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## **The Separate and Combined Effects of Heredity and Environment Predicting Alcohol Use Disorder Symptoms and Antisocial Personality Disorder Symptoms**

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The University of Southern Mississippi

The Separate and Combined Effects of Heredity and Environment Predicting Alcohol Use  
Disorder Symptoms and Antisocial Personality Disorder Symptoms

by

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## Abstract

The current study examined genetic and environmental influences in relation to alcohol use pathology. The 756 participants (378 adoptive, 378 non-adoptive) came from the 2001-2002 NESARC conducted by the NIAAA. A factorial ANOVA was used to measure the effects that the three grouping variables had on each dependent variable for a total of seven datasets. Results showed that biological parents' drinking did pose a risk in participants for Loss of Control ( $p = .000$ ) and Dangerous Behavior ( $p = .00$ ). Adoption status was correlated with Conduct Disorder ( $p = .007$ ) and Antisocial Personality Disorder ( $p = .014$ ). This suggests that genetic influences have a bigger impact on alcohol use pathology than environmental ones. Adoption status could be an indicator for CD and ASPD.

Key terms: alcohol use pathology, alcohol dependence, alcohol abuse, adoption, biological

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### **Introduction**

Alcohol use disorders affect an estimated eighteen million people in the United States alone. The consequences that result from these disorders can have major effects on a person's personal, relational, and work life. The two most commonly seen types of these disorders are alcohol dependence and alcohol abuse (National Institute on Alcohol Abuse and Alcoholism [NIAAA], n.d.).

The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994) defines dependence on any kind of substance as a collection of cognitive, behavioral, and psychological symptoms that encourage the repeated consumption of that substance without regard to any problems that might arise. DSM-IV determines dependence based on the following list which consist of seven symptoms: develop a tolerance to the substance, experience withdrawal in the absent of the substance, use for longer than intended or in greater amounts, express the desire to or attempt to quit without success, devote a large amount of time to getting substance, abandon activities that were once important in order to use, and continue to use when aware of problems caused by substance. To be considered dependent on a substance, a person must express three or more of these symptoms within one year. The two main symptoms for alcohol dependence are tolerance and withdrawal. Due to how severe withdrawal symptoms are for this disorder, some people choose to face the consequences of heavy drinking than go without alcohol.

Following the guidelines developed by DSM-IV, abuse is "a maladaptive pattern of substance use manifested by recurrent and significant adverse consequences related to the repeated use of substances" (American Psychiatric Association, 1994, p.182). The diagnosis of abuse for any substance is based on the following list of four symptoms: fail to meet obligations

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due to substance use, perform dangerous tasks while under the influence of a substance, legal problems resulting from use, and relationship issues due to use. A person must experience one or more symptoms in a one year period in order to be diagnosed with abuse. Alcohol abuse is not diagnosed if tolerance and withdrawal symptoms are seen in a patient. If these two symptoms are present, the patient is classified as being alcohol dependent.

Along with developing an alcohol use disorder, alcoholics also tend to fall into two different types: Type 1/A or Type 2/B. These two types were observed by Cloninger, Sigvardsen, Knorrning, and Bohman in their Stockholm Adoption Study (1995). The study focused on children and their own risk of alcohol abuse based on their biological parents and the prenatal environment. The children were adopted at a young age by people with no biological connection to them. Type 1/A alcoholics are characterized as developing alcoholism in late adulthood, progressing from mild to severe dependence rapidly, and affecting both sexes. The combination of genetic and environmental factors categorizes this type of alcoholism. Environmental factors have been found to have a stronger influence than genetic ones. There is an increased risk of developing type 1/A for people who have an anxious personality with high harm avoidance (Cloninger et al., 1995).

Type 2/B alcoholics differ from type 1/A by having early onset alcoholism in their teenage years and reoccurring legal and social problems stemming from their alcohol abuse (Cloninger et al., 1995). People with antisocial characteristics have a higher risk of developing type 2/B. The common antisocial characteristics associated with this type of alcoholism are high novelty seeking, low harm avoidance, and low reward dependence. It is not uncommon for people with this type of alcoholism to be diagnosed with Antisocial Personality Disorder [ASPD]. The model of transmission suspected for this type is hereditary since it has mainly been



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observed in fathers and sons with little to no environmental influences involved. While this type of alcoholism can occur in women, it is rare (Cloninger et al., 1995; Bottlender, Preuss, & Soyka 2006).

### *Genetic and Environmental Factors*

The factors that influence the development of alcohol use disorders have been found to come from a combination of genetic and environmental factors based on numerous studies conducted over the years. The biological sciences focus on genes to determine what the relationship is between certain genes and various disorders. Environmental factors also hold the interest of both scientists and psychologists because those factors can show the effects of nurture over nature. The two types of studies used by both disciplines to observe these factors are twin (identical and fraternal) and adoptions studies.

A claim by Williams and Noronha (2012) is that the current definition for genetics is out of date due to the recent breakthroughs that the field has had over the last several decades. They believe the new definition for genetics should include the differences that can be observed in individuals along with the classic meaning being the study of genes. These differences do not only come from genes located in DNA (genetic factors) but also through exposure of genetic factors to different environments throughout one's lifetime (environmental factors). According to research done by Kimura and Higuchi (2011), the use of genome-wide analysis like whole-genome linkage studies have connected a type of vulnerability to alcohol dependence to several chromosomal regions. This type of testing looks for genetic polymorphisms which are located on a genome using family-based samples. The goal of these types of studies is to find the region(s) on the chromosome that are influenced by a certain disease and/or its traits. Candidate gene association studies are conducted to narrow the search area down after the region(s) have been

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identified. The purpose here is to gather data on either the progress or treatment of the disease (Kimura & Susumu, 2011). van Beek et al. (2012) found that genetic influences for both alcohol dependence and abuse strengthened during mid-adolescence to young adulthood. Foroud and Phillips (2012) point out that the progress of locating these genes has slowed due to the complexity of the associated disorders.

Genes are also suspected to be involved in how alcohol consumption and the development of alcohol dependence differ between different racial groups. Agrawal and Bierut (2012) found in their overview of different studies that researchers discovered alcohol-metabolizing enzymes have encoded genes which contain different variations inside them. These variations were linked to the differences found in alcohol intake and risk of alcohol dependence between the various racial groups.

Both identical and fraternal twins have been used to look at possible genetic components for decades by both psychology and the biological sciences. Foroud and Phillips (2012) cite twin studies as one of two main research approaches used to study genetic predisposition to alcohol use disorders. Twin studies have shown that identical twins are more likely to develop alcohol dependence together than their fraternal counterparts. The results from both twin and family studies found that over half of the variances involved in the risk of alcohol dependence were genetic. These findings have confirmed that there is a genetic component involved in the possibility of developing alcoholism (Foroud & Phillips, 2012). Previous studies done on adoption have also found that children, particularly male ones, have a higher chance of developing alcoholism if members of their biological family also had the disease (King et al., 2009).

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Environmental factors, described as stressors (either social or emotional), can lead to alcohol consumption or abnormal drinking habits (Johnson, van den Bree, & Pickens, 1996). These types of stressors can include parents, siblings, relatives, and peers. A study done by King and colleagues (2009) found that adopted adolescents were four times more likely to use alcohol if they witnessed their adopted parents misuse it than adopted adolescents who did not witness such a thing. This increased risk was not seen in children living with their biological parents who also misused alcohol. These findings suggest that there is an environmental influence on adopted adolescents who witness alcohol misuse in their adoptive parents, but that risk is not the same in adolescents living in the same situation with their biological parents.

There is some evidence that drinking in older siblings may also have an effect on alcohol use in younger siblings. A study conducted by van der Zwaluw et al. (2008) found that drinking in older siblings led to an increased risk of alcohol consumption in younger siblings. Maternal drinking was also found to have a more direct effect on drinking in older adolescents than paternal drinking. This observation supports what Newlin et al. (2000) found in their study of substance-use disorders in adoptive and step families. Their study found that drinking in adoptive mothers showed an increased risk of alcohol abuse in children when compared to drinking in adoptive fathers. Children of alcoholic adoptive fathers did have an increased chance of developing drug abuse and dependence disorders.

### *Conduct Disorder*

The DSM-IV (American Psychiatric Association, 1994) defines Conduct Disorder as a pattern of behavior where an individual continuously violates social norms, rules, or the rights of others. A person must experience at least three symptoms of CD within a year and one symptom for at least six months in order to be diagnosed. The four main categories of symptoms for CD

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are aggressive behavior towards people and animals, destruction of property, deceitfulness or theft, and serious violations of rules. These symptoms must also have a major impact on the quality of the person's life. There are two types of age of onset for CD: childhood-onset and adolescent-onset. The childhood-onset type occurs when at least one symptom of CD is observed in a child under the age of ten. Adolescent-onset type is used when no symptoms are present before the age of ten.

Slutske et al. (1998) found that there was a strong correlation between CD and Alcohol Dependence [AD] in Australian twins. Men and women with a history of CD had a higher rate of AD than those who did not have such a history. They also found that women who experienced at least one symptom of CD had a higher rate of AD while men needed two symptoms for the same increase. A within-twin correlation found that the connection between CD and AD in men was due to genetics. For women, the connection came from environmental influences that were both shared and not (Slutske et al, 1998). These findings show that the relationship between CD and AD is the result of both genetic and environmental factors.

### *Antisocial Personality Disorder*

Individuals with alcohol use disorders are more likely to develop mental and physical health related problems. One of the most common mental health problems diagnosed in these individuals is Antisocial Personality Disorder [ASPD] (Goldstein et al., 2007). The DSM-IV (American Psychiatric Association, 1994) classifies ASPD as a prevalent pattern of disregard and violation of other people's rights that is present from childhood or early adolescence. The following seven symptoms are associated with ASPD: disregard social norms, display deceitfulness tendencies, act on impulses, behave very aggressively and are easily irritable, exhibit no regard for their own safety or others, showcase irresponsibility constantly, and show

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no remorse for actions. Some other requirements are the person has to be at least eighteen years old, have a history of CD before the age of fifteen, and express symptoms outside of Schizophrenia or Manic episodes.

ASPD is most commonly associated with Type 2/B alcoholism since this type expresses several antisocial characteristics like high novelty seeking, low harm avoidance, and low reward dependence (Cloninger et al., 1995; Bottlender et al., 2006). Female alcoholics are more likely to develop other psychiatric disorders like antecedent depression than ASPD (Babor et al., 1992). King et al. (2009) found in their study of parental alcohol consumption in adopted versus non-adopted families that biological children had higher levels of “behavioral disinhibition” (a term they use to describe a vulnerability to “substance use, delinquency, antisocial attitudes, and impulsivity”) when exposed to their parents’ alcohol dependence than children raised by adopted parents in the same environment. Based on this finding, King and colleagues believe that this difference in exposure comes more from genetics than environment. Several studies have shown that of the people seeking treatment for their alcohol use disorders, people with ASPD experience more severe symptoms in regard to their disorders and have lower rates of recovery than those who do not have ASPD (Goldstein et al., 2009).

### *The Current Study*

The present study investigated the roles of heredity and environment contributing to alcohol use pathology. Alcohol consumption in both sets of parents was used as the environmental factor. The variable that was used to test for a genetic factor was the genetic relationship between the subject and his or her parents (i.e., biologically related versus adopted).

There were five specific research questions that this study addressed. They are as followed:

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1. Is adoptive status alone a risk factor for alcohol use disorders?
2. Does drinking of biological parents convey risk?
3. Does drinking of adoptive parents convey risk?
4. Does adoptive status interact with biological parents drinking to increase risk?
5. Does adoptive parent drinking interact with biological parent drinking to increase risk?

Based on prior research and these research questions, five hypotheses were developed for this study. Adoptive status alone will not be a risk factor in relation to alcohol use disorders. Drinking of biological parents will cause an increased risk of developing alcohol use disorders due to genetic factors. Drinking of adoptive parents will also carry an increased risk for developing the same disorders due to environmental factors. Adoptive status and biological parents drinking will interact to increase risk of alcohol use disorders. Drinking in both adoptive and biological parents will interact to increase risk of developing alcohol use disorders.

## **Method**

### *Participants*

Archival data from the 2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) conducted by the NIAAA (NIAAA, 2006) was used to gather participants for this study due to the large number of people surveyed. The code book was available for use by researchers and scholars. This particular survey involved 43,093 adults living in either households or non-institutional group quarters in the United States. Data was gathered through personal interviews with a single adult randomly selected from each residency involved. Measures were taken to ensure that minorities were adequately represented with 19.1 percent being Black and 19.3 percent being Hispanic. Fifty-seven percent of those interviewed were women. Participants ranged in age from 18 to 98 years old with the mean age being 46. The

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large number of participants and range of questions from this survey made it ideal to conduct the research needed for the current study.

The focus of the study was to compare people who were raised by adoptive parents to those who were not on several different drinking characteristics and mental health disorders. In the archival data used, only 378 cases reported being raised by people outside of their biological family. Due to such a small sample size, relative to the full sample, and to optimize the ANOVA analysis, random samples of the non-adopted cases were used to create comparison samples of 378 participants each to ensure any results were not a fluke due to unique features that might be present in any given sample. The non-adopted cases were divided into ten groups of 4,168 except for the tenth group which had 4,167 cases in it. From each group, 378 cases were randomly selected to create ten random samples. The University of Southern Mississippi Institutional Review Board reviewed and approved this study (Appendix A).

### *Measurements*

The measurements used for this study came from two sources: the NESARC itself and a taxometric study done by Green, Ahmed, Marcus, and Walter (2010). The NESARC had three sections that were of interest to this study: Alcohol, Conduct Disorder, and Antisocial Personality Disorder. The Alcohol section covered 297 items which were split into four subsections. These subsections were Alcohol Consumption (alcohol use frequency, type of alcohol used); Alcohol Dependence (tolerance, withdrawal symptoms); Alcohol Treatment Utilization, and Family History of Alcoholism. The Alcohol Treatment Utilization section of the NESARC was excluded from this study. The Conduct Disorder and Antisocial Personality Disorder sections were congruent with the diagnostic criteria found in the DSM-IV.

Green et al. (2010) used the NESARC data to investigate the latent structure of alcohol use pathology via taxometric analysis. Their study created the alcohol use variables, Antisocial Personality Disorder variable, and the Conduct Disorder variable, used in the present study, from the NESARC dataset. After eliminating redundant items, Green et al. used principal components analysis to extract five components representing different aspects of alcohol use disorders from the 47 remaining items. The resulting factors, Frequency (of alcohol use), Tolerance (to alcohol effects), Loss of Control (over drinking behavior), Dangerous Behavior (while intoxicated), and Consequences (of alcohol use), became the alcohol use variables examined in the present study. A descriptive table containing the mean, standard deviation, skewness, and kurtosis of the NESARC variable used in the study can be found in Table 1. A listing of the actual NESARC alcohol use items, grouped by factor, can be found in Table 2.

### *Data Analysis*

The grouping variables used for this study were the adoption status of participants (raised by adopted or not adopted) and which set of parents drank (adopted, biological, or both). The dependent variables for this study were Frequency, Tolerance, Loss of Control, Dangerous Behavior, Consequences, Conduct Disorder, and Antisocial Personality Disorder. A two-way factorial ANOVA was conducted to compare the three grouping variables to each dependent variable for each dataset. The analysis examined the main effects of adoptive status, the main effect for parents having alcohol problems, the additive effects for those two main effects, and the interaction effect between number of parents with alcohol use problems and adoptive status.

A 2 (raised by adoptive parents or not adopted) by 2 (whether adoptive parents drank) by 2 (whether biological parents drank) between-subjects analysis of variance (ANOVA) was done for each of the following: alcohol behaviors (frequency, tolerance, loss of control, dangerous



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behavior, and consequences) and types of disorders (Conduct Disorder and Antisocial Personality Disorder) for each dataset. Seven ANOVAs were generated for each dataset in the IBM SPSS Statistics package for a total of seventy charts.

The number of cases where participants were raised by adoptive parents ( $N = 378$ ) was rather small in comparison to the full sample ( $N = 43,093$ ). Comparing the adopted subsample to the remaining cases could greatly distort any statistical analyses. However, extracting a single dataset of the same size for comparison, from the non-adopted majority, could result in a comparison sample that does not represent the characteristics of the larger group. Therefore, ten comparison datasets were used in this study to make sure that the results were not due to idiosyncrasies of a single comparison sample. Due to the results remaining largely consistent over the ten datasets, only the first dataset will be discussed in detail. In cases where analyses of the remaining nine comparison samples produce effects that were not reflected in the first comparison dataset, the effect and sample dataset that contained it will be reported. The nine confirmatory datasets were put into a chart that can be found in the Appendix B.

## Results

### *Frequency*

See Table 3. There were no significant effects on Frequency found for any grouping variables in the initial dataset. However, results from two other comparison datasets did find a significant interaction effect between two variables. Dataset five showed a significant interaction effect between raised by adoptive parents and whether biological parents drank,  $F(2, 756) = 3.26, p = .04$ . Dataset six also found a significant interaction effect between the same two variables,  $F(2, 756) = 3.06, p = .05$ . Participants in those two samples had statistically higher

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frequency of drinking if they were raised by adoptive parents and had biological parents who consumed alcohol.

### *Tolerance*

See Table 4. There were no significant effects on Tolerance found for any grouping variables in the initial dataset. However, there was a significant effect found in one of the comparison datasets. Dataset ten showed a significant effect for being raised by adoptive parents,  $F(1, 756) = 4.36, p = .04$ . In this comparison dataset, participants reported having a statistically higher tolerance for alcohol when they were raised by adoptive parents.

### *Loss of Control*

See Table 5. There was a significant effect on Loss of Control for whether adoptive parents drank,  $F(2, 756) = 4.05, p = .02$ . There was also a significant effect on Loss of Control for whether biological parents drank,  $F(2, 756) = 9.86, p = .000$ . Participants who had at least one set of parents that drank reported statistically greater loss of control when they drank regardless if that one set was biological or adoptive. The effect was bigger for biological parents drinking than adoptive parents.

There was a significant interaction effect between whether adoptive parents drank and whether biological parents drank,  $F(3, 756) = 3.27, p = .02$ . Loss of control when drinking was statistically higher in participants when both adoptive parents and biological parents had alcohol use problems. This interaction effect was not seen for datasets six and seven though the main effects for whether adoptive parents drank and whether biological parents drank fell in line with the other datasets.

One comparison dataset did find a significant interaction effect that the initial dataset did not. Dataset eight had a significant interaction effect between raised by adoptive parents and

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whether biological parents drank,  $F(2, 756) = 4.68, p = .01$ . In this sole comparison, participants had a statistically higher loss of control when they drank if their biological parents drank even though they were raised by adoptive parents.

### *Dangerous Behavior*

See Table 6. There was a significant effect found on Dangerous Behavior for whether adoptive parents drank,  $F(2, 756) = 3.33, p = .04$ . A significant effect was also found for whether biological parents drank,  $F(2, 756) = 8.15, p = .00$ . Participants demonstrated statistically greater dangerous behavior associated with alcohol if either set of parents consumed alcohol regardless of whether they were biological or adoptive.

A significant interaction effect was found between raised by adoptive parents and whether biological parents drank,  $F(2, 756) = 13.69, p = .01$ . Participants had a statistically higher rate of dangerous behavior associated with alcohol when they were raised by adoptive parents and their biological parents drank. This interaction effect was found only in the initial dataset and dataset seven. The remaining eight datasets reflected the main effects for adoptive parents drinking and for biological parents drinking, but did not reflect the interaction effect for being raised by adoptive parents and biological parents drinking.

### *Consequences*

See Table 7. There was a significant effect found on Consequences of drinking for whether biological parents drank,  $F(2, 756) = 8.58, p = .00$ . Participants reported statistically higher consequences associated with their alcohol usage if their biological parents consumed alcohol.

Comparative datasets seven and eight found interaction effects of Consequences that the initial dataset did not. Dataset seven had a significant effect between being raised by adoptive

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parents and whether biological parents drank,  $F(2, 756) = 3.10, p = .05$ . Dataset eight also had an effect between the same two variables,  $F(2, 756) = 2.99, p = .05$ . For these two datasets, participants demonstrated statistically greater consequences for their alcohol consumption when their biological parents drank and they were raised by adoptive parents.

### *Conduct Disorder*

See Table 8. A significant effect on Conduct Disorder was found for being raised by adoptive parents,  $F(1, 756) = 7.30, p = .007$ . Participants raised by adoptive parents had statistically more CD symptoms. In addition, effects were found for whether adoptive parents drank,  $F(2, 756) = 5.10, p = .006$ , and whether biological parents drank,  $F(2, 756) = 11.31, p = .000$ . Participants who had at least one set of parents that drank were statistically more likely to report symptoms of CD regardless of whether that set of parents were biological or adoptive.

There was a significant interaction effect found between whether adoptive parents drank and whether biological parents drank,  $F(3, 756) = 5.66, p = .001$ . Participants who had both sets of parents that drank reported having statistically more symptoms of CD than those who just had one set of parents that consumed alcohol.

### *Antisocial Personality Disorder*

See Table 9. There was a significant effect on Antisocial Personality Disorder found for raised by adoptive parents,  $F(1, 756) = 6.02, p = .01$ . Participants were found to report statistically greater symptoms of Antisocial Personality Disorder when raised by adoptive parents. There were also significant effects for whether adoptive parents drank,  $F(2, 756) = 4.00, p = .02$ , and whether biological parents drank,  $F(2, 756) = 5.33, p = .005$ . Participants endorsed statistically greater symptoms of ASPD if either their adoptive parents or biological parents drank. Biological parents drinking had a larger effect than adoptive parents drinking.

A significant interaction effect was found between whether adoptive parents drank and whether biological parents drank,  $F(3, 756) = 3.23$ ,  $p = .02$ . If both sets of parents consumed alcohol, participants were statistically more likely to report symptoms of ASPD.

### **Discussion**

The current study examined alcohol use pathology using adoption status. The five hypotheses for this study were partially supported. There were no occurrences where an effect was found for every variable within a single table. The first hypothesis, which stated that adoption status (environmental factor) by itself would not be a risk factor, was found to be true except for three occurrences. Within a comparison dataset, tolerance was reported to be higher in participants raised by adoptive parents. The effect for this variable was not seen in any of the other datasets. Adoption status was also found to be a possible indicator of CD and ASPD which was unexpected in the terms of this study.

The second hypothesis, which stated that there would be increased risk for alcohol use disorders if biological parents drank (biological factor with possible environmental effects as well), was found to be true for every variable except for frequency and tolerance. The variables for loss of control, dangerous behavior, consequences, CD, and ASPD were all shown to be significantly influenced by drinking in the biological parents.

The third hypothesis, which stated that there would be increased risk for alcohol use disorders if adoptive parents drank (environmental factor), was supported for loss of control, dangerous behavior, CD and ASPD, but not for frequency, tolerance, and consequences. This suggests that loss of control, dangerous behavior, CD, and ASPD are influenced by the

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environment via adoptive parent drinking behaviors, but frequency, tolerance, and consequences are not.

The fourth hypothesis, which stated that an interaction would occur between adoption status and biological parents drinking (combined biological and environmental effect), was found to be supported for four out of the seven variables tested. The variables which supported this interaction effect were frequency, loss of control, dangerous behavior, and consequences. However, only dangerous behavior was found to have an effect in the initial dataset. Frequency, dangerous behavior, and consequences found effects in two out of the ten datasets measures. Loss of control only had an effect in one of the ten datasets. The fact that the interaction was not consistent across datasets for any of the variables suggests that it may have no legitimate effect.

The final hypothesis, which stated that drinking in both adoptive parents and biological parents would also have an interaction effect (combined biological and environmental effect), was only supported by three of the variables being tested. The effect for loss of control was found in the initial dataset, but two of the comparison datasets did not show a significant interaction effect as seen in the initial dataset. Still, eight out of ten significant effects gives consistent support for this interaction effect. The variables CD and ASPD did have a significant interaction effect in the initial dataset, which was supported in the comparison sets.

While the findings of the current study did not support all hypotheses of the study, there were findings that support previous studies. Previous studies have found that biological parents' drinking does have an impact on their children (King et al, 2009; Foroud & Phillips, 2012; Bottlender, Preuss, & Soyka, 2006; Cloninger et al., 1995). The current study found that out of all the variables tested, the one that had the most effect was drinking in biological parents. Every time there was a main effect found in both adoptive parents drinking and biological parents

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drinking, the effect for biological parents was always larger. This has led support to the idea that biological influences have a bigger effect on the development of alcohol use disorders than environmental ones.

The relationships between factors predicting alcohol use disorders, and those predicting occurrences of symptoms of CD and ASPD were also supported with this study. Slutske et al. (1998) found that the relationship between CD and alcohol dependence was strong in both men and women using twin studies. There was an increased risk of developing alcohol dependence in participants that had either symptoms of CD or CD itself (Slutske et al., 1998). The current study found that drinking in either adoptive or biological parents predicted higher reports of symptoms of CD in the participants. There was also an interaction effect between adoptive parents drinking and biological parents drinking, suggesting both environmental and biological factors influence development of CD. The results were the same for ASPD in this study.

The most interesting finding was the strong relation between these two disorders and being raised by adoptive parents. This finding was not expected and opens a line of research that is worth investigating. A reason for this relationship could come from how the participants were treated in the foster care system in their younger years. Depending on their experience, this could explain why adoption status was found to be a risk factor. Another possibility is that children put up for adoption, as a group, may have a higher incidence of biological risks for CD and ASPD.

A particular strength for the current study would be the archival data used. The NESARC allows researchers to conduct a number of studies due to its large number of participants and the range of items covered. Without these qualities, this study would have been difficult, if not impossible, to do on one's own. The items measured also conveyed validity and favorable distribution properties to the variables used in this study. Adoption studies have been found to be

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a useful tool when researching various disorders (King et al., 2009; Newlin, Miles, van den Bree, Gupman, & Pickens, 2000). The current study, though not an adoption study in the traditional sense, effectively used adoptive status to investigate the contributions of environmental and biological factors on alcohol use variables and the related disorders Conduct Disorder and Antisocial Personality Disorder, both commonly associated with heavy alcohol consumption.

One limitation for the current study was missing information. Some of the adopted participants did not have information about their biological parents' drinking habit which is not unheard of due to the sensitive nature of adoption. This information could have had an effect on the results that this study found. A way that future researchers could work around this would be to separate those who do have information about their biological parents from those who do not, and examine them separately. Another limitation could be the age of the archival data itself. The NESARC was done almost eleven years ago. While the general trends seen may still apply, the makeup of the participants and their drinking habits may have changed during the past decade. There have been several important events that could have had some potential effects on drinking habits among Americans. Adoption is also on the rise so there could be a bigger pool of adopted participants when the next NESARC is conducted. One last limitation comes from the location of the study. All participants of the NESARC were located in the United States so some of the results may only apply to Americans. Future researchers would benefit by seeing if other countries have such a survey in order to see if the same results are found in places outside of the United States. More research using both the NESARC and other research methods is necessary to uncover more information about alcohol use disorders and their risk factors to gain better techniques to treat them.



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Table 1. Descriptive Statistics for Dataset 1

	Raised by Adoptive Parents				Raised by Biological Parents				Total Sample			
	M	SD	Skew	Kurtosis	M	SD	Skew	Kurtosis	M	SD	Skew	Kurtosis
Adoptive Parents Alcoholics	.22	.48	2.05	3.50	.00	.00			.11	.35	3.33	11.20
Biological Parents Alcoholics	.13	.42	3.47	11.34	.21	.46	2.14	3.90	.17	.45	2.71	6.78
Adoptive x Biological Parents	.11	1.29	7.30	76.77	-.09	.51	-2.14	3.90	.01	.99	8.26	117.25
Consequences	1.57	3.51	3.15	10.30	.98	2.71	3.87	17.22	1.28	3.15	3.47	13.12
Loss of Control	1.87	2.19	.97	.04	1.12	1.92	1.77	2.27	1.49	2.09	1.31	.77
Dangerous Behavior	1.53	1.91	.92	-.56	.92	1.62	1.64	1.42	1.23	1.79	1.23	.14
Tolerance	.75	1.60	5.33	54.95	.76	3.31	9.46	106.39	.76	2.60	10.37	144.04
Frequency	25.28	36.71	6.37	56.31	21.62	32.22	4.34	25.11	23.45	34.56	5.57	45.37
Conduct Disorder	1.69	2.20	1.62	2.45	.98	1.67	2.45	6.86	1.33	1.98	1.97	4.00
Antisocial Personality Disorder	1.57	1.83	1.02	.07	.83	1.41	2.04	3.87	1.20	1.67	1.43	1.23

Table 2. Items used

<b>Frequency</b>
Number consumed during heaviest drinking
Frequency during period of heaviest drinking
Frequency of 5+ during heaviest drinking
Duration of heaviest use
Impairment from withdrawal prior to 12 months
Impairment from withdrawal last 12 months
<b>Tolerance</b>
Tolerance last 12 months
Tolerance
Tolerance prior to 12 months
Last 12 Months drank more
Ever increasing amount for same effect
<b>Loss of Control</b>
Drank more than intended
Drank longer than intended
Wanted to stop more than once
Nausea after alcohol
Headaches after alcohol
Failed to stop more than once
Ever drank a fifth in one day
Sleep disturbance after alcohol
<b>Dangerous Behavior</b>
Drinking while passenger in car
Ride with drinking driver more than once
Drive intoxicated more than once
Drinking while drinking more than once
Dangerous activity while drinking
Reverse tolerance
<b>Consequences</b>
Give up pleasurable activities to drink
Give up important activities to drink
Drinking interfered with family responsibilities
Continue to drink after depressed, bored, etc.
Job or school problems from drinking
Continued drinking after health problems
Period sick due to alcohol
Seizures after alcohol
Medicated before hangover
Hallucinations after alcohol
Continued after family/friend disturbance
Continued drinking after having a blackout
Ever medicated for hangover
Ever sought treatment
Anxious after alcohol
Shakes after alcohol
Arrested/legal problems for drinking
Fighting while drinking
Period of heavy drinking
Restless after alcohol
Sweating or tachycardia after alcohol

Table 3. ANOVA Results for Frequency of Alcohol Use

Grouping Variables	df	Mean Square	<i>F</i>	<i>p</i>	Partial Eta Squared
Raised by Adoptive Parents	1	2267.111	1.897	.169	.003
Whether Adoptive Parents Drank	2	497.534	.416	.660	.001
Whether Biological Parents Drank	2	786.730	.658	.518	.002
Raised by Adoptive Parents x Biological Parents Drank	2	1898.433	1.588	.205	.004
Adoptive Parents Drank x Biological Parents Drank	3	1281.274	1.072	.360	.004

Table 4. ANOVA Results for Tolerance to Alcohol

Grouping Variables	df	Mean Square	<i>F</i>	<i>P</i>	Partial Eta Squared
Raised by Adoptive Parents	1	.482	.071	.790	.000
Whether Adoptive Parents Drank	2	7.418	1.094	.335	.003
Whether Biological Parents Drank	2	11.107	1.638	.195	.004
Raised by Adoptive Parents x Biological Parents Drank	2	1.276	.188	.829	.001
Adoptive Parents Drank x Biological Parents Drank	3	3.741	.552	.647	.002

Table 5. ANOVA Results for Loss of Control due to Alcohol Use

Grouping Variables	df	Mean Square	<i>F</i>	<i>p</i>	Partial Eta Squared
Raised by Adoptive Parents	1	.062	.015	.902	.000
Whether Adoptive Parents Drank	2	16.471	4.045	.018	.011
Whether Biological Parents Drank	2	40.150	9.861	.000	.026
Raised by Adoptive Parents x Biological Parents Drank	2	8.070	1.982	.139	.005
Adoptive Parents Drank x Biological Parents Drank	3	13.312	3.270	.021	.013



Table 6. ANOVA Results for Dangerous Behavior due to Alcohol Use

Grouping Variables	df	Mean Square	<i>F</i>	<i>p</i>	Partial Eta Squared
Raised by Adoptive Parents	1	2.180	.722	.396	.001
Whether Adoptive Parents Drank	2	10.056	3.328	.036	.009
Whether Biological Parents Drank	2	24.614	8.147	.000	.021
Raised by Adoptive Parents x Biological Parents Drank	2	13.688	4.530	.011	.012
Adoptive Parents Drank x Biological Parents Drank	3	5.391	1.784	.149	.007

Table 7. ANOVA Results for Consequences due to Alcohol Use

Grouping Variables	df	Mean Square	<i>F</i>	<i>p</i>	Partial Eta Squared
Raised by Adoptive Parents	1	.073	.008	.930	.000
Whether Adoptive Parents Drank	2	12.631	1.344	.262	.004
Whether Biological Parents Drank	2	80.696	8.584	.000	.023
Raised by Adoptive Parents x Biological Parents Drank	2	2.091	.222	.801	.001
Adoptive Parents Drank x Biological Parents Drank	3	7.615	.810	.489	.003

Table 8. ANOVA Results for Conduct Disorder

Grouping Variables	df	Mean Square	<i>F</i>	<i>p</i>	Partial Eta Squared
Raised by Adoptive Parents	1	26.322	7.304	.007	.010
Whether Adoptive Parents Drank	2	18.381	5.101	.006	.014
Whether Biological Parents Drank	2	40.765	11.312	.000	.029
Raised by Adoptive Parents x Biological Parents Drank	2	1.858	.515	.597	.001
Adoptive Parents Drank x Biological Parents Drank	3	20.394	5.659	.001	.022

Table 9. ANOVA Results for Antisocial Personality Disorder

Grouping Variables	df	Mean Square	<i>F</i>	<i>p</i>	Partial Eta Squared
Raised by Adoptive Parents	1	15.384	6.020	.014	.003
Whether Adoptive Parents Drank	2	10.208	3.995	.019	.001
Whether Biological Parents Drank	2	13.623	5.331	.005	.002
Raised by Adoptive Parents x Biological Parents Drank	2	1.226	.480	.619	.004
Adoptive Parents Drank x Biological Parents Drank	3	8.251	3.229	.022	.004

## Appendix A: IRB Approval Letter



THE UNIVERSITY OF  
SOUTHERN MISSISSIPPI

**INSTITUTIONAL REVIEW BOARD**

118 College Drive #5147 | Hattiesburg, MS 39406-0001  
Phone: 601.266.6820 | Fax: 601.266.4377 | [www.usm.edu/irb](http://www.usm.edu/irb)

**NOTICE OF COMMITTEE ACTION**

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.  
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **13101709**

PROJECT TITLE: **The Separate and Combined Effects of Heredity and Environment  
Predicting Alcohol Use Disorder Symptoms and Antisocial Personality Disorder Symptoms**

PROJECT TYPE: **New Project**

RESEARCHER(S): **Bradley Green, Ph.D.**

COLLEGE/DIVISION: **College of Education and Psychology**

DEPARTMENT: **Psychology**

FUNDING AGENCY/SPONSOR: **N/A**

IRB COMMITTEE ACTION: **Expedited Review Approval**

PERIOD OF APPROVAL: **10/21/2013 to 10/20/2014**

**Lawrence A. Hosman, Ph.D.**  
**Institutional Review Board**

## Appendix B: Eta Effect for the Comparison Datasets

## Frequency of Alcohol Use

	Dataset 2	Dataset 3	Dataset 4	Dataset 5	Dataset 6	Dataset 7	Dataset 8	Dataset 9	Dataset 10
Raised by Adoptive Parents	.001	.004	.001	.000	.002	.003	.001	.004	.001
Whether Adoptive Parents Drank	.001	.001	.001	.001	.001	.001	.001	.001	.001
Whether Biological Parents Drank	.001	.002	.001	.002	.001	.002	.001	.001	.001
Raised by Adoptive Parents x Biological Parents Drank	.003	.006	.006	.009	.008	.004	.003	.004	.005
Adoptive Parents Drank x Biological Parents Drank	.003	.005	.004	.004	.004	.004	.003	.003	.003

Running head: EFFECTS OF HEREDITY AND ENVIRONMENT

### Tolerance of Alcohol Use

	Dataset 2	Dataset 3	Dataset 4	Dataset 5	Dataset 6	Dataset 7	Dataset 8	Dataset 9	Dataset 10
Raised by Adoptive Parents	.000	.000	.000	.000	.001	.000	.000	.000	.006
Whether Adoptive Parents Drank	.004	.003	.003	.003	.004	.003	.002	.001	.001
Whether Biological Parents Drank	.006	.004	.004	.004	.007	.004	.003	.001	.006
Raised by Adoptive Parents x Biological Parents Drank	.000	.000	.000	.001	.000	.000	.000	.001	.003
Adoptive Parents Drank x Biological Parents Drank	.003	.002	.002	.003	.003	.002	.001	.001	.001

Running head: EFFECTS OF HEREDITY AND ENVIRONMENT

Loss of Control due to Alcohol Use

	Dataset 2	Dataset 3	Dataset 4	Dataset 5	Dataset 6	Dataset 7	Dataset 8	Dataset 9	Dataset 10
Raised by Adoptive Parents	.000	.000	.000	.000	.000	.003	.000	.001	.001
Whether Adoptive Parents Drank	.011	.010	.010	.011	.010	.012	.011	.011	.011
Whether Biological Parents Drank	.021	.025	.018	.027	.022	.021	.025	.020	.022
Raised by Adoptive Parents x Biological Parents Drank	.004	.008	.002	.005	.004	.006	.012	.006	.006
Adoptive Parents Drank x Biological Parents Drank	.013	.012	.013	.013	.013	.015	.013	.013	.014



## Dangerous Behavior due to Alcohol Use

[illegible]

Running head: EFFECTS OF HEREDITY AND ENVIRONMENT

Consequences due to Alcohol Use

	Dataset 2	Dataset 3	Dataset 4	Dataset 5	Dataset 6	Dataset 7	Dataset 8	Dataset 9	Dataset 10
Raised by Adoptive Parents	.001	.000	.006	.000	.001	.004	.000	.000	.000
Whether Adoptive Parents Drank	.004	.003	.004	.004	.004	.004	.003	.003	.004
Whether Biological Parents Drank	.018	.021	.012	.027	.019	.015	.018	.019	.017
Raised by Adoptive Parents x Biological Parents Drank	.004	.003	.006	.001	.001	.008	.008	.004	.003
Adoptive Parents Drank x Biological Parents Drank	.004	.003	.003	.003	.003	.004	.003	.003	.003

Running head: EFFECTS OF HEREDITY AND ENVIRONMENT

### Conduct Disorder

	Dataset 2	Dataset 3	Dataset 4	Dataset 5	Dataset 6	Dataset 7	Dataset 8	Dataset 9	Dataset 10
Raised by Adoptive Parents	.015	.009	.026	.005	.010	.026	0	.007	.009
Whether Adoptive Parents Drank	.014	.014	.015	.013	.014	.015	.022	.015	.014
Whether Biological Parents Drank	.032	.036	.024	.044	.034	.026	.048	.040	.032
Raised by Adoptive Parents x Biological Parents Drank	.002	.001	.008	.001	.001	.007	0	0	0
Adoptive Parents Drank x Biological Parents Drank	.023	.023	.024	.022	.024	.025	.035	.024	.023

Running head: EFFECTS OF HEREDITY AND ENVIRONMENT

Antisocial Personality Disorder

	Dataset 2	Dataset 3	Dataset 4	Dataset 5	Dataset 6	Dataset 7	Dataset 8	Dataset 9	Dataset 10
Raised by Adoptive Parents	.013	.005	.022	.002	.002	.018	0	.006	.007
Whether Adoptive Parents Drank	.011	.010	.010	.010	.011	.011	.017	.010	.011
Whether Biological Parents Drank	.012	.015	.007	.023	.018	.009	.022	.015	.017
Raised by Adoptive Parents x Biological Parents Drank	.004	.001	.010	.001	.001	.008	0	.003	.001
Adoptive Parents Drank x Biological Parents Drank	.013	.012	.012	.012	.013	.013	.021	.013	.013