian group for which the log odds ratio was negative ($B = -1.077$) and odds ratios $\exp(B) = 0.34$ was statistically significant. Also, the association between poor educational attainment and all the racial/ethnic groups were statistically significant with the exception of the

non-Hispanic Pacific group with a positive but not statistically significant association with poor educational attainment.

The Hispanic group had the highest odds ratio 4.89 indicating that after taking into account the effect of underage drinking history (UDHISTORY), currently legal age drinkers (CLADs) of the Hispanic race/ethnic group aged 25 years or older were about 5 times more likely to have PEA than their non-Hispanic White counterparts. The non-Hispanic Native group had the second highest odds ratio 3.05 indicating that, after taking into account the effect of having UDHISTORY, non-Hispanic Native who were CLADs aged 25 years or older were about 3 times more likely to have poor educational attainment (PEA) than their non-Hispanic White counterparts. The non-Hispanic Black group had the third highest odds ratio 1.95 indicating that, after taking into account the effect of UDHISTORY, non-Hispanic Blacks who were CLADs aged 25 years or older were about 2 times more likely to have PEA than their non-Hispanic White counterparts. The non-Hispanic mixed group had the fourth highest odds ratio 1.76 indicating that after taking into account the effect of UDHISTORY, non-Hispanic mixed races who were CLADs aged 25 years or older were about 1.8 times more likely to have PEA than their non-Hispanic White counterparts.

Result for Research Question 4 with 5

Do currently legal age drinkers (CLADs) with underage drinking history (UDHISTORY) have significantly higher probability of concomitant alcohol dependence and poor educational attainment (CADAPEA) than CLADs without UDHISTORY? Are there demographic (age, gender, race/ethnicity) differences among individuals specified in the research question above?

Comparable to the analyses conducted for research questions 2 and 3, research question 4 was addressed by running logistic regressions of concomitant alcohol dependence and poor

educational attainment on the main predictor underage drinking history (UDHISTORY) alone and subsequently in relation to demographic variables regarding the corresponding part of research question 5. Also, a hierarchical modeling along with Hosmer and Lemeshow's (2000) model building approach was used.

In the first regression, only underage drinking history was entered. In the second regression, four blocks of variables were entered with underage drinking history in the first block, the demographic variables in the second, third and fourth blocks. Four dummy vectors represented the categories of the age variable were entered in the second block with the 25-34 years old category serving as a reference group. Gender was input in the third block. In the fourth block, the variables were race/ethnicity represented by six dummy vectors. Since the subsample size for Non-Hispanic White race was larger than the others, this group was used as reference vector to other race/ethnic groups and therefore was not entered as input in the analysis. The statistical analyses of the effects of these variables on the prediction of poor educational attainment based on underage drinking history gave the following results:

Underage drinking history (UDHISTORY) as a lone predictor of concomitant alcohol dependence and poor educational attainment (CADAPEA). Results of the univariate logistic regression analysis showed that the association between underage drinking history alone and concomitant alcohol dependence and poor educational attainment was statistically significant $\chi^2(1, n = 16323) = 13.97, p < .001$. The odds ratio, $\exp(B) = 4.75$ indicated that the odds of having concomitant alcohol dependence and poor educational attainment were 4.75 times higher among currently legal age drinkers (CLADs) 25 years or older with underage drinking history than their counterparts without underage drinking history. In other words, among respondents aged 25 years or older, CLADs with underage drinking history were close to five times more

likely to experience concomitant alcohol dependence and poor educational attainment than their counterparts without underage drinking history. Based on this result, underage drinking history was considered a strong and statistically significant predictor of concomitant alcohol dependence and poor educational attainment.

AGE difference in the prediction of CADAPEA by underage drinking history. The association between concomitant alcohol dependence and poor educational attainment and underage drinking history was positive and statistically significant ($phi = 0.03, p < .001$). After controlling for AGE, this association remained positive and became stronger but not statistically significant ($phi = 0.06, \chi^2 = 0.38, p = .54$). However, when concomitant alcohol dependence and poor educational attainment was regressed on underage drinking history with AGE as a continuous covariate predictor, the result, $\chi^2 (2, n = 19236) = 18.32$, Adjusted Wald $F_{(2, 19236)} = 9.16, p < .001$, of the logistic regression showed the odds ratio of underage drinking history to be $\exp(B) = 4.58$. The log of odds ratio for AGE was negative ($B = -0.033$) suggesting a negative association between AGE and concomitant alcohol dependence and poor educational attainment, while the odds ratio $\exp(B) = 0.97$ indicated little or no effect of AGE on CADAPEA, after taking into account the effect of underage drinking history. But upon using the re-categorized dichotomous age variable AGE-RECAT2, it was observed that the odds ratio for age became 0.532 indicating that, after taking into account the effect of underage drinking history, currently legal age drinkers (CLADs) in the 35 years or older age category were about 2 times ($1/0.532 = 1.88$) less likely to have CADAPEA than CLADs in the 25-34 years old group. The odds ratio of underage drinking history was $\exp(B) = 4.72$ indicating only a very slight decrement (0.03) from what it was $\exp(B) = 4.75$ in the logistic model with UDHISTORY alone.

Gender difference in the prediction of CADAPEA by underage drinking history

(UDHISTORY). The association between concomitant alcohol dependence and poor educational attainment (CADAPEA) and underage drinking history (UDHISTORY) was positive and statistically significant ($\phi = 0.03, p < .001$). After controlling for the effect of GENDER, this association remained overall unchanged and statistically significant. Also when CADAPEA was regressed on UDHISTORY with GENDER as a covariate predictor, the result of the logistic regression was statistically significant $\chi^2 (2, n = 16321) = 24.85$, Adjusted Wald $F_{(2, 16321)} = 12.42, p < .001$ and showed the odds ratio of UDHISTORY to be $\exp(B) = 4.42$, indicating a decrement of 0.33 from what it was $\exp(B) = 4.75$ in the model with UDHISTORY alone. The odds ratio for GENDER was 1.73 indicating that, taking into account the effect of UDHISTORY, male CLADs aged 25 years or older were about 1.7 times more likely to have CADAPEA than their female counterparts. In other words, upon controlling for gender, the predicted effect of UDHISTORY on CADAPEA decreased in terms of odds ratio by an amount equal to 0.33.

Race/Ethnicity differences in the prediction of CADAPEA by UDHISTORY. The association between CADAPEA and UDHISTORY was positive and statistically significant ($\phi = 0.03, p < .001$). After controlling for RACE/ETHNICITY, this association remained unchanged and statistically significant. When CADAPEA was regressed on UDHISTORY together with the RACE/ETHNICITY dummy vectors using the non-Hispanic White group as a reference group, the overall result of the logistic regression model was statistically significant $\chi^2 (7, n = 16311) = 109.26$, Adjusted Wald $F_{(2, 19226)} = 15.60, p < .001$ and showed UDHISTORY to be statistically significant with an increased odds ratio $\exp(B) 5.69$. Three groups, Pacific, Asian and Mixed race/ethnic groups were not statistically significant. Also the association between

CADAPEA and all the racial/ethnic groups was positive with the exception of the non-Hispanic Asian group with a negative but non-statistically significant association with CADAPEA. The non-Hispanic Native group had the highest odds ratio 10.85 indicating that, after taking into account the effect of UDHISTORY, 25 years or older non-Hispanic Native CLADs were about 11 times more likely to have CADAPEA than their non-Hispanic White counterparts. The Hispanic group had the second highest odds ratio 4.21 indicating that, after taking into account the effect of UDHISTORY, 25 years or older non-Hispanic Native CLADs were about 4 times more likely to have CADAPEA than their non-Hispanic White counterparts.

The non-Hispanic Black group had the third highest odds ratio 3.55 indicating that, after taking into account the effect of UDHISTORY, 25 years or older non-Hispanic Black CLADs were about 3.6 times more likely to have CADAPEA than their non-Hispanic White counterparts. The non-Hispanic Pacific group had the fourth highest odds ratio 3.02 indicating that, after taking into account the effect of UDHISTORY, 25 years or older non-Hispanic Pacific CLADs were about 11 times more likely to have CADAPEA than their non-Hispanic White counterparts, but this result is not statistically significant ($t = 1.09, p = 0.278$). The non-Hispanic Mixed group had the fifth highest odds ratio 1.96 indicating that, after taking into account the effect of UDHISTORY, 25 years or older non-Hispanic Mixed race CLADs were about 2 times more likely to have CADAPEA than their non-Hispanic White counterparts, but this result is not statistically significant ($t = 1.30, p = 0.193$). The non-Hispanic Asian group had the lowest odds ratio 0.74 indicating that after taking into account the effect of UDHISTORY, 25 years or older non-Hispanic Mixed race CLADs were about 1.4 times ($1/0.74 = 1.35$) less likely to have CADAPEA than their non-Hispanic White counterparts, but this result is not statistically significant ($t = -0.429, p = 0.668$).

Summary of Findings

The NSDUH 2010 survey dataset contained a final sample size of 57,873 respondents. Among these, some 27,516 (70% of valid cases) were currently legal age drinkers (CLADs) as at the survey period. Respondents considered in this study were the 19,100 CLADs aged 25-75, about 69% of all CLADs in the overall sample. About 47% of these respondents were male 52% were female. There were seven race/ethnicity groups. The largest group was non-Hispanic White group (67.8%) followed by the Hispanic (13.4%). The non-Hispanic Black group was 10.9%. The remaining groups were each five percent or less. The average age at onset of drinking was about 17 years. Age at onset of drinking was slightly higher for males than for females (17.95 years old and 16.3 years old) respectively.

Most (84%) of respondents in the study had underage drinking history (UDHISTORY). Among those with underage drinking history, 42% (11,566) were males and 11,909 were females. The average length of period of underage drinking (LOPUD) was 5.3 years. Males had longer periods of underage drinking (5.6years) than females (5 years). About 4.3% (815) of respondents in the study had alcohol dependence (AD). Males had higher prevalence of alcohol dependence 2.6% (496) than females 1.7% (319). Majority of respondents in the study (88% or 16,808) completed high school and 12% (2,292) did not complete high school education. The 12% who did not complete high school fall under the poor educational attainment (PEA) classification. Among those with PEA, 55% (1,264) were males and 1103 were females. About 1.0% (153) of the respondents considered in the study experienced concomitant alcohol dependence and poor educational attainment (CADAPEA) and among them 0.6% (93) were males while 60 were females, but there was missing data (2876, 5% of sample) for this variable.

The final multivariable logistic regression model for underage drinking history (UDHISTORY) as a predictor of concomitant alcohol dependence and poor educational attainment (CADAPEA) was identified. The model contained 6 predictors (UDHISTORY, AGE-RECAT2, GENDER_x, RACE-BLACK, RACE-HISPANIC, RACE-ASIAN) and the number of cases in the smaller criterion dichotomy group was 230 comprising of those respondents without CADAPEA, and as such the model met Hosmer and Lemeshow's minimum sample size. This model was statistically significant, $\chi^2(6, n = 55) = 170.43$, Adjusted Wald $F_{6, 55} = 26.04$, $p = 0.00 < .001$, accounting for 1.8% (Cox and Snell R square), 7.2% (Log Likelihood Pseudo R square) to 7.9% (Nagelkerke R square) of the variance in CADAPEA. Some effects of demographic variables of the study on UDHISTORY as a predictor of CADAPEA are notable. Study outcomes that helped satisfy the second half of the purpose of the study include findings showing that, controlling for other variables in the model, CLAD respondents aged 25 years or older were more likely to experience CADAPEA if they were males (1.8 times). Also, when compared to their non-Hispanic White counterparts, CLAD respondents aged 25 years or older were more likely to have experienced CADAPEA if they were non-Hispanic Native (11 times), Hispanic (3.7 times) and non-Hispanic Black (3.4 times). Findings also suggest that as age increased, respondents were less likely to experience CADAPEA. In fact, respondents' current age in dichotomous form had an odds ratio of 0.597 indicating that CLAD respondents aged 35 years or older were almost twice ($1/0.597 = 1.7$) less likely to experience CADAPEA, controlling for other variables in the model. In Chapter 5, a discussion of these findings in light of the literature reviewed is presented along with the implications, some conclusions and recommendations for further study.

CHAPTER 5

DISCUSSION

The background to this study has been given in the introduction, Chapter 1 followed by the literature review in Chapter 2, methodology in Chapter 3, and results of the analyses carried out for the study in Chapter 4. In this last chapter, a discussion is presented along with implications of the findings, limitations of the study, and the work is concluded with some recommendations for future research. Noteworthy outcomes of the data analyses are highlighted and compared with what was found in the literature. Further hypotheses are made in the light of the findings from both the present study and the literature reviewed. Recommendations for future research in this direction are also provided.

Summary of the Study

Concomitant Alcohol Dependence and Poor Educational Attainment (CADAPEA) is a resultant serious condition facing underage drinkers who are exposed to a number of negative consequences – economic, civil, social, educational, mental and physical health impairments – that interrupt their normal lives immediately and in the long run, and in many cases warranting rehabilitative services. The purpose of this study has been to use correlation and regression analyses to examine the relationships between underage drinking, alcohol dependence and poor educational attainment based on the 2010 National Survey on Drug Use and Health data set ICPSR 32722-0001. In particular, this extant data set has been used in the study to examine whether and how underage drinking history predicted concomitant alcohol dependence and poor educational attainment. Furthermore, whether demographic factors (age, gender, and race/ethnicity) had any influence on the prediction has been investigated.

Research Questions

This study was guided by five research questions:

1. Are there statistically significant correlations between underage drinking history and concomitant alcohol dependence and poor educational attainment in relation to age, gender, and race/ethnicity?
2. Do currently legal age drinkers with underage drinking history have higher probability of alcohol dependence than currently legal age drinkers without underage drinking history?
3. Do currently legal age drinkers with underage drinking history have a higher probability of poor educational attainment than currently legal age drinkers without underage drinking history?
4. Do currently legal age drinkers with underage drinking history have a higher probability of concomitant alcohol dependence and poor educational attainment than currently legal age drinkers without underage drinking history?
5. Are there statistically significant demographic (age, gender, race/ethnicity) differences among individuals specified in research questions 2, 3, and 4 above?

Research Hypotheses

In line with the research questions above, the following null hypotheses were tested.

H_{01} : There are no statistically significant correlations between underage drinking history and concomitant alcohol dependence and poor educational attainment in relation to age, gender, and race/ethnicity.

H_{02} : There is no statistically significant difference in probability of alcohol dependence between currently legal age drinkers with underage drinking history and currently legal age drinkers without underage drinking history.

H₀₃: There is no statistically significant difference in probability of poor educational attainment between currently legal age drinkers with underage drinking history and currently legal age drinkers without underage drinking history.

H₀₄: There is no statistically significant difference in probability of concomitant alcohol dependence and poor educational attainment between currently legal age drinkers with underage drinking history and currently legal age drinkers without underage drinking history.

H₀₅: There are no statistically significant demographic differences among currently legal age drinkers with underage drinking history in research questions 2, 3, and 4 above.

The 2010 National Survey on Drug Use and Health data set ICPSR 32722-0001 was used for this study. Logistic regression modeling of this extant data was used to explain concomitant alcohol dependence and poor educational attainment with underage drinking history as the main predictor variable augmented by the demographic factors age, gender and race/ethnicity. Correlation and regression analyses, t-test for independent groups, or Chi-square statistics were used to address the research questions depending on the variables involved. Four methodological steps were used for (1) Operationalization of Predictor (Independent) Variables, (2) Operationalization of Criterion (Dependent) Variables, (3) Data Screening and Preliminary/Residual Analyses, and (4) Answering the Research Questions.

Research Question 1 Analysis

With Research Question 1, whether and how underage drinking history in relation to current age, gender, and race/ethnicity correlated with concomitant alcohol dependence and poor educational attainment was investigated by running Chi-square cross tabulations. A variety of tests and measures of association between the dichotomous criterion variable concomitant alcohol dependence and poor educational attainment and the main predictor variable underage

drinking history controlling for Current age, Gender, and Race/ethnicity were observed in accordance with the study criteria. Applicable test statistics and measures were used to summarize the strength and statistical significance of the observed relationships (see Table 8).

Research Question 2 Analysis

There are two parts to Research Question 2 – the second question itself as the first part and Research Question 5 for demographic differences as the second part. This question was used to investigate the probability of higher incidence of alcohol dependence among currently legal age drinkers with underage drinking history, and whether there were demographic (age, gender, race/ethnicity) differences among the same individuals. Hierarchical logistic regression model building was used. Alcohol dependence was regressed on underage drinking history (the main predictor variable) first, and then in relation to the demographic variables from Research Question 5. The association between underage drinking history in the univariate logistic regression analysis was statistically significant. The odds ratio indicated that currently legal age drinkers 25 years or older who had a history of underage drinking were 3.7 more likely to develop alcohol dependence than their counterparts without underage drinking history. It was therefore determined that underage drinking history is a statistically significant predictor of alcohol dependence.

A negative association existed between AGE and alcohol dependence after controlling for underage drinking history and currently legal age drinkers 35 years and older were 2 times less likely to have alcohol dependence than currently legal drinkers 25-34 years old. After accounting for the effect of underage drinking, male legal age drinkers aged 25 years and older were 1.7 times more likely to have alcohol dependence than their female counterparts. The overall result of regressing alcohol dependence and the RACE/ETHNICITY dummy vectors was

statistically significant. Using the non-Hispanic White group as a reference, the overall result of the multivariable logistic regression model was statistically significant. With the exception of non-Hispanic Asian and non-Hispanic Pacific groups, all the racial groups showed positive associations. Every other racial group indicated a statistically significant association with alcohol dependence. Compared to their non-Hispanic White counterparts, currently legal age drinkers of the non-Hispanic Native, non-Hispanic Mixed, non-Hispanic Black, and Hispanic race/ethnicity groups members aged 25 years or older were about 3.5 times, 1.6 times, 1.5 and 1.3 more likely to have alcohol dependence respectively.

Research Question 3 Analysis

Similar to Research Question 2, Research Question 3 has two parts: Research Question 3 itself as the first part and Research Question 5 for demographic differences as the second part. These questions were used to investigate the probability of higher incidence of poor educational attainment among currently legal age drinkers with underage drinking history, and whether there were demographic (age, gender, race/ethnicity) differences among the same individuals. Hierarchical logistic regression model building was used. Poor educational attainment was regressed on underage drinking history (the main predictor variable) first, and then in relation to the demographic variables from Research Question 5. The association between underage drinking history in the univariate logistic regression analysis was statistically significant. The odds ratio indicated that currently legal age drinkers 25 years or older who had a history of underage drinking were 1.2 more likely to experience poor educational than their counterparts without underage drinking history. It was therefore determined that underage drinking history is a statistically significant predictor of poor educational attainment.

A negative association existed between AGE and poor educational attainment. After controlling for underage drinking history, currently legal age drinkers 35 years and older were 2 times less likely to experience poor educational attainment than their counterparts in the 25-34 years age group. Also, accounting for the effect of underage drinking, male legal age drinkers aged 25 years and older were 1.4 times more likely to experience poor educational attainment than their female counterparts. The overall result of regressing poor educational attainment on underage drinking history and the RACE/ETHNICITY dummy vectors was statistically significant. Using the non-Hispanic White group as a reference, the overall result of the multivariable logistic regression model was statistically significant. With the exception of non-Hispanic Asian and non-Hispanic Pacific groups, all the racial groups showed positive associations. Every other racial group indicated a statistically significant association with poor educational attainment. Compared to their non-Hispanic White counterparts, currently legal age drinkers of the Hispanic, Non-Hispanic Native, non-Hispanic Black, and non-Hispanic Mixed race/ethnicity groups aged 25 years or older were about 5, 3, 2, and 1.6 times respectively more likely to experience poor educational attainment.

Research Question 4 Analysis

Research Question 4 and the corresponding part of Research Question 5 were also considered together investigating the possibility of using underage drinking history to predict concomitant alcohol dependence and poor educational attainment, and the role of demographic variables on the prediction. The association between underage drinking history alone and concomitant alcohol dependence and poor educational attainment was statistically significant and the odds of having concomitant alcohol dependence and poor educational attainment were 4.75 times higher among currently legal age drinkers 25 years or older with underage drinking history

than their counterparts without underage drinking history. After controlling for AGE, this association remained positive and became stronger but not statistically significant. After taking into account the effect of underage drinking history, currently legal age drinkers in the 35 years or older age category were about 2 times less likely to have concomitant alcohol dependence and poor educational attainment than currently legal age drinkers in the 25-34 years old group. Also when concomitant alcohol dependence and poor educational attainment was regressed on underage drinking history with GENDER as a covariate predictor, the result of the logistic regression was statistically significant and taking into account the effect of underage drinking history, male currently legal age drinkers aged 25 years or older were about 1.7 times more likely to have concomitant alcohol dependence and poor educational attainment than their female counterparts.

The association between concomitant alcohol dependence and poor educational attainment and all the racial/ethnic groups was positive with the exception of the non-Hispanic Asian group with a negative but non-statistically significant association with concomitant alcohol dependence and poor educational attainment. The non-Hispanic Native group had the highest odds ratio 10.85 indicating that, after taking into account the effect of underage drinking history, 25 years or older non-Hispanic Native currently legal age drinkers were about 11 times more likely to have concomitant alcohol dependence and poor educational attainment than their non-Hispanic White counterparts. The Hispanic group had the second highest odds ratio 4.21 indicating that, after taking into account the effect of underage drinking history, 25 years or older non-Hispanic Native currently legal age drinkers were about 4 times more likely to have concomitant alcohol dependence and poor educational attainment than their non-Hispanic White counterparts.

Discussion

Results of the analyses reported in Chapter 4 indicated statistically significant relationships between underage drinking history and alcohol dependence in concomitance with poor educational attainment. These findings are consistent with the literature on underage drinking and its ramifications on the drinkers' mental health and human capital acquisition (Brown & Munson, 1987; Child Trends Data Bank, 2010; Grant & Dawson, 1997; Matsen et al., 2008; NIAAA, 2009 NIH, 2007; Teenage Drinking, [n. d.]). The findings also substantiate generally held beliefs that there are relationships between underage alcohol consumption and alcohol use disorders (alcohol abuse and alcohol dependence) and subsequently poor educational attainment. That is, that people with a history of underage drinking were close to four times more likely to develop alcohol-related mental health impairment(s) (alcohol dependence) than their counterparts with no underage drinking history.

Some risks associated with underage drinking can be noticeable from any perspective, though some ills of the phenomenon are at times more emphasized than others. The segment or branches of social and civil services systems often focus on individual negative outcomes of underage drinking can misrepresent and even minimize the problem to only the aspect focused on. For example, when the juvenile justice system presents delinquency as the underage drinking consequence at issue, often the emphasis on this one aspect overshadows other associated problems whether instrumental or consequential to the behavior. The same is true when underage drinking is viewed only through the lenses of economics, physical or mental health symptoms, or failure in education.

With a comprehensive screening, delayed and hidden damages of underage drinking can be discovered and addressed. Otherwise the not so obvious issues concomitantly present with underage drinking (e.g., long term mental health impairment, interrupted neurological development, cognitive deficiencies, physical injuries and disabilities, psychological trauma and distress) may not be diagnosed and treated. For this reason, studies such as this is that combine both what is in the literature and results of the current data analysis to bring to light the visible as well as invisible conditions that may be predictors or outcomes of underage drinking are critical. Comprehensive knowledge of all possible implications of underage drinking is critical to effective planning for prevention and treatment, and for lasting intervention.

Additionally, while common sense may lead to speculation about the risks of exposure to habit-forming activities such as alcohol consumption at an early age, scientific studies provide concrete evidence confirming the dangers of underage drinking. For decades, the strongest arguments in support of efforts to prevent underage drinking have been the obvious behavioral, health, economic, and other associated social ills (Hingson & White, 2014; Komro & Toomey, 2002). Even then, the literature on underage drinking has predominantly been narrow-focused segments based on the specific angle from which it was being viewed. But the ramifications of underage drinking go beyond such emphasized behavioral problems as juvenile delinquency, truancy or infractions of the law (Brown, Tapert, Granholm, & Delis, 2000; OJJDP, 2012; Tapert & Brown, 1999; Weschler, Lee, et al., 2002). Most of these outcomes can be considered secondary to neurological damage that interfere with brain development and function with immediate and delayed cognitive consequences (Brown & Tapert, 2004; Brown, Tapert, Granholm, & Delis, 2000; CDC, 2010; NIAAA, [n. d.]; Norberg et al., 2009; SAMHSA, 2009; Surgeon General, 2007; Tapert & Brown, 1999).

The association between underage drinking and neurological damages has been established (Giedd, 2004; Gilpin and Koob, 2008; NIAAA, 2009; Noulhiane, & Hertz-Pannier, 2014; Winters, 2008; Zeigler et al., 2005) yet this critical fact has seemingly not deterred underage drinking. It seems safe to speculate that key players in the underage drinking arena may not be well informed or informed at all of possible neurological outcomes (Simpson, [n.d.]). For example, if those who see adolescent alcohol consumption as a rite of passage (e.g., parents at hunting camps, some Native American tribes), those who consider underage drinking an act of social conformity (e.g., adult/parent organizers of house parties where alcoholic beverages are made available to minors, adolescent drinkers themselves), and advocates of lower legal drinking age know that the brain is still developing through early adulthood (mid 20s), would they still ignore the immensity of such risk (Dills, 2010; Farley, 2006; Frantz, 2004; Friese & Grube, [n.d.]; Koerner, 2013; Room, 2004; Simpson [n. d.]). Or is it possible that such risks are not taken seriously? Could it be that people dismiss possible harm thinking that it would not befall them? Stasson and Fishbein (1990) reported that knowledge of risk alone was not enough to compel some drivers and passengers to wear seatbelts, rather what people were used to seeing practiced around them together with personal persuasions on the issue of wearing seatbelts determined whether or not they wore them. Similarly, some have questioned the age restrictions on driving at 16 years of age, voting at 18, and first drink of alcoholic beverages at 21. Geidd (2004) and Simpson (n. d.) observed that rental car companies are the only ones close enough to embracing the realities of brain development and the maturation that happens as a result when they impose a minimum age to rent a car at 25 years of age.

Whether or not the effects of alcohol on the brain are acknowledged does not change the possible prognoses of neurobiological changes that can be induced by a drinker ranging from

foetal alcohol spectrum disorders to neurocognitive deficiencies (Brown, Tapert, Granholm, & Delis, 2000; Geidd, 2004; Koren, Nulman, Chudley, & Looke, 2003; Masten et al., 2009; Weed, 2011; Zeigler et al., 2005). The detrimental effects of foetal alcohol syndrome, for instance, can last from generation to generation. Masten et al. (2009) determined that female children born with foetal alcohol spectrum disorders are at greater risk of underage drinking than those without foetal alcohol disorders and males. Given that underage drinking heightens the risk of unplanned pregnancy, drinking during pregnancy as well as alcohol dependence, the ill perpetuates itself as generation after generation exposure to the risks of underage drinking is repeated (Griesler & Kandel, 1998; Koren et al., 2003; Masten et al., 2009; Spicer & Taylor, 2006).

In this second part of the discussion we look at the results of the data analyses testing the null hypothesis that there are no statistically significant correlations between underage drinking history and alcohol dependence in concomitance with poor educational attainment.in terms of age. The initial analysis indicated a statistically significant association between underage drinking history and concomitant alcohol dependence and poor educational attainment only for the younger age category (25-34 years of age) when viewed categorically. However, when the age categories were collapsed, the association remained positive and statistically significant over all. The association of underage drinking and age can be viewed in many ways. One critical view is the actual age at onset of drinking. While underage drinking encompasses all ages of onset before 21, research has found that the effect of initiating drinking at an earlier age, for example at 12, can be remarkably different from initiating drinking at age 19 (Grant & Dawson, 1997; CAMY, 2014). Recent research also shows a steady decrease in age at onset of drinking in the past two decades (CAMY, 2014; Foster et al., 2003; McNamee, 2014). It is possible that

participants in the lower age category may have started drinking earlier than their counterparts in the older age category. In that case, younger age of onset can be another plausible explanation for the difference observed in the age categories given that earlier age at onset of drinking would have an even greater impact on the youth's education. Grant and Dawson (1997) found that even a year's delay in age at onset of drinking had tremendous effects on the outcome of underage drinking. That is, alcohol may have a more profound effect on a 12 year old than it would on a 19 year old. Neurological evidence shows that brain development and maturation continues through the early-twenties (National Institute of Mental Health [NIMH], 2011; Paus, 2005; Toga, Thompson, & Sowell, 2006), therefore the closer the age of onset of drinking is to brain maturation perhaps the less damage would be sustained by the drinker.

Another possible explanation for the differences observed could be that members of the 35 and older category have had enough time to remedy their poor educational attainment, hence the results obtained for this group. It is also possible that recovery had taken place which would have meant restored cognitive abilities and enabled reinstatement of the ability to learn and make up for lost time and/or learning opportunities (Bartsch et al., 2007, NIDA, 2008). With evidence of brain regeneration over time following sustained abstinence from drinking, the theory of making up for lost time is plausible (Bartsch et al., 2007; NIDA, 2008). Specifically, Bartsch et al. (2007) concluded that their "findings emphasize metabolic as well as regionally distinct morphological capacities for partial brain recovery from toxic insults of chronic alcoholism and substantiate early measurable benefits of therapeutic sobriety" (p. 36).

Whether gender had any effect on the prediction of concomitant alcohol dependence and poor educational attainment with underage drinking history and what that effect might be was another question investigated in this study. The null hypothesis of no statistically significant

gender difference among currently legal age drinkers with underage drinking history was tested. A statistically significant relationship was found for females but not for males, and a positive relationship was found for both.

Similar observations have been reported (Borsari et al., 2007; Hoffmann, 2006; Schulte et al., 2009). Borsari et al. (2007), Hoffmann (2006), as well as Schulte et al. (2009) found statistically significant differences between males and females generally, and specific differences in socially, physically, and personally. Schulte et al. (2009) suggested that general role perceptions may contribute to the gender differences observed. Physical or biological differences between males and females have also been reported as accounting for more medical consequences for females than for males (Ammendola, Gemini, Iannacone et al., 2000; Fernández-Solà et al., 1997; Loft, Olesen, & Dossing, 1987; NIAAA, 2004; NIAAA, 2013). According to the NIAAA (2004) women experience twice the medical consequences for the same amount of drinking. Furthermore, though recent research hints at the possibility of male contribution to foetal alcohol syndrome (FAS), it has been established without question that FAS is a consequence of female alcohol intake especially immediately before and during pregnancy (Gearing, McNeill, & Lozier, 2005; NIAAA, 2004). Other areas of gender differences that could help explain the results obtained include psychological differences and personality (Bönte & Jarosch, 2012; Thom, 2003). Bönte and Jarosch (2012) among others (Byrnes, Miller, & Schafer, 1999; Ronay & Kim, 2006; Thom, 2003) are of the opinion that females avoid risk-taking situations more so than males. Thom (2003) looked at risk-taking behaviours of males versus females in a national sample and found that males have more potential for self-medicating psychological stress with alcohol than females and suggested that the phenomenon be investigated further.

Gender differences on the effects or results of underage drinking or any drinking in general can also be seen in death, disabilities and temporary and permanent loss of function due to drunk driving accidents and conditions on the continuum of foetal alcohol spectrum disorders (FASD) (Hingson et al., 2002; Goldschmidt, Richardson, Stoffer et al., 1996; Miller et al., 2006; Niclasen, Nybo Andersen, Teasdale, & Strandberg-Larsen, 2013). Males dominate the drunk-driving accidents records while foetal alcohol syndrome and similar conditions are attributed to the females' actions generally (Goldschmidt, Richardson, Stoffer et al., 1996; Hingson et al., 2002; Miller et al., 2006; NIAAA, 2004; Niclasen et al., 2013; Sayal, Heron, Golding, & Emond, 2007). Whether a father's drinking can contribute to FASDs is still under investigation (Gearing, McNeill & Lozier, 2005).

Some aspects of the foetal alcohol spectrum disorders (FASD), the continuum of irreversible birth defects which may be manifested in physically, psychologically/cognitively, and behaviourally in children born to mothers who consume alcohol while pregnant, have been reported to vary between the genders (Goldschmidt, Richardson, Stoffer et al., 1996; NIAAA, 2004; Niclasen et al., 2013; Sayal et al., 2007). Whether indeed there are gender differences and the nature, degree or extent of any differences is yet to be confirmed. The effects of cognitive liabilities investigated by Sayal et al. (2007) include IQ and the areas of reading, writing, and math while Niclasen et al. (2013) looked at gender-based mental health differences in seven year olds exposed to prenatal drinking.

In relation to race/ethnicity overall, a positive and statistically significant association was found between underage drinking history and alcohol dependence in concomitance with poor educational attainment. However varying results were obtained for race/ethnicity groups singly. For instance, for non-Hispanic White, non-Hispanic Black, and Hispanic groups, the association

between concomitant alcohol dependence and poor educational attainment and underage drinking history was higher for these groups over the others. Although the literature on concomitant alcohol dependence and poor educational attainment for all individual groups is sparse, some hypotheses regarding race/ethnicity, substance use disorder, and poor educational attainment can be surmised.

African American adolescents use alcohol more than they use other substances (Alaniz & Wilkes, 1998; Snyder, Milici, Slater, Sun, & Strizhakova, 2006; Wallace, Jr. et al., 2003; Wallace, Jr., & Muroff, 2002). A common belief is that African American youth drink more than they use other drugs because alcohol is most accessible and least expensive to them (Peterson, Hawkins, Abbott, & Catalano, 1994). Paschall and Flewelling's (2002) observation that having the money to spend encourages underage drinking seems to validate this point. Furthermore, when compared to their White counterparts, African American youth drink less, and have been found to drink for other reasons as well (Amey, Albrecht, & Miller, 1996; Barnes, Welte, & Hoffman, 2002; CAMY, 2014; Gibbs, 1984; Sinha, Cnaan, & Gelles, 2007; Wallace Jr., & Bachman, 1991; Wallace Jr., Brown, Bachman, & Laveist, 2003; Zimmerman, & Schmeelk-Cone, 2003). Exposure to alcohol has been known to be influential to both early initiation and continued underage drinking, however, advertisers have been accused of targeting, even saturating the market for African American youth with alcohol commercials (Peterson et al., 1994; Snyder et al., 2006). Snyder et al. (2006) tested the hypothesis that youth exposure to alcohol advertisement led to underage drinking. The authors also noted that alcohol advertisements in the media indeed target youths more so than adults. How much advertising the youth watched corresponded to how much alcohol they drank as well as determined early and later adult drinking.

What has not been addressed fully in the literature are the psychological root causes of underage drinking especially impacting minorities such as poverty, oppression, parental exposure peer pressure, and escapism. Deep-rooted psychological background causes of poverty, past and current social ills and attitudes are explored by David (2014). In his book *Internalized Oppression*, David and colleagues explore the negative impact of oppression, social classism, devaluation, prejudice and discrimination of numerous marginalized groups. Book contributors in discussing the behavioral, emotional, and mental state of marginalized groups cite that internalized oppression can lead some individuals to lose self-esteem and hope, become anxious and depressed, and respond through alcohol and drugs use, domestic violence, and internalized hatred of both self and others. The authors opine that constant micro aggressive messages by the majority culture that minorities are inferior can lead to alcohol and drug abuse, lower educational attainment based on feelings that one is not good enough, and essentially giving up. The psychosocial factors may indeed be represented in some of the findings in the current study, particularly for Native Americans and African Americans.

Although the negative psychological ramifications of internalized oppression has just recently begun to be explored in greater depth, the cultural mistrust of majority counselors is perhaps one of several reasons why minority ethnic groups do not access mental health services (Blank, Mahmood, Fox, & Guterbock, 2002; Horsman, Rodriguez, & Marini, 2009; Seffrin, 2012). The behavioral fallout for marginalized individuals according to David (2014) is that individuals may drop out of school early, engage in risky behaviors, and the ripple effect of sporadic employment, poor access to health care, poverty, and poor health.

Implications

At this point, it is fitting to revisit four viewpoints first presented in Chapter 1 of the study in the light of study results presented above. Three of these viewpoints were encountered in the literature reviewed and the fourth was advanced as part of the overarching statements of the problem and significance of the present study.

Viewpoint 1. As introduced in Chapter 1, and from the point of view of human capital theory, educational attainment is expected to be directly and negatively predictable by underage alcohol use (Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Bonomo et al., 2004; Gotham et al., 2003; Hansell & White, 1991). This viewpoint was addressed by Research Question 3, and the null hypothesis that *there is no statistically significant difference in probability of poor educational attainment between CLADs with UDHISTORY and CLADs without UDHISTORY* was rejected because the results of regressing PEA on UDHISTORY supported this viewpoint.

Viewpoint 2. The second viewpoint is based on the arguments that (1) the perceived negative effects of heavy alcohol consumption on educational attainment may not be founded (Chatterji, 2006; Dee & Evans, 2003; Duncan et al., 1972; Koch & Ribar, 2001) and (2) that other childhood factors may be behind any observed differences between underage drinkers' (including heavy drinkers) and nondrinkers' educational attainment (Duncan et al., 1972). Duncan et al. (1972) supported this view with the reasoning that individual goals and ambitions coupled with pre-drinking level of accomplishment would be stronger predictors of educational attainment than alcohol consumption including heavy drinking. A further extension of this viewpoint is NIAAA's (2006) suggestion that the sequence of events surrounding alcohol consumption and educational attainment could be the other way round – that is, it could be that

low school commitment and academic failure do increase the risk of heavy adolescent drinking (NIAAA, 2006). Others, (Chatterji, 2006; Dee & Evans, 2003; Koch & Ribar, 2001) maintain that preexisting and unobserved differences between students in prior achievements may be responsible for the relationship between heavy alcohol use and educational attainment.

Results of the present study are predominantly in line with the previous research findings noted above. However, the nature of the extant data used for this study did not permit a thorough investigation in consideration of this second viewpoint given that certain childhood and adolescent factors as Duncan et al., (1972) alleged that may be responsible for any observed correlation between teenage alcohol use and educational attainment were not available in the data set for the age categories used in the study (25 years and older). For example, such issues as foetal alcohol syndrome, childhood abuse and neglect, poverty and other stressful family environments, and emotional trauma have been associated with both underage drinking and poor educational attainment (Corcoran, 1665; Goldman, Salus, Wolcott & Kennedy, 2003; Griesler & Kandel, 1998; Jensen, 2009; Lacour & Tissington, 2011; Langeland & Hartgers, 1998; Masten et al., 2008). In an investigation of effects of educational attainment, school completion status, and childhood exposure and familiarity with alcohol abuse and dependence on long-term alcohol abuse, Crum, Ensminger, Ro and McCord (1998) found a correlation between educational achievement, younger age school behavior, and risk for alcohol use disorders.

Jensen (2009) advanced the argument that emotional and social challenges, acute and chronic stressors, cognitive lags, and health and safety issues can overwhelm children growing up in poverty and consequently lead to choices of negative behaviors. Jensen (2009) concluded that poverty forces acceptance of “suboptimal conditions” which derail the adolescents’

educational attainment and statistically can lead to generation after generation of cyclical poverty for children in such families.

Viewpoint 3. The third line of thought is that the relationship between alcohol consumption and educational attainment may be conditional (Fagan & Pabon, 1990). This viewpoint considers the presence of social and environmental factors and personal characteristics as possible mediators of the long-term impact of heavy alcohol use on educational attainment (Berkman & Kawachi, 2000; Garcia, 2012; NIAAA, 2006; Rehm et al., 2004; Tapert et al., 2004, 2005). Thus, such factors as habit and marital status were employed in assessing this viewpoint.

Drinking habit variables and marital status were considered as possible relevant covariate predictors based on studies found in the literature (Kim, Tiberio, Pears, Capaldi, & Washburn, 2013; Capaldi, Feingold, Kim, Yoerger, & Washburn, 2013). Furthermore, Blomeyer et al. (2011) looked at the relationship between stressful life events (SLE) and early onset use of alcohol and found that the combination of early onset drinking and SLE were associated with high levels of alcohol consumption. Thus, such factors as habit and marital status were employed in assessing this viewpoint based on studies found in the literature (Kim et al., 2013; Capaldi et al., 2013) suggesting their possible role as mediators. Drinking or drugs, then become a behavioral form of escapism or avoidance and not having to deal with these stressful events.

Viewpoint 4. The fourth and final viewpoint addressed in Chapter 1 was that being advanced through the present study which suggests a fresh look at how underage drinking (given the age categories in the present study [25 years of age and older], underage drinking history) predicts the unique situation of concomitant alcohol dependence and educational attainment. The present study was focused on drawing attention to a neutral view on underage drinking, alcohol dependence, and poor educational attainment. This view steps away from causation and

focuses on the unique situation where alcohol dependence and poor educational attainment concomitantly exist, to inform both policy and intervention efforts. From this perspective, the question is no longer which occurred first, alcohol dependence or poor educational attainment but what is the best intervention approach? This view also supports considerations of every possible role demographic factors may play in the process of predicting alcohol dependence, educational attainment, and concomitant alcohol dependence and educational attainment with underage drinking. In other words, a new hypothesis is advanced that determining the effects of other demographic factors in addition to those employed in the present study would enhance the prediction of alcohol dependence, poor educational attainment and concomitant alcohol dependence and poor educational attainment based on underage drinking history.

Summary of Implications

Rehabilitation professionals as counselors, educators, and advocates for individuals with mental health and/or substance use disorders will benefit from a holistic view, knowledge and insight of the issues related to underage drinking. Whereas alcohol use disorders are often treated in isolation and in other settings than vocational rehabilitation counseling except in cases of dual diagnoses, it is critical that rehabilitation and substance abuse counselors thoroughly review clients' diagnostic and referral and social history records to ensure complete diagnoses and comprehensive intervention (Allen, 2002; Drebing et al., 2002). In the absence of detailed diagnoses from referral sources, the counselor with knowledge of the possibility of co-occurring or concomitant diagnoses could complete the screening and thus be better informed prior to commencing interventions (Allen, 2002; Drebing et al., 2002). In addition, counselors must become familiar with the minority clients' social narrative and psychosocial circumstances. In order to successfully understand and assist clients in drinking or drug cessation, pursuing school

or a career, and maintaining their mental health, we will have to understand their worldview, and the facts that triggered self-destructive behaviors.

Findings of the current study lead to further suggestion of cross-sectional approaches to addressing underage drinking including closer collaboration between the agencies that provide services and treatment for underage drinking. When agencies and different treatment and service entities collaborate, underage drinking and associated conditions can easily be identified and tackled in more effective, economical fashion, and derived knowledge and information more widely disseminated.

Limitations

One major limitation to the present study is the omission of the young adult age categories. These age categories cover persons 21 to 24 years old newly legal age drinkers. Among the young adult age categories are college-aged persons some of whom would be college students whose past and current drinking behaviors and habits could shed more light on how underage drinking history predicts alcohol dependence, poor educational attainment, and concomitant alcohol dependence and poor educational attainment. The missing category could have also provided insight into the progression from underage drinking toward alcohol dependence, moderate drinking or drinking cessation. Such information, while not the main focus of the current study, could have shade more light on the subject of underage drinking.

Other limitations of this study include those already mentioned in Chapter 1, such limitations as are inherent to studies using extant data. Data collection procedures involved self reports which sometimes may not be totally accurate. RTI International (2012) reported the omission of what was termed critical populations. Specifically, that certain critical populations were excluded from the survey is a limitation to the data set and consequently to this study.

Such exclusion poses a limitation to this study given the fact that any differences in the characteristics of the omitted population groups in relation to the current study variables limits the generalizability of study results to the 2010 NSDUH survey populations.

Conclusion

This study was carried out to identify a model that considers underage drinking history as a predictor of concomitant alcohol dependence and poor educational attainment among individuals aged 25 and older, and to gain a better understanding as to whether and how demographic variables (age, gender, race/ethnicity) affect the prediction. The effects of demographic factors on *underage drinking history* as a predictor of *concomitant alcohol dependence and poor educational attainment* were assessed to the extent possible with the study data set. Findings of the current study are in agreement with those reported in the literature reviewed and meaningfully legitimized the advancement of a fresh and unique view on the relationships between underage drinking, alcohol dependence, and educational attainment. This unique view establishes the notion that alcohol dependence in concomitance with poor educational attainment is predictable by underage drinking history and demographic factors (age, gender, and race/ethnicity) have effects on the prediction.

Recommendations

Based on such findings as were obtained in the present study and the literature reviewed, it is recommended that this phenomenon (the relationship between underage drinking, mental health impairment in terms of alcohol dependence, and lack of human capital acquisition in terms of poor educational attainment) be further investigated. One immediate suggestion is to employ more variables in the study in addition to underage drinking history which measures only whether the respondent has underage drinking history. *Length of period underage drinking* for

example, which contains extra information in terms of duration of the respondent's underage drinking history, should be employed to further study the ramifications of underage drinking. In other words, whether there are differences in outcomes for the underage drinker based on particular age of onset of drinking should be investigated further. More studies of the effect(s) of neurological damages resulting from underage drinking directly or indirectly are needed to better understand the cognitive deficits that interfere with educational attainment.

Even though the results so far tended to downplay the role of the demographic variables considered in this study, demographic influences on underage drinking, alcohol dependence, and poor educational attainment are considered critical to understanding the psychology behind underage drinking, as well as actions taken to abate the outcomes. As such, further inquiry ought to be made into race/ethnicity differences based on the results obtained for the current study's race/ethnicity groups. Other possible areas of inquiry might include such questions as: Does technology play any role in underage drinking? How might the newly authorized powdered alcohol sales in the United States affect underage drinking, especially considering access, convenience, and possibly price? Other recommendations for further studies include studying the new trends from socioeconomic, environmental, and socio-cultural history perspectives.

The results obtained from this study validate holistic rehabilitation approaches, and highlight the need for thorough screening beyond consumers' presentations at treatment intake. In other words, it would not be enough to treat only alcohol dependence when there are socio-cultural, educational and economic situations exacerbating the conditions, interfering with treatment, and threatening relapse once treatment is completed.

Dissemination of Study Results

The results of this study will be shared through publications as appropriate, presentations and case studies at conferences and workshops for professional development of rehabilitation counselors and other health and human services personnel. Additionally, a copy of this report will be submitted to SAMHSA in fulfillment of the requirements for using the NSDUH data set for the study.

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APPENDICES

APPENDIX A

RTI International – Information on Human Subjects Protection

Excerpted from http://www.rti.org/page.cfm/Regulatory_Affairs

Regulatory Affairs

The RTI Office of Research Protection (ORP) ensures compliance with all regulations related to the protection of human research subjects and assists study investigators in developing appropriate study procedures

Human Subjects Protection

The RTI Protection of Human Subjects Committee (PHSC) consists of three Institutional Review Boards (IRBs), each of which meets monthly to ensure timely review of all studies. All biomedical and behavioral research conducted by us under a grant or a contract involving human subjects must have the approval of this committee before data collection or analysis begins. The Office for Human Research Protections (OHRP) of the DHHS has granted a Federal-Wide Assurance (FWA #3331) to RTI that grants the right to independently review and approve studies. In turn, OHRP has the right to audit our IRB records or any study's procedures at any time to ensure our compliance with the federal regulations regarding research with human subjects.

IRB Coordination

Our staff members assist clinical sites with all aspects of IRB coordination and communications, including support with protocol and study forms review packages, interim reports, maintenance of regulatory files, and annual updates. We assist sites with any necessary modifications required to comply with site-specific IRB requirements, advocacy groups, or cultural norms. Each site sends required documentation of local clearance approvals and copies of clearance packages and consent forms to RTI before data collection. Site regulatory files, including regulatory correspondence, are created and maintained at RTI. We also track and remind sites of annual updates and approval schedules.

Regulatory Filing and Submissions

Our researchers serve as the regulatory liaison and a resource for regulatory submissions to the U.S. Food and Drug Administration (FDA). Strategic regulatory plans, timelines, and milestones, are always discussed early in the development of a clinical program with study investigators, the protocol team, the medical monitor, Scientific Advisory Committee, and appropriate quality assurance staff. Our regulatory staff organize, format, assemble, and track submission documents and packages for FDA approval and submit annual updates as required.

Monitoring Adverse Events and Patient Safety

Our staff members routinely coordinate and report safety data, such as adverse events (AEs) and statistically significant adverse events (SAEs), to project data safety and monitoring boards (DSMBs), IRBs, and scientific advisory committees during the conduct of clinical studies. By NIH guidelines, IRBs should determine what type of monitoring is appropriate for each protocol based on the level of risk and the number of subjects to be studied. Our researchers collaborate with study investigators to efficiently implement patient safety monitoring.

Site Monitoring

Our staff members have extensive experience conducting site visits to monitor protocol compliance, train personnel, and provide implementation support. Clinical monitoring typically uses both field-monitoring staff and in-house monitoring staff to optimize efficiencies while reducing data discrepancies. Protocol processes, including enrollment practices, data collection, and pharmacy and laboratory procedures, are all assessed over the course of the visit. Site regulatory documents also are reviewed, including required clinical manuals, standard operating procedures, protocols, manuals of operations, completed 1572 forms, and signed informed consent forms.

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