PREDICTING ALCOHOL CONSUMPTION DURING PREGNANCY

A Thesis

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MASTER OF PUBLIC POLICY AND ADMINISTRATION

by

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Abstract

of

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People exposed to alcohol in the womb can experience lifelong physical and developmental problems known as Fetal Alcohol Spectrum Disorders (FASDs). The resulting short- and long-term health outcomes of individuals with FASD-related problems, including FAS, create a significant fiscal burden on families, communities, and American taxpayers, who pay for medical treatment, long-term care, and loss of productivity resulting from healthcare institutionalization or criminal detention. It is possible to prevent prenatal exposure and FASDs, including FAS, by ensuring that pregnant women, as well as those who are trying to get pregnant or likely to get pregnant, abstain from alcohol, but many women continue to drink in spite of the serious health risks to their fetuses.

Using publicly available data about pregnant women living in the United States between the ages of 18-44 from the 2010 Behavioral Risk Factor Surveillance System annual health survey, I endeavored to determine which characteristics of American pregnant women best predict whether they report alcohol consumption. In examining this topic, I used binomial logit regression analysis to determine how several broad causal factors predict the dependent variable of whether or not pregnant women report alcohol consumption. Additionally, I compared the

results of the analysis to the federal Center for Disease Control's Project CHOICES intervention program, a program designed to reduce alcohol-exposed pregnancies by identifying women at high risk of drinking alcohol while pregnant, helping them reduce or cease alcohol consumption, and providing contraceptive counseling.

I found that several demographic and personal characteristics help predict whether a woman reports alcohol consumption during pregnancy, including age, race, marital status, health insurance access, level of education completed, employment status, and state of residence. I found that the Project CHOICES program included several useful intervention techniques for reaching at-risk women, but that the program and others like it may need to adjust the criteria for identifying at-risk women in order to reach and treat more women.

With the combined results of this regression analysis and case study, policy makers can adjust their current programs, or better target their outreach efforts, to help change the behavior of those groups of women who are at greatest risk for consuming alcohol during pregnancy. In this thesis, I recommend that policy makers who wish to reduce drinking among pregnant women should focus on targeting certain populations of women for public messaging and enrollment in public health programs, as well as addressing certain external factors that could lead to lower drinking rates among pregnant women.

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Date

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Chapter 1

INTRODUCTION

In 1973, the United States Surgeon General first publicly recognized no safe level of alcohol exposure for fetuses and indicated that alcohol exposure in the womb could have a detrimental effect on fetal development (Carmona, 2005). In the subsequent decades, many researchers have calculated the financial and social burdens on communities resulting from prenatal alcohol exposure. Alcohol exposed pregnancies (AEPs) can result in lasting harm to individuals, affecting some people into adulthood (Carmona, 2005; CDC, 2009; DHHS, 2009; NIAAA, 2011). Some of these people are born with a range of permanent physical and/or mental problems known as Fetal Alcohol Spectrum Disorders (FASDs), not all of which are immediately recognizable or diagnosable at birth (CDC, 2012). Fetal Alcohol Syndrome (FAS) is the most severe type of FASD; the sufferers of this condition have severe physical malformations and developmental delays (CDC, 2012). It is possible to prevent prenatal alcohol exposure and FASDs, including FAS, by ensuring that pregnant women, as well as women who are trying to get pregnant or likely to get pregnant, abstain from alcohol; however, many women continue to drink in spite of the serious health risks to their fetuses (NIAAA, 2011). The resulting short- and long-term health outcomes of individuals with FASD-related problems, including FAS, create a significant fiscal burden on American taxpayers, who pay the bill for medical treatment, long-term care, and loss of productivity resulting from healthcare institutionalization or criminal detention (NIAAA, 2011). In the below chapter, I further describe FASDs, the American population affected by them, and costs associated with them.

To prevent and reduce the incidence of FASDs in the United States, federal, state, and local governments have implemented a patchwork of programs and policies of varying effectiveness. Because paying to care for FASD-afflicted individuals can be quite expensive to

the public, these governmental entities administer periconceptional and prenatal programs that include components designed to reduce the incidence of FASDs by educating all women of childbearing years about the dangers of drinking while pregnant, and through screening for alcohol consumption during pregnancy (SAHMSA, 2009). Additionally, the federal government provides some pregnant women alcohol cessation services through Medicare (CMS, 2011). Unfortunately, pregnant women continue to consume alcohol and infants continue to be born with FASDs (NIAAA, 2011).

Policy makers must find ways to use the dollars they have available to prevent or reduce the incidence of FASDs in the most efficient and effective manner for their communities. In order to ensure the maximum reach and efficacy of these programs, and to best distribute restricted resources aimed at reducing the incidence of costly preventable problems associated with AEPs, policy makers should seek to understand which pregnant women are most likely to consume alcohol. They may find it helpful to understand which demographic and personal characteristics best predict whether a pregnant woman will consume alcohol. They may wish to apply this information to existing publicly funded prenatal programs. They may also wish to understand which intervention and treatment approaches are most effective in helping women at risk of having AEPs to curb their alcohol use. Using this information, policy makers can make FASD-reduction programs more effective in two ways: 1) they can direct program dollars toward the women identified in such a study; 2) they can develop new programs and modify existing programs to correctly identify at-risk women and positively change the behavior of the women identified.

Below, I pose the research question I seek to answer with this Master's thesis to assist policy makers. Next, I describe the incidence of alcohol consumption during pregnancy and the incidence of FASDs in the United States. I then explain the short- and long-term negative health

and social results of FASDs, as well as the direct and indirect costs to society of FASDs. Finally, I outline the remainder of this thesis.

Research Question

Because of the negative fiscal, public health, and social consequences that prenatal alcohol exposure can inflict upon individuals, communities, and governmental entities, in this Master's thesis I seek to answer the following question: What characteristics of American pregnant women best predict whether they report alcohol consumption? In examining this topic, I use regression analysis to determine how several broad causal factors, particularly my key explanatory variable of education level, predict the dependent variable of whether or not pregnant women report alcohol consumption. I predict that highly educated women will be more likely to consume alcohol during pregnancy than those with less education. I chose this variable because my review of the literature reveals conflicting reports about how education levels effect alcohol consumption. I expect that several other variables will also indicate pregnant women's greater likelihood to consume alcohol. For the purpose of this Master's thesis, I compare the results of the regression analysis to the CDC's Project CHOICES intervention program, which is designed to reduce AEPs by identifying women at high risk of drinking alcohol while pregnant, helping them reduce or cease alcohol consumption, and providing contraceptive counseling. From this comparison, I make recommendations on how Project CHOICES can improve its results, and how other governmental entities could implement programs that incorporate the best practices of this existing program while adopting improvements. With the combined results of this regression analysis and case study, policy makers can adjust their current programs, or better target their outreach efforts, to help change the behavior of the groups of women who are at greatest risk for consuming alcohol during pregnancy.

Need for Study: Fetal Alcohol Spectrum Disorders Create Lifelong Consequences for Individuals and Long-Term Costs for American Taxpayers

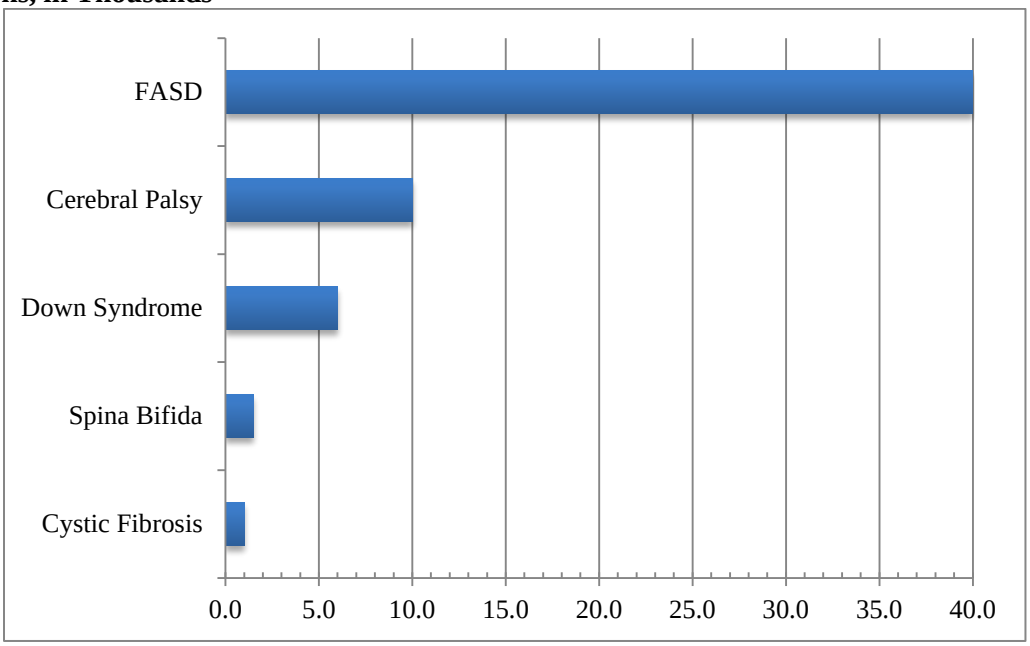
Scope of the Problem

Alcohol consumption is one of the most common preventable potentially harmful behaviors in which women engage during pregnancy. About twice as many women consume alcohol during pregnancy as illicit drugs (Mollman, 2012). In California specifically, about 67,000 pregnant women were estimated to use alcohol during pregnancy, while only 40,000 were estimated to use illicit drugs, out of a total of approximately 552,000 women who gave birth in 2008 (see Figure 1.1) (CDADP, 2012). This data reveals that alcohol consumption during pregnancy, in California at least, remains an even larger problem behavior than illicit drug use during pregnancy. In 2002, 10.1% of women living in the US self-reported that they continued to drink during their pregnancies; clearly, either pregnant women do not know about the potential harmful effects of drinking while pregnant, or they continue to drink in spite of knowing the risks (Mengel et. al., 2006). In a survey completed between 2006 and 2010, one in 13 pregnant women, or 7.6%, in the US reported that they had consumed alcohol in the previous 30 days (DHHS, 2009). In California alone, in 2003, 19% of women who gave birth reported drinking alcohol at the beginning or end of their pregnancy (CADP, 2006). This is also troubling information, given that significant fetal development occurs during the first trimester of pregnancy, meaning that Californians who consumed alcohol during that portion of their pregnancy put their fetuses at particular risk of harm (CDC, 2009).

Fetal alcohol exposure affects between one and three percent of live births in the United States, but some experts believe that this estimate is low because more mild forms of FASDs can be difficult to diagnose, particularly right after birth (Mengel et. al., 2006). Although this percentage may seem small, the federal government estimates that as many as 40,000 babies are born each year with an FASD, meaning that this disorder is more common at birth than autism

spectrum disorder diagnoses in children, and more common than Down Syndrome, cystic fibrosis, cerebral palsy and spina bifida diagnoses combined (see Figure 1) (SAHMSA, 2006; NOFAS, 2012).

Figure 1.1: Approximate Number of Babies Born Annually in the U.S. with Specified Conditions, in Thousands



Source: CDC, 2009.

The Center for Disease Control and Prevention estimates an incidence of between .2 and 2.0 per 1,000 live births of FAS, the most severe and most expensive condition on the FASD spectrum (CDC, 2012). The state of California provides a clear example of the problem: About 5,550 babies with FAS are born in California each year, and CDSS estimates that over 380,000 Californians have FAS (CDSS, 2010). FAS is further described in the following section, with explanations of how even this small number of affected babies creates significant immediate and long-term costs.

Fetal Alcohol Exposure Associated with Short- and Long-Term Health and Social Problems

A tremendous body of research indicates that alcohol consumption can lead to worse health outcomes for expectant mothers and their infants, while reduced or no alcohol consumption can help curtail such outcomes. Although not all babies exposed to alcohol in the womb develop any FASDs, the US Surgeon General has repeatedly affirmed that no level of alcohol exposure is known to be safe for a fetus, and has consistently recommended women totally abstain from alcohol consumption when trying to get pregnant or once learning of pregnancy (Carmona, 2005). This recommendation is in place because when a pregnant woman consumes alcohol, the alcohol freely crosses the placenta; at times, blood alcohol level of the fetus and the mother are the same (Mengel et. al., 2006). Such exposure can result in infants developing one or more FASDs, which include a range of negative outcomes associated with alcohol consumption during pregnancy, manifesting in particular physical, mental, emotional, and behavioral anomalies (DHHS, 2009). The most severe FASD, FAS, results in permanent facial malformations, growth retardation, brain developmental delays and motor skill development problems (DHHS, 2009; Mengel et. al., 2006). Much research has shown an increased risk of low birth weight or length, two traits of FAS, when a mother consumed alcohol during pregnancy, regardless of in which pregnancy trimester she drank (CDHS, 2012). Perhaps unsurprisingly, alcohol abuse during pregnancy is one of the leading preventable causes of mental retardation in the US (Maier and West, 2001).

As infants with various FASDs, including FAS, grow into adults, other long-term complications arise. In addition to physical malformations and motor skill delays, individuals who suffer from one or more FASDs may have learning disabilities, impulse control problems, seizures, deficits in language skills, and deficiencies in math skills, memory, attention, and judgment (Mengel et. al., 2006). They may also experience problems with higher-level mental functions and skills, such as planning, problem solving, organizational thinking, and acting

appropriately when socializing (NIAAA, 2011). Children with one or more FASDs may require intervention at school to help them address these problems, work and socialize in the classroom, and complete schoolwork. Without treatment, these problems can worsen as children grow, and can seriously affect academic performance and attainment level (Mengel et. al., 2006; NOFAS, 2012).

Adults with one or more FASDs and/or FAS may have lifelong dependency on their families or government services. These adults might need assistance finding appropriate, affordable housing and transportation, maintaining employment and handling their financial matters (NOFAS, 2012). In a survey of FASD-afflicted adults, over half reported having trouble keeping a job (60%), and 80% reported problems managing their money and making financial decisions by themselves (SAHMSA, 2006). Additionally, because of their behavioral problems, FASD individuals may get in trouble with the law: one study found that 35% of individuals with FASD have been committed to jail or prison during their lives (SAHMSA, 2006). The National Task Force on Fetal Alcohol Syndrome and Fetal Alcohol Effect reported that FASD-affected adults might have an increased risk of injuries, unintended pregnancies, sexually transmitted diseases, and substance abuse (DHHS, 2009). Further, they may face difficulties being parents themselves; if they become involved in the child welfare system, they may repeatedly fail to follow through with court-ordered services for their children because they do not understand the requirements (Whitney, 2012). Clearly, the long-term health and social problems associated with fetal alcohol exposure can negatively affect the quality of life of individuals with FASDs, those who care for them, and the children who depend on them.

Effects of Fetal Alcohol Exposure Create Significant Costs

Poor health outcomes from fetal alcohol exposure create many direct and indirect costs. Direct costs include the actual use of goods and services by individuals with FASDs, such as

physical and mental healthcare services and treatments, special education, social services, residential or institutional care, and processing and incarceration in the criminal justice system (Lupton, 2003). These costs are striking: an infant with FAS incurs about $800,000 to $2 million in lifetime health costs, as opposed to $316,000 in lifetime health costs for an average American (CDC, 2012; Alemayehu, 2004). In 2003, the US government estimated that it spent $3.9 billion in direct costs on FAS alone (CADP, 2012). Indirect costs include foregone productivity as a result of mortality, morbidity (including sickness, lost or impaired days of work), disability, or incarceration of afflicted individuals, as well as the lost productivity of the caregivers of those afflicted (Lupton, 2003). In 2003, this lost productivity resulted in $1.5 billion in indirect costs in the United States (Lupton, 2003). Given these estimated dollar amounts, even a program that costs up to $850,000 per child to prevent FAS is cost effective (Lupton, 2003). Because of these costs and the cost effectiveness of prevention, policy makers at the federal, state, and local levels have implemented several strategies to reduce alcohol consumption among pregnant women, and therefore reduce the amount of permanent consequences and costs associated with fetal alcohol exposure.

Publicly Funded Options to Reduce Incidence of Fetal Alcohol Exposure

Since not all fetuses exposed to alcohol ultimately develop an FASD, there is some debate in the medical community about whether there is a safe level of alcohol consumption for pregnant women. As mentioned above, the US Surgeon General has indicated that no level of alcohol consumption has been shown to be safe for a fetus, and has reaffirmed that finding multiple times (Carmona, 2005). As a result, public policies in the United States focus as much as possible on ensuring that pregnant women abstain totally from alcohol, and on encouraging pregnant women who drink to cease doing so for the remainder of their pregnancies.

In order to minimize or prevent fetal alcohol exposure, policy makers can approach the issue in two ways. First, they can encourage pregnant women and women who are likely to become pregnant to abstain from alcohol consumption (Mengel et. al., 2006). For this approach, policy makers can best target public resources to address the problem by determining which women are most likely to drink during pregnancy. Once they have identified the women they wish to educate about alcohol abstention during pregnancy, they can tailor awareness campaigns and treatment options in ways that are most likely to encourage those women to change their behaviors. This approach is the primary focus of this research.

Second, policy makers can attempt to increase the use of effective contraception by sexually active women of childbearing age who drink alcohol (Mengel et. al., 2006). While it is not the focus of this thesis, this approach is also important to take into account, since 49% of pregnancies in the US were unplanned in 2006 (CDC, 2013). Women not planning to get pregnant – even those who understand the risks of fetal alcohol exposure and who would not drink if they knew they were pregnant – might inadvertently expose a fetus to alcohol before they learn they are pregnant (CDC, 2013). Although this approach is beyond the scope of this research, policy makers may wish to review and incorporate the contraception strategy into their outreach efforts to women who already know that they are pregnant, as those women may wish to try to ensure that they do not get pregnant in the future when they want to drink alcohol.

Whether policy makers choose one or both approaches to reduce fetal alcohol exposure, the policies they implement should result in lower direct and indirect costs to administer than the direct and indirect costs of unchecked FASDs. Additionally, the policies should reflect collaboration between the levels of government, academia, healthcare and social welfare systems, and community members (DHHS, 2009).

Thesis Structure

The following sections of this thesis will include a literature review chapter, a methodology chapter featuring a regression model, data, and case description, a results chapter including a regression analysis and a case study, and a conclusion. The following chapter includes the literature review, which will cover the broad themes of previous research on factors for predicting pregnant women's alcohol consumption, and which will include an overview of several government programs designed to reduce women's alcohol consumption to compare them to the Project CHOICES program's identification and treatment of at-risk women. In Chapter 3, I describe my regression method, discuss my hypothesis, include tables and explanations of descriptive statistics of the variables I use, and explain the way I assess the Project CHOICES intervention model. In Chapter 4, I explain the results of running the equation and of comparing the case study to these results and other alcohol intervention programs. Finally, in the conclusion I more broadly explain how the regression results, in combination with the analysis of the Project CHOICES AEP prevention efforts, are applicable to policy changes, further research and improvements to government policies.

Chapter 2

LITERATURE REVIEW

Many studies indicate that certain factors consistently help predict whether a woman is likely to drink alcohol during pregnancy and thus potentially harm her fetus. Some of these studies show that immutable **demographic characteristics** (i.e., age, ethnicity, foreign-born status) predict higher rates of alcohol consumption for various reasons. Other studies indicate that several potentially temporary **personal characteristics** that may or may not change over the course of a woman's childbearing years (i.e., pregnancy status, marital status, employment status, educational attainment) clearly predict rates of alcohol consumption. I have included these factors in this literature review to compare past researchers' findings with my own. Because FASDs are caused by both repeated drinking, as well as by episodes of binge drinking during pregnancy (CDC, 2002), I have included studies with both of these drinking categories. I include a table in Appendix A to summarize the specific results and conclusions of the regression-based studies. A primary purpose of this literature review is to inform my own creation of a regression analysis of this subject, and to compare the results derived in my own study with results from previous studies.

In addition, this literature review covers the results of several studies of alcohol use intervention and alcohol cessation programs to compare with the Project CHOICES case study described later. This comparison, along with the results of my regression analysis, can help policy makers determine whether they should continue to fund and replicate the Project CHOICES program elsewhere, or if the program needs changes.

Demographic Characteristics

Age: Older women more likely to drink when pregnant

A woman's age is a particularly strong predictor of whether or not she is likely to consume alcohol, and whether or not she is likely to consume it heavily. In a multi-year study of American pregnant and non-pregnant women of childbearing age, the Center for Disease Control (CDC) found that pregnant women who reported any alcohol use, binge drinking, or frequent drinking were more likely to be over 30 years as compared to those who did not report such use (CDC, 2002). A later similar study by CDC (2009) confirmed these findings and postulated that older women may be more likely to be alcohol dependent than younger women and therefore have greater difficulty abstaining, particularly considering that many older pregnant women who consumed alcohol reported binge drinking prior to pregnancy. Both studies used binary logistic regression to calculate the association between the dependent variables of drinking/binge drinking/frequent drinking and the independent variable of age, among other independent variables discussed later, including race, income level, education level, and employment status. Using binary logistic regression, Morris et. al. (2008) found that among pregnant women ages 18-44, the mean drinks per month were the highest among women in the age range of 40 to 44, who drank a mean of 3.02 drinks per month, about two more alcoholic drinks per month than the lowest group, ages 28-33, which drank a mean of 0.99 drinks per month. Women ages 18-27 reported a mean number of 1.3 drinks per month, and women ages 34-39 reported a mean number of 1.51 drinks per month. Apparently, this pattern has persisted for some time: A study using 1980 data from the National Natality Survey found that women ages 25 and older were 10% more likely to continue drinking during pregnancy than women under age 25 (Prager et. al., 1984). Unfortunately, this pattern has grave implications: Children of older mothers who drank during pregnancy are more likely to suffer more severe effects of FASD-related attention problems than those of younger mothers (Chiodo et. al., 2010). Each of these studies reported similar weaknesses, including sampling issues, since they all derived their results from survey data in

either English or Spanish and either by landline telephone or by mail, meaning that those excluded from the study were either non-English or Spanish speakers who did not have a land line or postal address. Given the sharp increase in cell phone use and the decline in landline use among younger people, the authors indicate that this could create a bias toward older study participants. The authors also note the flaw of underreporting potential, since many women may not have wanted to admit to participating in the negative behavior of drinking during pregnancy. In the case of age, older women may have received less information than younger women have received regarding dangers of alcohol-exposed pregnancies, and they may be more likely to report their alcohol intake honestly, leading to skewed results.

Since nearly half of all pregnancies in the United States are unintended (Finer, 2006), several researchers denoted the importance of learning about alcohol consumption habits of non-pregnant women of childbearing age. The CDC found that non-pregnant women under 30 years old reported the highest rates of binge drinking (15.5%) and frequent drinking (17.3%) among all women surveyed (CDC, 2002). The 2009 CDC study reported the same result, and discussed the particular problem of these younger women (who are most likely to have an unplanned pregnancy) binge drinking prior to learning of a pregnancy during a critical time of fetal development (CDC, 2009). Tsai and Floyd (2004) used logistic regression to analyze women who might become pregnant, defined as women of childbearing age who were not using any form of birth control. They found that although over half of the women reported alcohol use and 12.4% reported binge drinking, younger women were about 37% more likely to report binge drinking than the lowest category of women (ages 35-44). Using binary logistic regression, Morris et. al. (2008) found that among non-pregnant white and black women, women ages 18 to 27 averaged the highest number of monthly drinks; however, his model only accounted for about 9% of the variance in drinking, indicating a potentially poor model fit.

This collection of studies shows that while older women are more likely to report drinking during pregnancy, younger women may also be at risk of having AEPs due to their binge drinking habits. Older women may have fewer concerns about drinking while pregnant because they may not have been the target of recent public policy campaigns promoting alcohol abstention during pregnancy. Younger women, on the other hand, may be more likely to have an AEP due to their heavier drinking habits, which could lead to drinking prior to recognition of pregnancy.

Race, ethnicity, and country of origin: Whites more likely to drink, minorities less likely to stop or reduce drinking

In several studies that examined more than one race, white women consistently proved most likely to consume alcohol during pregnancy (CDC, 2002 and 2009; Tsai and Floyd, 2004; Perreira and Cortes, 2006). Among minorities, Perreira and Cortes (2006) found that black mothers were 41% less likely to drink during their pregnancies than whites, and Morris et. al. (2008) found that black non-pregnant women were less likely to report either binge drinking or any alcohol consumption than white women. Perreira and Cortes (2006) learned that Hispanic mothers were 58% less likely to drink alcohol than were their white counterparts. While white women were the most likely to report consuming alcohol during pregnancy, African American and Native American women's children have higher rates of FASD (Tenkku et. al., 2009). This may indicate that although African American and Native American women may be less likely to drink alcohol, the ones who do drink during pregnancy may do so because they are dependent on alcohol; therefore, they may have difficulty reducing consumption during pregnancy (Tenkku et. al., 2009). Tenkku et. al. (2009) found that black, Asian/Pacific Islander, and Hispanic women were all significantly more likely than white women were to reduce their heavy drinking after becoming pregnant. Similarly, Ebrahim et. al. (1998) postulated that although fewer black women reported alcohol consumption than white women did, there might be a heavier concentration of black women who have difficulty abstaining from alcohol.

Whether or not a woman was born in the United States or foreign-born strongly affected her likelihood to report drinking during pregnancy; most studies attributed this to an acculturation process whereby women more integrated into American society were more likely to consume alcohol than those less steeped in the country's culture. Perreira and Cortes (2006) found that foreign-born women were 38% less likely to drink alcohol during pregnancy than native-born American women, but the authors note that the risk of all substance use during pregnancy increased as immigrant women assimilated into the United States. This corresponds with the findings of Bakhireva et. al. (2009), who found that Latinas born in the United States were 3.21 times more likely to binge drink during the periconceptional period (the time in their menstrual cycle when they were at risk of becoming pregnant). The author also found that pregnant Latinas who predominantly spoke English at home – that is, those who were more integrated into mainstream American culture – were also at an increased risk of binge drinking (Bakhireva et. al. 2009). Bakhireva notes that foreign-born Latina women may have immigrated from countries where families often have less disposable income for alcohol, and where alcohol is less readily available than in the United States.

Personal Characteristics that May Change

Current pregnancy status: Women reduce alcohol consumption upon recognition that they are pregnant

Morris et. al. (2008) found that when women learned that they were pregnant, their frequency of drinking sharply decreased to varying levels, depending on their age. For instance, they found that women ages 18-27 reduced their reported drinks-per-month consumption by 83% when pregnant, compared to a decrease of just 48.6% among women ages 40-44. This finding is particularly concerning, given that, as mentioned in the discussion on the factor of age in this literature review, this study found that women in the oldest age group reported the greatest

number of drinks per month among all age groups while pregnant. The authors observed a similar decrease in binge drinking days in pregnant versus non-pregnant women, but they found that the percentage of women reducing binge drinking after they learned that they were pregnant differed by race: white pregnant women reduced binge drinking by 85.4% per month, whereas black women reduced binge drinking by 64% per month. In both cases, the authors used simple main effects tests to confirm that the results were significant for both whites and blacks, finding $p < .001$. Using these results, the authors concluded that public health campaigns should target white women to inform them about alcohol consumption risks prior to conception, while public health campaigns should particularly target alcohol-consuming black women to help reduce drinking after conception (Morris et. al., 2008).

Using logistic regression and data from a multi-year national survey, Ebrahim et. al. (1998) determined that pregnant women were 80% less likely to binge drink than non-pregnant women were. They found these results by computing prevalence rate ratios for binge drinking (dividing the prevalence of pregnant women by the prevalence among non-pregnant women for each subgroup), with higher prevalence ratios indicating less of a reduction in binge drinking while pregnant. However, this study suffers from the problem of the survey's alcohol-related questions changing several times over the period studied, as well as a changed definition of binge drinking (from 5 drinks in one episode to 4) leading to possible underreporting problems. Although this thesis is concerned with any alcohol consumption during pregnancy, it is nevertheless worthwhile to review binge drinking and frequent drinking patterns among women of childbearing age, since researchers at the CDC report that heavy alcohol use, especially binge drinking or frequent drinking, is highly predictive of continued use during pregnancy, especially among older women (CDC, 2002).

Marital status: Studies divided on predictive ability

Some studies found that being married predicted lower rates of alcohol consumption, while other studies found no statistically significant difference. In both of the CDC's studies (2002, 2009), a greater percentage of unmarried women (13.4%) reported alcohol use than married women (10.2%). The CDC researchers indicated that they did not understand this behavior well, but they tentatively attributed it to the possibility that unmarried women might be more likely than married women are to attend social events with alcohol (CDC, 2009). Although there is just a 3.2% difference between the categories of women, the difference has potentially serious health outcome implications, since unmarried women are more likely than married women to have unplanned pregnancies, and babies of unplanned pregnancies are more likely than those of planned pregnancies to be exposed to alcohol in utero. Tsai and Floyd (2004) found that unmarried women who did not use birth control reported about 10% more alcohol consumption and binge drinking than married women who did not use birth control, also possibly as a result of having greater access to events where alcohol was served. The information about lack of birth control use is important since unplanned pregnancies are more likely to be AEPs than planned pregnancies (Tsai and Floyd, 2004). Perreira and Cortes (2006) concluded that marital status mattered less than the quality of a partner: They found that pregnant women's use of alcohol and other substances correlated highly with her partner's substance use and his level of emotional support. Such findings could muddle the results about unmarried and married women reporting alcohol consumption during pregnancy, in that unmarried women in emotionally supportive relationships with non-substance abusing partners might be less likely to report alcohol consumption, while married women in unstable relationships might be more likely to report alcohol consumption.

Concurrent smoking hampers alcohol cessation in pregnant women, but pregnant women who quit smoking more likely to quit drinking

A logistic regression study of Danish pregnant women found that smoking was a predictor for binge drinking both before and after the recognition of pregnancy (Strandberg-Larsen et. al., 2007). Specifically, the researchers learned that factors that were associated with binge drinking (single status, weekly alcohol consumption amount before pregnancy) were also associated with smoking; however, they did not discuss any attempt to control for simultaneity. In addition to having the usual weakness from self-reporting and recall bias, this study suffered from a relatively small number of persistent binge drinkers available for the multivariate analysis, as only 4% of all study participants reported binge drinking. The researchers only reviewed binge drinking behavior rather than casual drinking behavior and smoking. Among both pregnant and non-pregnant women, Ebrahim et. al. (1998) found that current tobacco smoking was associated with binge drinking between both non-pregnant women (odds ratio 3.2, 95% confidence interval 3.1-3.3) and pregnant women (odds ratio 3.5, 95% confidence interval 2.1-5.7). In other words, current smokers were 13.8% more likely to binge drink than those who had never smoked, and among pregnant women, current smokers were less likely to stop binge drinking than those who had never smoked (1998). Interestingly, the researchers found that the largest pregnancy-related reduction in binge drinking was among women who quit smoking (indicated by a low prevalence ratio of 0.2). While Ebrahim et. al. noted that other research has shown that smoking is a characteristic associated with binge drinking, they also did not attempt to control for simultaneity in their study, and therefore did not discuss the potential for reciprocal effects. The Strandberg-Larsen and Ebrahim studies may be of limited application to my research, given that they only included the effect of smoking on binge drinking pregnant and non-pregnant women, rather than including any report of drinking during pregnancy, which my study includes. Ockene et. al. (2002) concluded that low-income women who had greater social support to quit smoking were also more likely to cease drinking alcohol spontaneously upon learning of pregnancy, although

they did not discuss the magnitude. Perreira and Cortes (2006) similarly found that pregnant women's social support from family, friends, religious institutions, and the workplace helped reduce any prenatal substance use (alcohol, tobacco, or illicit drugs).

Education: Educated pregnant women drink more, but rates shift when race taken into account

Several studies over different periods, and using different analyses, found that women who attained higher levels of education were more likely to drink during pregnancy than women who had not done so. Using a national survey over several years, the CDC found that pregnant women with a high school diploma or less were 6.9% less likely to drink than women with a college degree or more (CDC, 2009). Phares et. al. (2004) confirmed these results, finding that women who had attained educational levels above high school were more likely to drink; however, they did not speculate why this could be the case except to note that further research should take cultural adaptation into consideration in order to understand how it might have an effect on maternal drinking behavior. This logistic regression study used data from a survey that only asked women to report alcohol use during the final pregnancy trimester, possibly leading to underreporting issues by not including women's alcohol consumption patterns from the first six months of their pregnancies. The greatest number of women underreporting alcohol consumption would probably be those who drank during their first trimester, prior to their recognition that they were pregnant, per the findings of the literature in the previous subsection. In their logistic regression study designed to determine differences in alcohol consumption during pregnancy between whites, blacks, Hispanics, and US or foreign-born women, Perreira and Cortes (2006) found more nuanced results about how education level played a role in alcohol consumption. Specifically, they found that the education level of women at a higher risk of having AEPs differed depending on the study participants' race. While more highly educated white women were more likely to consume alcohol while pregnant than less educated white women, both the

least (less than high school) and most (college or above) educated black women were more likely to consume than those with a mid-level education (high school graduate or some college). The researchers speculate that the link between higher education levels and higher likelihood of alcohol consumption during pregnancy might be because more highly educated women could attain lucrative employment, leading to a higher discretionary income that they could use to purchase alcohol. This finding comports with the research on income affecting drinking while pregnant, which I discuss in the next subsection. The researchers did not control for other factors to isolate the influence of education. Additionally, none of the above studies differentiates between alcohol consumption prior to pregnancy recognition and after pregnancy recognition. Such results might provide insight into whether highly educated women, who presumably have better access to prenatal care and knowledge of AEP dangers, curbed their drinking after they realized that they were pregnant, leading to such women reporting that they consumed alcohol before they realized they were pregnant, but reporting that they stopped drinking after their recognition of pregnancy.

Employment/income status: Employed and higher income women more likely to consume

As might be expected from the findings regarding highly educated women being at greater risk of consuming alcohol during pregnancy, employment and higher income levels also correlate with higher reporting of alcohol consumption during pregnancy. CDC's multi-year study found that 13.7% of employed pregnant women reported alcohol consumption, as opposed to those who were unemployed (8.3%) (2009). This study used logistic regression to examine the association of the independent variable of employment (along with several other variables) with the dependent variable of alcohol consumption among pregnant and non-pregnant women. However, the study found that employment status and alcohol consumption rates were similar among all women, regardless of pregnancy status (CDC, 2009). Phares et. al. (2004) obtained

significant results from simple logistic regression that mirror these findings: they learned that higher income earners in six of seven US states examined reported the highest prevalence of alcohol consumption during the last three months of pregnancy. Phares et. al. (2004) used a chi-square test with a significance level of $p<.05$ to verify these results. These findings are consistent with the above studies regarding educational attainment, because one would expect income and employment status to rise as education levels rise.

Evaluating Substance Abuse Programs

This thesis reviews several of the practices of Project CHOICES, a federal grant that funds two statewide programs and four local programs to target women who are at increased risk of having AEPs. Project CHOICES uniquely attempts to reduce AEPs by employing a dual approach to sexually active women ages 18 to 44 who are moderate to heavy alcohol drinkers (eight or more drinks per week and/or four or more drinks per occasion): 1) reducing alcohol consumption, and 2) preventing pregnancy through contraception (SAHMSA, 2013). In this thesis, I focus on the first component of reducing drinking among at-risk women, and I describe the program in further detail in the next chapter. To explain the policy environment and findings on similar programs, I review the literature on alcohol use intervention and alcohol abuse programs. In the first portion, I discuss programs designed to prevent alcohol use among young people, which is similar to the Project CHOICES approach designed to reduce or eliminate alcohol use among women at risk of having an AEP before they actually become pregnant. In the second subsection, I review studies about efforts to reduce alcohol consumption and treat alcohol dependence in the general population, regardless of whether or not a participant is pregnant. I review these broader programs to help evaluate the potential effectiveness of the Project CHOICES program, as well as to determine whether or not the Project CHOICES program

administrators should modify their methods to encourage more at-risk women to change their behaviors.

Programs preventing alcohol use

Stigler et. al. (2009) highlighted key findings of different school-based intervention programs with a meta-analysis of several studies focusing on alcohol use prevention programs for minors. They found that most intervention programs are designed for middle schools, since rates of first time drinking rapidly increase between students in grades 8 and 9, and that most programs were designed primarily for the individual (that is, to enhance a student's knowledge or skills, rather than to address environmental factors that could lead to alcohol use in a population). They also discussed the features of the most successful school based interventions. Such programs accomplish the following: they are theory driven and based on the social influences model, helping students resist media messages and peer pressure; they reinforce that alcohol- use is neither normal nor frequent among youth; they use interactive teaching techniques to promote personal and social skills to resist alcohol; they have peer facilitation and help connect families to the programs; they provide age-appropriate and culturally-sensitive messages; and finally, they provide adequate training to teachers and facilitators (Stigler et. al., 2009).

A landmark study compared school-based intervention strategies' success using risk-stratified analysis to determine which different programs resulted in less alcohol use among teens (Spoth et. al., 2008). The researchers randomly assigned 7th grade students and their families to three different levels of alcohol use intervention programs: 1) a combination approach that included "Life Skills Training" sessions and "Strengthening Families Program" sessions; 2) "Life Skills Training" sessions only; and 3) a minimal contact program that simply mailed leaflets about teen development to parents (Spoth et. al., 2008). "Life Skills Training" sessions used interactive teaching techniques to promote social resistance skills to peer pressure, self-

management, and a knowledge base about problems associated with alcohol abuse. "Strengthening Families Program" sessions targeted empirically acknowledged family environmental factors associated with teenage alcohol use, and enhanced parental skills such as setting limits, nurturing, and communication to reduce youth substance abuse over the long term (Spoth et. al., 2008). Using data obtained from yearly self-reported classroom questionnaires, the researchers found that 5.5 years after participating in these programs, teens' initiation of drinking and measures of more serious substance abuse decreased by as much as 2.5% and 10.6% respectively among the teens who participated in either of the more comprehensive intervention programs. Specifically, the groups of students who participated in the Life Skills Training/Strengthening Families intervention had slower rates of first-time alcohol initiation than the control group ($p < .09$), as did those who participated in the Life Skills Training only ($p < .04$). The limitations of the study included that researchers relied upon self-reported questionnaires, which could have been subject to underreporting; additionally, since the population studied was Midwestern, predominantly white students, it was not necessarily representative of the US population (Spoth et. al., 2008).

Reducing alcohol dependence: formal treatment and community care

Several studies reviewed the effects of alcohol dependency treatment in different settings. In a cross-sectional survey, Edlund et. al. (2004) found that 28.3% of adult patients reported that doctors, social workers, or others had screened them for an alcohol or drug disorder, and that among those screened, about 60% reported that they received any treatment. The data came from a self-reported telephone survey, potentially suffering from under-reporting of a sensitive subject and missing those individuals without landline telephones. Adrian et. al. (1998) found that in Ontario, where community-based alcoholism treatment options were available, patients tended to substitute such services in place of hospital-based alcohol treatment facilities. Perhaps

unsurprisingly, Kelly and Yeterian (2008) found that individuals who participated in community mutual- or self-help groups such as Alcoholics Anonymous (AA) more successfully maintained alcohol abstinence than those in formal treatment; about one-half of the drinkers who self-selected only AA treatment reported abstinence, in comparison to just one-fourth of those who had self-selected into formal treatment programs only. They also found that those who participated both in formal outpatient treatment and AA were more likely to be abstinent than those with just outpatient treatment (Kelly & Yeterian, 2008). However, people who participate in self-help groups initiate contact, they may participate voluntarily, and the groups are anonymous. These conditions inevitably lead to weaknesses in any study of such groups because of the impossibility of randomizing the data; additionally, researchers find it difficult to control for external factors in such studies (Kelly & Yeterian, 2008).

Clinicians and researchers at the National Institute on Alcohol Abuse and Alcoholism (NIAAA) postulated that individuals with alcohol use disorders would respond better to different types of treatment based on their personal characteristics; they tested the theory through a study called Project MATCH (Huebner & Kantor, 2008). In the project, researchers randomly assigned patients with a variety of different personal characteristics (gender, psychiatric conditions, severity of alcohol disorder, etc.) to 12-step group therapy, cognitive behavioral therapy, or motivational enhancement therapy. The researchers found that patients with low psychiatric severity experienced more abstinent days than those treated with the other types of therapy (Huebner & Kantor, 2008). None of these studies indicated whether their participants were pregnant.

Conclusion

The literature in this review reveals that alcohol consumption among pregnant women continues to be a problem in the United States, resulting in costly negative health outcomes. Researchers have found that pregnant women may already be consuming alcohol, and non-pregnant women may inadvertently consume alcohol before they realize they are pregnant (or continue to consume once they become pregnant). The literature indicates that demographic characteristics such as age, race, and country of origin strongly predict women's drinking patterns. Potentially changeable personal characteristics such as being pregnant and getting married predict lower rates of consumption. Higher levels of education, employment, and income mostly predict higher rates of consumption. Given these findings, I designed this thesis to confirm whether previous findings comport with my regression, which uses national data from 2010. The factors previously covered by the literature that I also included in my study are age, race, marital status, employment status, income level, and education level. Additionally, in my review of the literature I did not find sufficient information about drinking patterns based on several factors, which I included in my study. These factors include the presence of children in the home, state of residence, and access to healthcare. I discuss how I analyze these factors as independent variables in the next chapter.

This section also reviews studies of several alcohol intervention programs, including programs that prevent initial alcohol consumption, or reduce or eliminate abusive levels of consumption, in order to compare these findings to the Project CHOICES program. Policy makers could apply the findings of these broader studies to more specific programs designed to reach women at risk of having alcohol-affected pregnancies. Between both preventative and cessation programs, the factors of family and community involvement helped ensure that individuals reduced or eliminated their alcohol consumption. The research associated with preventing alcohol consumption indicated the greatest success from a multi-pronged approach

whereby programs educated individual students about risks of alcohol and taught skills to avoid peer pressure, while their families learned parenting skills designed to help support the students refusal of alcohol. Finally, the studies also emphasized that no single approach or treatment successfully helped each individual avoid alcohol. In assessing the Project CHOICES program, I compare the practices of the program to the findings of these studies to determine whether the program applies the "best practices" discussed in this literature review. I also search for ways in which the program identifies women at risk of experiencing an AEP and analyze whether the program's methods for doing so comport with the findings of the literature.

Chapter 3

METHODOLOGY

My review of the literature in the previous chapter revealed factors that researchers have found to influence whether or not a pregnant woman reports alcohol consumption. I also discussed some features of programs designed to help individuals avoid or cease consuming alcohol. This chapter includes the analytical model and the data that I use to explore the factors that predict whether a woman reports consuming alcohol while pregnant; additionally, it includes a description of my methods for a case study of a clinical intervention program designed to reduce the occurrence of AEPs. I chose regression analysis to examine this issue because it allows for measuring the isolated effects of specific independent variables on a dependent variable, while controlling for other independent variables that are also influencing the dependent variable (Studenmund, 2011). I chose to use both a regression analysis as well as a case study to inform policy decisions designed to reduce the incidence of FASDs. Through regression, I can identify the characteristics of women who are most likely to have an AEP. Through a case study of a federally funded program, I can review the effectiveness of a major current policy decision in this area. Additionally, the regression analysis and the case study provide two different views of the problem: the regression uses self-reported data of women who are already pregnant, whereas the case study focuses on a program targeting currently non-pregnant, sexually active and alcohol-consuming women identified as being likely to drink if they become pregnant. Therefore, while the regression identifies which characteristics of pregnant women are most likely to predict whether they report alcohol consumption, the case study program attempts to change the behavior of women at risk of drinking during pregnancy before they ever get pregnant.

In the first section of this chapter, I review my dependent variable, explanatory variable, and analytical model of my regression equation. In the second section, I describe the regression

model equation with broad causal factors, as well as the expected signs for the independent variables within those factors. I chose the independent variables and assigned them signs based on my findings and gaps in the literature review. Next, I identify and describe in detail the independent variables used in the regression analysis, and I discuss my reasons for excluding certain independent variables from the regression. Finally, I describe the way in which I analyze my case study of the Project CHOICES program, incorporating the findings of the literature review and the findings of the regression analysis.

Dependent Variable, Key Explanatory Variable and Analytical Model

In this section, I review my dependent and key explanatory variables, and I explain my analytical model. For all of my variables, I used a subset of data from the US Center for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS) in 2010. Using the BRFSS, my subset sample consisted of women over age 18 and up to age 44 in the United States who reported being pregnant when they took the survey.

Dependent Variable

My dependent variable is a dummy variable of whether a woman self-reported any alcohol consumption during pregnancy. That is, one indicated that the woman reported consumption of alcohol, and zero indicated that she reported she had not consumed alcohol. Specifically, I reduced the data set to women who positively answered the survey question, "To your knowledge, are you now pregnant?" The dependent variable comes from the question, "During the past 30 days, have you had at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?" I opted against choosing other potential alcohol consumption measures, such as whether a pregnant woman reported drinking more than a certain number of servings per month, or how many instances of binge drinking she reported over a certain time

period (CDC, 2002). This is because as mentioned previously, although not all babies born from AEPs develop FASDs, the U.S. Surgeon General has repeatedly affirmed that researchers do not consider any level of alcohol exposure to be safe for a fetus, and has consistently recommended women totally abstain from alcohol consumption when trying to get pregnant or once learning of pregnancy. Therefore, a report of any alcohol consumption during pregnancy is an appropriate dependent variable (Carmona, 2005). In the discussion below, I explain the broad causal factors that may contribute to whether or not a pregnant woman reports consumption. I then break down these factors into specific variables.

Key Explanatory Variable

My key explanatory variable for whether or not a woman reports drinking during pregnancy is the level of education that a woman reported completing at the time of the survey, and falls within the broad causal factor of "educational characteristics." This variable comes from the survey question, "What is the highest grade or year of school you completed?" The answer options included 1) Never attended school or only kindergarten, 2) Elementary school, 3) Some high school, 4) High school graduate, 5) Some college or technical school, 6) College graduate, 7) Refused to answer. I created dummy variables for each of these categories, where one meant a positive response (i.e., one = the woman said she graduated from college) and zero meant a negative response (with the exception of "refused to answer," which became the excluded base value). I combined the categories of "never attended school or only kindergarten" and "elementary school" into a single category indicating completion of "elementary school or less," since both of these values indicate a very low level of educational completion and because the literature rarely separated educational attainment into anything less than the elementary level. A review of the literature revealed that women who attained a maximum education level of a high school degree were less likely to report any consumption of alcohol (CDC, 2009; Phares et. al,

2004). On the other hand, according to the literature review, women who completed some college, attained a college degree, or attended/completed graduate school were more likely to report consumption during pregnancy. In the next chapter, I compare these previous findings with my regression in order to confirm that my study comports with these findings. I also compare the results of my findings regarding education levels with the practices of the Project CHOICES program in my case study to see whether the program takes education level into account when identifying and intervening with women at risk of AEPs.

Analytical Model

In this analytical model, I include measures both for previously researched variables and some that the literature did not thoroughly cover in the previous chapter. According to the literature, several characteristics within the data available in the BRFSS roundly describe adult United States women of childbearing age between 18 and 44, and the literature indicates these to be influential factors of alcohol consumption during pregnancy. These variables include age, race, marital status, employment status, income level, and education level. In addition to the variables well covered by the literature, I chose some variables that researchers did not understand well or examine thoroughly in the hope that some of these variables might provide insight into pregnant women's consumption behavior. These variables include the presence of children in the home, health insurance status, access to a doctor, and state of residence.

Basic Model, Broad Causal Factors, and Discussion of Variables

In this section, I discuss my regression model equation and reveal my expected signs for each explanatory variable. I also review the reasons for my expected signs. I also discuss my reasons for excluding a potential explanatory variable. Finally, I discuss my independent variables and provide tables with summary statistics.

Model and Explanation of Expected Signs

The explanation below delineates each of the explanatory variables and their expected signs: positive (+), negative (-), or uncertain/unknown (?). A positive sign indicates that I expect a variable to increase the likelihood that a woman reports alcohol consumption, and a negative sign illustrates that I expect a variable to reduce the likelihood that a woman reports alcohol consumption. An uncertain sign indicates that I cannot predict whether a variable has a positive or negative sign, because there was insufficient previous research on the variable or because previous research resulted in mixed findings. I also provide a justification for these expected signs based on a review of the literature. My basic model with broad causal factors is as follows:

Alcohol Consumption During Pregnancy (yes/no) = f(Demographic characteristics, Lifestyle characteristics, Health care characteristics, Economic characteristics, Educational attainment, State of residency)

Broad Causal Factors and Expected Signs

- Demographic characteristics = f(age (+), Hispanic status (-), African American race (?), Asian/Pacific Islander race (-), American Indian (+), other race (?), [white race is reference])
- Lifestyle characteristics = f(children presence (?), married (-), divorced (+), widowed (+), separated (?), unmarried couple (?) [single is reference])
- Health care characteristics = f(health insurance (-), doctor access (-))
- Economic characteristics = f(medium income: annual household income cohort $35,000-$75,000 (?), high income: annual household income cohort $75,000 and above (+), [low income: annual household income cohort under $35,000 is reference], employed (+))
- Educational characteristics = f(some high school (?), high school (?), some college or technical school (+), college graduate (+), [elementary or less is reference])

- State of residency = f(each state (?) [California is reference])

Demographic Characteristics. This category includes age as a continuous variable and race/ethnicity variables as dummy variables. Research indicates that as a pregnant woman's age increases, her likelihood of drinking rises; therefore, I expect a positive sign. As I described in the previous chapter, researchers posit several reasons for this trend: older women may be more established in their careers, be higher income earners, and have disposable income to purchase alcohol; older women may not have experienced more recent alcohol-abstention public health campaigns; older women may have had more years to establish dependence on alcohol and have a more difficult time abstaining. I also anticipate the youngest women to be the least likely to report alcohol consumption because of a lack of access to alcohol (since it is illegal in the United States for those in the data set aged 18-20 to purchase alcohol).

For race categories, I accounted for each measured by BRFSS, as race has been shown to have an effect on the likelihood of a woman drinking during pregnancy. I created dummy variables for the following race/ethnicities: white, African American, Asian/Pacific Islander, American Indian, other/unknown race, and Hispanic (this is not measured as a race category; women were asked to report whether or not they were Hispanic *as well as* their preferred race category. I included it within race as the literature often analyzes it as a race). "White" is the excluded category in the regression, and I viewed each of the race variable effects in relation to the white race results.

According to the literature, whites and Native Americans were the most likely races to report consuming alcohol during pregnancy, but African Americans who did drink during pregnancy were less likely than whites were to stop drinking after learning about a pregnancy. However, some effects that appear to be the influence of race may actually be the result of underlying causes; for instance, more whites reported higher incomes and education levels, which

comports with higher alcohol consumption. I review race results carefully to control for the influence of other such features. Ultimately, given previous research, I expect alcohol consumption to increase for women who are American Indian in comparison to whites (although given their small sample size in this data set, I need to treat the data carefully). Existing research conflicts on whether or not African Americans or those who identified as another race increases or decreases the likelihood of consumption in comparison to white women. I expect alcohol consumption to drop for Hispanics and Asian/Pacific Islanders relative to white women, since women in these race categories are more likely to be foreign-born. The literature indicated that foreign-born women are less likely to consume alcohol during pregnancy than US-born women, and that as children of immigrants become acculturated to American society where drinking is a common activity, they are more likely to drink.

Lifestyle characteristics. This category includes characteristics of a woman's life that may change over time, including presence of children in the home and her marital status. I do not have an expectation for presence of children in the home since the literature did not thoroughly cover this variable; therefore, I left this variable sign in question. The stress of children in the home may cause greater likelihood of drinking, while concern for health and being supportive for children may cause a lower likelihood of drinking.

To determine the effects of marital status, I created several dummy variables for various categories reported. First, I created a dummy variable where one meant the woman reported being married, and zero meant the woman reported being unmarried. I also created dummy variables for the several subcategories of a woman who reported herself as unmarried: "divorced," "widowed," "separated," and "unmarried member of a couple." I excluded the "single" marital status dummy variable. The literature indicated that unmarried women of all different subcategories are more likely to have an unplanned pregnancy and are less likely to have

a social support network. In line with the literature, I expect most of the subcategories of unmarried women (single, divorced, widowed, unmarried member of a couple) to be more likely to consume alcohol during pregnancy than married women (thus a negative sign for the "married" dummy variable). As postulated by CDC, this may be because unmarried women could be more likely than married women to attend events where alcohol is served. Another possibility, as previously established in the literature review, is that unmarried women are more likely to have unplanned pregnancies than married women, and are therefore more likely to drink prior to recognition of pregnancy. This is a possibility since the literature indicates that women are significantly less likely to drink if they are aware that they are pregnant. An exception to this subcategory may be for "members of unmarried couples," who reported a relationship status that may function similarly to that of a married woman, and may decrease her likelihood of reporting alcohol consumption; because of this uncertainty, I could not predict a sign for this group. Similarly, I did not predict a sign for women who classified themselves as "separated," who are married but in a relationship status that may function more like an unmarried woman.

Health care characteristics. This category controls for whether or not a woman had access to services that included prenatal care, including alcohol screening and treatment. Women who have access to health care are more likely to seek and receive prenatal care than those who do not have such access, which often includes screening for alcohol consumption and education about the dangers of consuming alcohol while pregnant. For this variable, I expect that if a woman reported being covered by any health insurance, she would be less likely to drink in pregnancy than a woman who was not covered, because she was more likely to have access to (and therefore take advantage of) services and advice about stopping such behavior. I expect women who identified an individual as their doctor to be less likely to drink during pregnancy than those who did not identify a doctor for the same reason. Additionally, the literature

indicated that individuals with social support systems are more likely to abstain from alcohol than those without such a social support system; access to a doctor may serve as a proxy for external support to abstain or quit consuming alcohol while pregnant.

Economic characteristics. These variables help control for the economic advantages or disadvantages of pregnant women. In accordance with the literature, in general, I expect women with low household incomes to be less likely to drink than high household incomes, which I expect to be more likely to drink (reference variable: low income cohort). For the purposes of this regression equation, I reduced the eight annual household income categories (less than $10,000; less than $15,000; less than $20,000; less than $25,000; less than $35,000; less than $50,000; less than $75,000; and more than $75,000) into three income categories (low income = less than $35,000; middle income = $35,000 - $75,000; high income = greater than $75,000). I anticipate those in the high-income category to be the most likely of the three categories to report alcohol consumption because of more disposable income.

For the employment dummy variable, I expect alcohol consumption to rise when women were employed (consistent with the literature), and therefore I gave the variable a positive sign. This is because women who reported employment would probably be more likely to have higher household incomes than those who did not report that they have a job. In turn, employment might lead to more disposable income to use to purchase and consume alcohol. I used a dummy variable to reveal employment status. Specifically, one indicated that a woman reported being "employed for wages" or "self-employed," and zero indicated that a woman reported being "out of work for more than one year," "out of work for less than one year," "homemaker," "student," "retired," or "unable to work." I combined all of these subcategories because they would all have the same effect of precluding a woman from engaging in activities to earn income.

Educational characteristics. This category includes my key explanatory variable, and I explain it in more detail above. It controls for differences in educational attainment. Research indicated that women with higher levels of education were more likely to drink during pregnancy than those of lower levels of educational attainment. Therefore, I am uncertain about lower levels of education (high school or less) in relation to the reference variable, whereas I expect higher levels (some college or more) to have positive signs (reference variable: completed elementary school or less).

State of residency. For the state of residence, I created dummy variables for all 50 states and the District of Columbia. California is my reference variable. The literature did not review women's drinking patterns based on state of residence, and few studies discussed location as a factor. Therefore, my signs for all of the states are uncertain. The state of residence variables serve as a set of general controls of cultural or public policy differences across the states that might influence alcohol consumption beyond the other variables in my analysis.

Excluded Explanatory Variable

I exclude the variable of "smoking status," even though I discussed it in the literature review, because of its potential for simultaneity – that is, that the explanatory variable of smoking is not truly independent because that variable could be caused by other dependent or explanatory variables (or has a reciprocal effect with other variables) in the regression. I could not use this variable as an explanatory variable in a standard linear regression model like this because such models assume that all explanatory variables are independent. Smoking status, however, could accompany drinking (that is, the two behaviors could cause one another). Therefore, I could not use it as an explanatory variable without using two-stage least squares.

Explanation of Independent Variables

This subsection provides a thorough description of the independent variables I used in the regression. I also provide tables that identify and describe my dependent and independent variables, provide summary statistics, and reveal correlation coefficients. I define the dependent and independent variables, and describe the variables' source. I also review each variable's summary statistics. Finally, I discuss the simple correlation coefficients between all of the independent variables. For all of my variables, I used a subset of data from the BRFSS in 2010. Using the BRFSS, my subset sample consisted of women ages 18 to 44 in the United States who reported being pregnant when they took the survey, totaling 2415 observations.

Table 3.1: Identification and Description of All Variables Used in Regression Analysis

Variable Name	Description
Dependent Variable	
Drinks	Dummy variable = one for report of any alcohol consumption during pregnancy in 2010.
Independent Variables: Demographic Characteristics*	
Age	Continuous variable for reported age of pregnant woman in 2010
Hispanic	Dummy variable = one for Hispanic women (note: this is not a race category; women reported whether they were Hispanic as well as their preferred race category)
African American	Dummy variable = one for African American race
Asian/Pacific Islander	Dummy variable = one for combined Asian and Pacific Islander race
American Indian	Dummy variable = one for American Indian/Native American/Alaskan Native race
Other Race	Dummy variable = one for other/unknown race
Independent Variables: Lifestyle Characteristics**	
Children Presence	Dummy variable = one for the presence of children in the home of a pregnant woman.
Married	Dummy variable = one if a woman is married
Divorced	Dummy variable = one if a woman is divorced
Widowed	Dummy variable = one if a woman is widowed
Separated	Dummy variable = one if a woman is separated
Unmarried couple	Dummy variable = one if a woman is a member of an unmarried couple
Independent Variables: Health Characteristics	
Health Insurance	Dummy variable = one if a woman reported that she has health insurance coverage
Doctor Access	Dummy variable = one if a woman reported that she has regular access to one or more doctors
Independent Variables: Economic Characteristics***	
Medium Income	Dummy variable = one for reported annual household income $35,000-75,000

High Income	Dummy variable = one for reported annual household income above $75,000
Employment	Dummy variable = one if employed
Independent Variables: Educational Characteristics****	
Some High School	Dummy variable = one for educational attainment above elementary school, but below high school graduate
High School Grad	Dummy variable = one for educational attainment of a high school diploma or GED
Some College	Dummy variable = one for educational attainment of some college, career, or technical school
College Grad	Dummy variable = one for educational attainment of college, career, or technical school diploma and more (including doctorates and professional degrees)
Independent Variables: State of Residence*****	
State	Set of dummy variables for each state and Washington, D.C.

Source, all variables: US Center for Disease Control, BRFSS, 2010.
*White race variable omitted.
**Single marital status variable omitted and California omitted.
***Low income (reported annual household income under $35,000) variable omitted.
****Educational attainment of elementary school or below variable omitted.
*****State of California variable omitted.

I acquired summary statistics for the dependent and independent variables of my regression to determine the mean, standard deviation, minimum and maximum for each (see Table 3.2). When a respondent did not know the answer to a question or refused to answer a question, I removed that data point, which is why some variables have slightly different sample sizes due to missing values. As a result, the variable sample sizes range from N = 2350 to N = 2415. Only the "age" independent variable is continuous; all of the other variables are dummy variables, meaning that most variables have a minimum of zero and a maximum of one.

Table 3.2: Summary Statistics for Dependent and Independent Variables

Variable Name	Sample Size, N=	Mean	Standard Deviation	Minimum	Maximum
Dependent Variable					
Drinks	2412	.0721393	.2587721	0	1
Independent Variables: Demographic Characteristics					
Age	2403	30.07074	5.605174	18	44
Hispanic	2402	.1482098	.3553818	0	1
African American	2350	.12	.3250307	0	1
Asian Pacific Islander	2350	.0468085	.2112734	0	1
American Indian	2350	.0238298	.1525511	0	1
Other Race	2350	.0340426	.1813771	0	1

Independent Variables: Lifestyle Characteristics					
Children Presence	2415	.7552795	.4300104	0	1
Married	2411	.7254251	.4463924	0	1
Divorced	2411	.0327665	.1780618	0	1
Widowed	2411	.0020738	.0455015	0	1
Separated	2411	.0223973	.1480027	0	1
Unmarried couple	2411	.0700954	.2553607	0	1
Independent Variables: Health Characteristics					
Health Insurance	2411	.9046039	.2938222	0	1
Doctor Access	2407	.8458662	.361152	0	1
Independent Variables: Economic Characteristics					
Medium Income	2168	.4035978	.4907318	0	1
High Income	2168	.326107	.4688951	0	1
Employment	2406	.556941	.4968504	0	1
Independent Variables: Educational Characteristics					
Some High School	2407	.0673037	.2505993	0	1
High School Grad	2407	.2002493	.40027	0	1
Some College	2407	.2559202	.4363679	0	1
College Grad	2407	.4507686	.4976738	0	1
Independent Variables: State of Residence					
Alabama	2415	.0169772	.1292127	0	1
Alaska	2415	.0074534	.0860286	0	1
Arizona	2415	.0115942	.1070725	0	1
Arkansas	2415	.0041408	.0642289	0	1
Colorado	2415	.0256729	.1581902	0	1
Connecticut	2415	.015735	.1244742	0	1
Delaware	2415	.0124224	.1107841	0	1
District of Columbia	2415	.010766	.1032209	0	1
Florida	2415	.0616977	.2406556	0	1
Georgia	2415	.0169772	.1292127	0	1
Hawaii	2415	.0124224	.1107841	0	1
Idaho	2415	.0182195	.1337719	0	1
Illinois	2415	.0128364	.1125918	0	1
Indiana	2415	.0219462	.1465381	0	1
Iowa	2415	.0136646	.1161183	0	1
Kansas	2415	.0173913	.1307514	0	1
Kentucky	2415	.0132505	.1143694	0	1
Louisiana	2415	.0178054	.1322709	0	1
Maine	2415	.0124224	.1107841	0	1
Maryland	2415	.0244306	.1544139	0	1
Massachusetts	2415	.0430642	.2030437	0	1
Michigan	2415	.0161491	.1260748	0	1
Minnesota	2415	.026087	.1594269	0	1
Mississippi	2415	.0161491	.1260748	0	1
Missouri	2415	.0091097	.0950289	0	1
Montana	2415	.0161491	.1260748	0	1
Nebraska	2415	.0310559	.1735047	0	1
Nevada	2415	.0082816	.0906443	0	1

New Hampshire	2415	.0115942	.1070725	0	1
New Jersey	2415	.0293996	.1689588	0	1
New Mexico	2415	.0120083	.1089449	0	1
New York	2415	.0240166	.1531322	0	1
North Carolina	2415	.0248447	.155684	0	1
North Dakota	2415	.0136646	.1161183	0	1
Ohio	2415	.0169772	.1292127	0	1
Oklahoma	2415	.0202899	.1410192	0	1
Oregon	2415	.0066253	.0811424	0	1
Pennsylvania	2415	.0236025	.1518386	0	1
Rhode Island	2415	.0169772	.1292127	0	1
South Carolina	2415	.015735	.1244742	0	1
South Dakota	2415	.0124224	.1107841	0	1
Tennessee	2415	.0128364	.1125918	0	1
Texas	2415	.0488613	.2156226	0	1
Utah	2415	.0360248	.1863906	0	1
Vermont	2415	.0120083	.1089449	0	1
Virginia	2415	.010766	.1032209	0	1
Washington	2415	.0438923	.204898	0	1
West Virginia	2415	.0078675	.0883676	0	1
Wisconsin	2415	.0078675	.0883676	0	1
Wyoming	2415	.0132505	.1143694	0	1

I ran simple correlation coefficients for all variables, as well as their significance at the 90% level in order to determine where variables highly correlate and possibly affect one another. Fortunately, few variables are highly correlated with one another, and I do not anticipate moderately correlated variables to create multicollinearity problems. For instance, *high income* negatively correlates with *medium income* at 57%; however, this simply reflects that the women responding are unlikely to earn both “high income” and “medium income” at the same time. Similarly, the variables of *college graduate* and *some college* negatively correlates at 53%; they probably have the same issue. Finally, *college graduate* correlates with *high income* at 45%; this makes sense because college graduates are more likely to have a higher income, so the variable probably does have some overlap. In other words, women who report that they are college graduates are probably more likely than women who did not graduate college to report that they earn over $75,000 annually. I monitor this variable for multicollinearity and then determine

whether I should include it in the regression based upon the Variance Inflation Factors I calculate in the Results chapter.

Case Study

After completion of the regression analysis, I performed a case study of the Project CHOICES program intervention model, which I describe in further detail below. This section discusses the way in which I performed the case study and assessed the features of this program. First, I describe my reasoning behind selecting Project CHOICES as an appropriate case study. Second, I describe the Project CHOICES program and the intervention methods to which the program subscribes. Finally, I ask questions to determine the effectiveness of the Project CHOICES program, the answers to which I acquired by comparing the program to the regression results and literature review. I include the assessment of this program in the conclusion of this thesis, where I combined these findings with the regression equation results to provide recommendations for further research and improvements to government policies.

Case Selection

Project CHOICES is an appropriate program to serve as a case study because it targets non-pregnant women who researchers considered likely to have an AEP. In this thesis, I endeavor to determine which characteristics about a pregnant woman and her life predict whether she will consume alcohol, to help policy makers 1) target women most at risk of having an AEP, and 2) design programs that effectively influence at-risk women to avoid consuming alcohol if they are trying to get pregnant or realize that they are pregnant. I can meet the first objective through the regression analysis described above, since the regression portion of this thesis analyzes whether pregnant women report drinking. I can meet the second objective best by discussing the results of this regression analysis in conjunction with a program like Project

CHOICES, which attempts to keep women who are at risk of becoming pregnant to avoid drinking before they become pregnant. Additionally, Project CHOICES is unique among programs whose objective is to promote alcohol abstention; as discussed in the literature review, most such programs target pre-teens and teenagers, or alcoholics, without regard to the special training and educational needs of women at risk of experiencing an AEP. Finally, this program is a better selection as a case study than various prenatal programs, because such programs provide an array of services to pregnant women, of which alcohol cessation education, screening, intervention, counseling and/or follow-up are usually a small, limited component, whereas curbing AEPs is the primary objective of Project CHOICES. Given these objectives, it is appropriate for this thesis to review the ways in which the Project CHOICES program identifies women at risk of having AEPs, and the methods by which they attempt to change the behaviors that could result in such a pregnancy.

Program History and Description

Project CHOICES is an evidence-based intervention strategy designed for use by clinicians, health care providers, tribal governments, and social workers to increase motivation and commitment among women of childbearing age to reduce or stop drinking in order to reduce their likelihood of having an AEP. Three universities funded by CDC developed the program, also known by its lengthier title, "Project CHOICES: Changing High-Risk Alcohol Use and Increasing Contraceptive Effectiveness Study" (CDC, 2013). The universities (Nova Southeastern University in Fort Lauderdale, FL; University of Texas at Houston; and Virginia Commonwealth University in Richmond, VA) developed brief intervention strategies designed to prevent AEPs in settings that included access to large numbers of women at risk of having such a pregnancy. The initial testing of the strategy occurred in several such settings, including a county jail, several health clinics, and alcohol recovery facilities, and through recruitment of a cohort of

women concerned about their drinking habits. The original Project CHOICES program coordinators, who were individuals working in the aforementioned settings, considered women "at risk" if they were of childbearing age, reported significant alcohol use, and reported not using contraception effectively (as mentioned previously, this case study will focus on the alcohol use piece of the intervention; the contraception piece is beyond the scope of this thesis). The below table more thoroughly describes how practitioners identify women who are at risk of having an AEP and are therefore eligible for the intervention strategy.

Table 3.4: Project CHOICES Criteria for Identifying Women at Risk of AEPs

Demographic characteristics	Reported alcohol consumption	Contraceptive choices
• Female • 18-44 years of age • Not pregnant at the time of initial contact • Presumed able to become pregnant (no anatomical or surgical sterility)	• More than 4 drinks per occasion AND/OR • 8 or more drinks per week	• Reports that she is not trying to get pregnant • Reports not using contraception OR • Reports not using contraception in a way that effectively prevents pregnancy

The Project CHOICES behavioral intervention strategy focuses on a dual approach of providing information to at-risk women about the risks of alcohol use during pregnancy, as well as a motivational intervention consisting of four parts. In brief, the four parts are: 1) assess in-depth a woman's alcohol and contraceptive use patterns; 2) provide counseling about alcohol use during pregnancy; 3) provide advice about alcohol intake reduction for those identified as moderate or heavy drinkers, and referral to community treatment centers for those who are identified as alcohol-dependent drinkers; 4) provide advice about contraception methods and services. In the next chapter, I more comprehensively describe the intervention strategy, and compare it to similar intervention strategies discussed in the literature review.

Currently, CDC is working to create a more comprehensive Project CHOICES intervention package of materials for wider dissemination, including a training curriculum for

interveners, user's manual, and participant workbook. CDC currently is studying the implementation of the original Project CHOICES strategy, as well as modified versions of the strategy, in family planning and STD clinics in several large cities, in hospitals, and in health care facilities serving American Indian women in the rural Great Plains states. As these programs are ongoing and the studies are not complete, I did not use the data from these implementation sites.

Performing the Case Study

In the next chapter, I thoroughly describe the brief intervention techniques advocated by the Project CHOICES program. I compare these descriptions to other successful alcohol abstention programs related in the literature review. I also discuss the settings in which the program is running and the profiles of women the program administrators consider "at-risk." Then, I compare those findings with the findings of the regression analysis. In making these comparisons, I hope to be able to determine if the program targets the women at greatest risk of experiencing an AEP, if the program needs to focus on women with different characteristics, or if the program needs to seek at-risk women in different settings than those where the program currently operates.

By examining the results of this case study, in conjunction with the regression analysis results, I hope to be able to provide several beneficial policy recommendations. First, the regression analysis results may help Project CHOICES refine their targeted populations of women. Second, by comparing the successful intervention strategies of these more general programs as described in the literature review, to the techniques employed in the Project CHOICES program, I may be able to provide recommendations for techniques of other programs targeted directly at women at risk of having an AEP. Finally, the recommendations resulting from this case study could help inform such prenatal programs in their intervention efforts and help make them more effective in helping pregnant women cease alcohol consumption.

Conclusion

This chapter delineates the broad categories of explanatory variables, and describes the expected signs for each individual characteristic within each category. I account for my dependent variable of alcohol consumption with the broad categories of demographic, health, economic, and education characteristics. This chapter also provides a thorough overview of my data, variables, definitions, sources, summary statistics and potential correlations. Among correlation coefficients, I have the greatest concern between *college graduate* and *high income*, which may prove to create multicollinearity issues. Finally, this chapter reviews the Project CHOICES program that is the subject of my case study in the next chapter, and describes the way in which I assess the effectiveness of the program. The next section reports the results of the regression analysis and my efforts to correct potential problems, as well as the findings of my case study.

Chapter 4

RESULTS

This chapter delineates the report of the regression analysis trials and results using the variables described in the methodology section of this thesis, as well as the results of my case study of the Project CHOICES program. The purposes of this chapter are: 1) to test the hypothesis that women with higher levels of education are more likely to report alcohol consumption during pregnancy; 2) to determine what additional independent variables predict whether or not a woman reports alcohol consumption; and 3) to discuss significant findings about comparisons between a particular AEP reduction program, other alcohol consumption reduction programs, and the regression results.

Under the regression analysis section, I perform two types of regression and ultimately choose the more appropriate model. After using a linear-linear form, I include a check for multicollinearity, as well as tests and a correction for heteroskedasticity. Additionally, I include a table with the uncorrected regression results, my linear-linear equation, and the Variance Inflation Factor (VIF) results. However, since my dependent variable is dichotomous (zero or one), ultimately the appropriate type of regression model is the binary logistic, or binomial logit, regression model. I report those results, their Odds Ratios, discuss my findings, and finally include my corrected results.

In the case study section, I review the components of the Project CHOICES intervention strategy. I discuss the program locations and the profiles of women the program administrators consider "at-risk." I also thoroughly describe the brief intervention techniques advocated by the Project CHOICES program and compare these descriptions to other successful alcohol abstention programs related in the literature review. Finally, I compare the findings of the case study with the results of the regression analysis.

Regression Analysis

Uncorrected Regression Results – Linear Probability Model

First, I review the uncorrected regression results using my above-described model (see Table 4.1). I first used a linear-linear Ordinary Least Squares (OLS) regression, where I found seven significant variables. Because my dependent variable has a zero or one value, I could not run any logged equations. This regression yielded the following significant variables at the 90% confidence level: *age, Hispanic, African American, married, widowed, health insurance, some high school, high school graduate, some college, college graduate, employment, Delaware, Michigan,* and *New York.* At the 95% confidence level, the following variables were significant: *age, Hispanic, married, widowed, health insurance, high school graduate, some college,* and *New York.* Finally, at the 99% confidence level, the following variables were significant: *age, married, widowed,* and *health insurance.*

Table 4.1: Uncorrected Linear-Linear Regression Results: Non-standardized Coefficients, Significance at Several Confidence Intervals, (Standard Errors), and Variance Inflation Factor when Dependent Variable is One for Drinking While Pregnant and Zero for Not Drinking

Variables	Linear-Linear	Variance Inflation Factor
Age	.0034*** (.0012)	1.33
Hispanic	-.0442** (.0214)	1.69
African American	-.0377* (.0201)	1.39
Asian Pacific Islander	-.0282 (.0288)	1.20
American Indian	.0348 (.0399)	1.14
Other Race	.0012 (.0356)	1.27
Children Presence	-.0168 (.0136)	1.14
Married	-.0698*** (.0199)	2.50
Divorced	-.0204 (.0367)	1.29
Widowed	.5408*** (.1483)	1.05

Separated	-.0447 (.0403)	1.19
Unmarried couple	-.0346 (.0272)	1.49
Health Insurance	-.0686*** (.0216)	1.17
Doctor Access	-.0027 (.0167)	1.14
Medium Income	-.0105 (.0170)	2.32
High Income	.0078 (.0206)	3.13
Some High School	-.0881* (.0479)	4.16
High School Grad	-.1063** (.0446)	9.99
Some College	-.1114** (.0446)	12.75
College Grad	-.0848* (.0451)	16.86
Employment	.0203* (.0122)	1.21
Alabama	-.0655 (.0492)	1.36
Alaska	-.0655 (.0673)	1.14
Arizona	.0070 (.0563)	1.24
Arkansas	.0296 (.0832)	1.10
Colorado	-.0328 (.0415)	1.41
Connecticut	.0179 (.0480)	1.30
Delaware	.0977* (.0535)	1.26
District of Columbia	-.0103 (.0572)	1.24
Florida	.0167 (.0333)	1.95
Georgia	.0008 (.0484)	1.32
Hawaii	.0008 (.0556)	1.36
Idaho	-.0448 (.0467)	1.33
Illinois	-.0175 (.0524)	1.25
Indiana	-.0378 (.0461)	1.33
Iowa	-.0764 (.0507)	1.29

Kansas	-.0657 (.0491)	1.32
Kentucky	-.0447 (.0527)	1.26
Louisiana	-.0214 (.0482)	1.34
Maine	-.0779 (.0551)	1.24
Maryland	-.0629 (.0422)	1.46
Massachusetts	.0196 (.0354)	1.70
Michigan	-.0841* (.0499)	1.29
Minnesota	-.0348 (.0407)	1.46
Mississippi	-.0663 (.0505)	1.32
Missouri	-.0322 (.0613)	1.18
Montana	-.0527 (.0480)	1.37
Nebraska	-.0315 (.0396)	1.57
Nevada	.0841 (.0663)	1.18
New Hampshire	.0338 (.0565)	1.21
New Jersey	.0022 (.0391)	1.53
New Mexico	.0301 (.0550)	1.24
New York	.1122** (.0443)	1.37
North Carolina	.0395 (.0436)	1.42
North Dakota	.0502 (.0515)	1.29
Ohio	.0505 (.0499)	1.28
Oklahoma	-.0659 (.0463)	1.37
Oregon	-.0223 (.0715)	1.13
Pennsylvania	.0487 (.0423)	1.45
Rhode Island	-.0606 (.0488)	1.30
South Carolina	-.0290 (.0503)	1.30
South Dakota	-.0366 (.0559)	1.23

Tennessee	-.008 (.0560)	1.23
Texas	.0079 (.0345)	1.60
Utah	-.0561 (.0374)	1.67
Vermont	-.0124 (.0539)	1.23
Virginia	.0209 (.0600)	1.19
Washington	.0101 (.0346)	1.72
West Virginia	-.0934 (.0655)	1.15
Wisconsin	-.0195 (.0640)	1.16
Wyoming	-.0856 (.0565)	1.21
Constant Term	.2060	
R-Squared	.0665	
# of Observations	2087	
# of Significant Variables at 90%	13	
# of Significant Variables at 95%	8	
# of Significant Variables at 99%	4	
*Statistical significance at 90%. **Statistical significance at 95%. ***Statistical significance at 99%.		

Multicollinearity: I tested to determine whether multicollinearity was present in my results from the linear-linear model. One of the reasons that the linear probability model can be an appropriate model is because it provides VIF values to help determine multicollinearity, which the logit model cannot provide. In Chapter 3, I found the correlation coefficients of all independent variables; I determined that c*ollege graduate* and *high income* correlated somewhat closely and could present multicollinearity problems. Second, the VIF test above (using the VIF results from the linear-linear equation) shows all variable VIFs; those over five whose results were not significant likely have multicollinearity issues. The three variables that have a VIF over five are *college graduate, some college,* and *high school graduate.* The variables that have a VIF

over five and no significant result are *high school graduate* and *some college*. To attempt to correct for this issue, I tried combining *college graduate* and *some college* into a single variable (*all college)*. By doing so, the *all college* variable became significant at the 95% level, but the VIF was still quite high at 12.57 (better than *college graduate* at 16.86 but almost identical to *some college* at 12.75). However, since the VIF improved, I used the *all college* variable in the tests below and the corrected linear-linear model.

Heteroskedasticity: Since heteroskedasticity is a concern for the linear probability model, I ran a series of tests to determine whether my calculated standard errors are incorrect because of my variables not having constant variance. Using the Breusch-Pagan test, I determined that my overall model almost certainly has heteroskedasticity issues, as the resulting p-value was well below .10. Second, I tried using the Szroeter test, which separated out my variables and indicated that all but the following variables received p-values of less than .10: *African American, Asian/PI, other race, separated, unmarried couple, some high school, Alaska, Arizona, Arkansas, Colorado, Washington DC, Georgia, Hawaii, Illinois, Indiana, Louisiana, Minnesota, Missouri, Oregon, South Dakota, Tennessee, Texas, Vermont, Virginia, Wisconsin.* To correct for this issue, I re-ran the regression with robust standard error reporting and a correction for heteroskedasticity (see Table 4.2 for corrected linear-linear form results).

Table 4.2: Corrected Linear-Linear Regression Results: Corrected Coefficients, Significance, and Standard Errors when Dependent Variable is One for Drinking While Pregnant and Zero for Not Drinking

Variables	Coefficient	Standard Error
Age	0.0036***	0.0013
Hispanic	-0.0460**	0.0232
African American	-0.0379**	0.0192
Asian Pacific Islander	-0.0262	0.0327
American Indian	0.0315	0.0513
Other Race	0.0023	0.0387
Children Presence	-0.0188	0.0154
Married	-0.0672***	0.0219
Divorced	-0.0200	0.0443
Widowed	0.5427	0.3976

Separated	-0.0448	0.0417
Unmarried couple	-0.0346	0.0312
Health Insurance	-0.0681***	0.0256
Doctor Access	-0.0034	0.0181
Medium Income	-0.0073	0.0175
High Income	0.0165	0.0214
Some High School	-0.0869	0.0640
High School Grad	-0.1076*	0.0619
All College	-0.1010	0.0630
Employment	0.0215*	0.0124
Alabama	-0.0639	0.0439
Alaska	-0.0135	0.0703
Arizona	0.0097	0.0663
Arkansas	0.0293	0.1055
Colorado	-0.0299	0.0433
Connecticut	0.0206	0.0633
Delaware	0.0950	0.0797
District of Columbia	-0.0063	0.0664
Florida	0.0163	0.0388
Georgia	-0.0001	0.0546
Hawaii	-0.0010	0.0635
Idaho	-0.0471	0.0384
Illinois	-0.0131	0.0561
Indiana	-0.0380	0.0441
Iowa	-0.0719**	0.0294
Kansas	-0.0646**	0.0325
Kentucky	-0.0461	0.0447
Louisiana	-0.0211	0.0495
Maine	-0.0759**	0.0301
Maryland	-0.0644*	0.0349
Massachusetts	0.0192	0.0433
Michigan	-0.0820***	0.0297
Minnesota	-0.0327	0.0407
Mississippi	-0.0663**	0.0301
Missouri	-0.0304	0.0597
Montana	-0.0540	0.0388
Nebraska	-0.0318	0.0397
Nevada	0.0835	0.1088
New Hampshire	0.0357	0.0765
New Jersey	0.0026	0.0457
New Mexico	0.0317	0.0708
New York	0.1127*	0.0664
North Carolina	0.0380	0.0557
North Dakota	0.0491	0.0698
Ohio	0.0505	0.0627
Oklahoma	-0.0653*	0.0363
Oregon	-0.0225	0.0768
Pennsylvania	0.0482	0.0555
Rhode Island	-0.0607	0.0408
South Carolina	-0.0310	0.0422

South Dakota	-0.0345	0.0499
Tennessee	-0.0110	0.0621
Texas	0.0088	0.0376
Utah	-0.0600*	0.0313
Vermont	-0.0109	0.0565
Virginia	0.0227	0.0721
Washington	0.0110	0.0400
West Virginia	-0.0946***	0.0318
Wisconsin	-0.0223	0.0666
Wyoming	-0.0863***	0.0297
Constant Term	.1981	
R-Squared	.0650	
# of Observations	2087	
# of Significant Variables at 90%	18	
# of Significant Variables at 95%	12	
# of Significant Variables at 99%	7	
*Statistical significance at 90%. **Statistical significance at 95%. ***Statistical significance at 99%.		

Problems with the Linear-Linear Form: Unfortunately, there are some problems associated with using the above models with a dichotomous dependent variable. Specifically, even though the variables cannot exceed one or be less than zero, the linear probability models have an "unbounded" straight-line fit of the model. Additionally, my R-Squared value is not useful: my model may explain the dependent variable quite well, and R-Squared is still far below one (in this case, .0650), since the predicted value and the actual value are extremely different on part of the line. Because of these problems, I also ran the binomial logit regression model. It is the preferred way of doing this type of regression, and from it I draw conclusions. The next section discusses that model.

Uncorrected Regression Results – Binomial Logit Model

Because the dependent variable is a dummy variable, it is dichotomous (either zero or one). Therefore, it is appropriate to run a binomial logit regression as well to determine whether such a model provides a better fit. Binomial logit regression does not indicate fit with a straight line; rather, it creates an S-curve, which may provide a better fit, particularly because the results

will never exceed one nor will it be less than zero. Using logistic regression, I achieved the below results. In this table, I reported odds ratios as a percentage, as determined by subtracting one from the calculated odds ratio, to more accurately reflect the meaning of the value. Results reported as "higher" or "lower" compare the likelihood that the presence of the variable influenced drinking during pregnancy in one direction or the other. Ultimately, this model yielded 12 significant variables and a pseudo-R-Squared of .1115 (one more significant variable than with the above linear-linear model, and a higher pseudo-R-Squared). The significant variables at the 90% confidence level were: *age, Hispanic, African American, married, widowed, health insurance, some high school, high school graduate, some college, college graduate, employment, Delaware,* and *New York.* At the 95% level, the significant variables decreased to *age, Hispanic, married, widowed, health insurance, high school graduate, some college,* and *New York*. Finally, at the 99% confidence level, the only significant variables were *age, married,* and *some college.* Table 4.3 summarizes the results of the regression for all variables.

Table 4.3: Binomial Logit Results – Regression Coefficients, Significance, Standard Errors, and Odds Ratios when Dependent Variable is One for Drinking While Pregnant and Zero for Not Drinking

Variables	Coefficients	Standard Errors	Odds Ratio
Age	0.0556***	0.0183	1.0572
Hispanic	-0.7603**	0.3822	0.4676
African American	-0.5836*	0.3375	0.5579
Asian Pacific Islander	-0.4380	0.4713	0.6453
American Indian	0.4138	0.5779	1.5125
Other Race	-0.0146	0.5690	0.9855
Children Presence	-0.2531	0.2058	0.7764
Married	-1.1117***	0.3098	0.3290
Divorced	-0.4713	0.5084	0.6242
Widowed	3.2327**	1.6177	25.3475
Separated	-0.5476	0.6603	0.5783
Unmarried couple	-0.4797	0.4109	0.6190
Health Insurance	-0.9889**	0.3079	0.3720
Doctor Access	-0.0735	0.2675	0.9291
Medium Income	-0.2136	0.2951	0.8077
High Income	0.1489	0.3480	1.1606
Some High School	-1.1120*	0.6442	0.3289
High School Grad	-1.4822**	0.5874	0.2271
Some College	-1.5362***	0.5800	0.2152

College Grad	-1.0267*	0.5841	0.3582
Employment	0.3741*	0.2110	1.4537
Alabama	-1.5071	1.3374	0.2216
Alaska	-0.0721	1.1128	0.9304
Arizona	0.2070	0.8695	1.2300
Arkansas	0.5403	1.1511	1.7165
Colorado	-0.4730	0.7086	0.6231
Connecticut	0.2974	0.6581	1.3463
Delaware	1.0846*	0.6409	2.9582
District of Columbia	-0.1197	0.8553	0.8872
Florida	0.3166	0.5051	1.3724
Georgia	0.1388	0.7231	1.1489
Hawaii	0.0663	0.8797	1.0685
Idaho	-0.9659	1.0980	0.3807
Illinois	-0.2080	0.8381	0.8122
Indiana	-0.4377	0.8245	0.6455
Iowa	(omitted)		
Kansas	-1.8348	1.4561	0.1597
Kentucky	-0.7979	1.1052	0.4503
Louisiana	-0.2015	0.8353	0.8175
Maine	(omitted)		
Maryland	-1.5155	1.0873	0.2197
Massachusetts	0.3333	0.5202	1.3956
Michigan	(omitted)		
Minnesota	-0.4924	0.7096	0.6112
Mississippi	(omitted)		
Missouri	-0.3803	1.1123	0.6837
Montana	-1.0484	1.1034	0.3505
Nebraska	-0.3805	0.7148	0.6835
Nevada	0.8752	0.7870	2.3994
New Hampshire	0.4829	0.7355	1.6208
New Jersey	0.0799	0.5771	1.0832
New Mexico	0.3917	0.7784	1.4795
New York	1.0765**	0.5395	2.9343
North Carolina	0.5654	0.5954	1.7602
North Dakota	0.7245	0.6767	2.0637
Ohio	0.7249	0.6733	2.0645
Oklahoma	-1.4514	1.1033	0.2342
Oregon	-0.4811	1.1585	0.6181
Pennsylvania	0.6062	0.5721	1.8335
Rhode Island	-1.1096	1.0881	0.3297
South Carolina	-0.6138	1.0968	0.5413
South Dakota	-0.5085	1.0998	0.6014
Tennessee	0.0545	0.8481	1.0560
Texas	0.2274	0.5387	1.2554
Utah	-1.5838	1.0843	0.2052
Vermont	-0.1810	0.8586	0.8345
Virginia	0.4154	0.8556	1.5150
Washington	0.2816	0.5306	1.3252
West Virginia	(omitted)		

Wisconsin	-0.1833	1.1114	0.8325
Wyoming	(omitted)		
Constant Term		.3161	
Pseudo R-Squared		0.1115	
# of Observations		1922	
# of Significant Variables at 90%		13	
# of Significant Variables at 95%		8	
# of Significant Variables at 99%		3	
*Statistical significance at 90%. **Statistical significance at 95%. ***Statistical significance at 99%.			

In order to make sense of these results, I converted the odds ratios to a percentage by subtracting the odds ratio from one (see Table 4.4). In doing so, I could determine how each variable compared to its reference variable as predicting whether a woman was more or less likely to report drinking alcohol while pregnant. For the variables that were significant at 90% or higher, I found the following: for each year that a woman's *age* increased, she had a 5.7% greater likelihood than the previous year that she would report drinking during pregnancy. A woman who identified herself as *Hispanic* had a 53.2% lower likelihood of reporting alcohol consumption than the white reference variable, whereas a woman identifying as *African American* had a 55.8% higher likelihood of reporting consumption. A *married* woman was 67.1% less likely than a *single* woman to report alcohol consumption, while a *widowed* woman was 2434.7% more likely to report consumption than a *single* woman was. A woman with *health insurance* was 62.8% less likely than a woman without health insurance was to report consumption. Among all education categories, there existed a lower likelihood that women would report drinking than the reference variable of women whose highest completed education level was *elementary* school or less: *some high school,* 67.1% lower; *high school graduate,* 77.2% lower; *some college,* 78.5% lower; and *college graduate,* 64.2% lower. A woman who reported being *employed* was 45.4% more likely to indicate consumption than was an unemployed woman. Finally, among states of residence, women in *Delaware* were 195% more likely and women in

New York were 193% more likely to report consumption than women in California were. I discuss the implications of these findings in the next chapter.

Table 4.4: Odds Ratio of Significant Variables Reported as a Percentage

Variables	Odds Ratio reported as percentage
Age	5.7% higher*** (.0194)
Hispanic	53.2% lower** (.1987)
African American	55.8% higher* (.1784)
Married	67.1% lower*** (.0991)
Widowed	2434.7% higher** (34.9954)
Health Insurance	62.8% lower** (.1097)
Some High School	67.1% lower* (.1997)
High School Grad	77.2% lower** (.1285)
Some College	78.5% lower*** (.1190)
College Grad	64.2% lower* (.2075)
Employment	45.4% higher* (.3166)
Delaware	195.8% higher* (1.970)
New York	193.4% higher** (1.676)
Constant Term	.3161
Pseudo R-Squared	.1115
# of Observations	1922
# of Significant Variables	12
*Statistical significance at 90%. **Statistical significance at 95%. ***Statistical significance at 99%.	

Case Study Results

In this section, I discuss the results of my case study of the Project CHOICES program. I compare both the findings of the literature review with the practices of the Project CHOICES program, as well as my findings in the regression analysis. First, I compare the ways in which the program identifies women at risk of having an AEP to the significant variables found from the above regression analysis, using the variables found to be significant at the 90% confidence level. I also compare Project CHOICES identification factors to those found to be significant in the literature review. From these comparisons, I draw initial conclusions about the appropriateness of the Project CHOICES identification factors. Next, I discuss the brief intervention strategy

utilized by Project CHOICES practitioners and compare that strategy to the ones described in my literature review. I discuss broader policy implications in the next chapter.

Defining "At-Risk" Women

The previous chapter discusses the factors that Project CHOICES practitioners use to identify women at risk of an AEP. Given that program practitioners work with non-pregnant women in an attempt to prevent any alcohol exposure in a pregnancy before it occurs, the program identifies women more broadly than the regression analyses discussed in the literature review or the one performed above. Nevertheless, there is some overlap between at-risk identification factors Project CHOICES uses, the significant variables in my regression, and the regressions in the literature review. However, none of the identifying factors overlap in other areas. Some of these differences likely result from the studies having different goals than the Project CHOICES program. Whereas my regression and those in the literature reveal behaviors and characteristics predicting when pregnant women report drinking alcohol, Project CHOICES practitioners attempt to identify women at risk of having an AEP before they ever become pregnant. Additionally, the comparisons below are imperfect in that under Project CHOICES, a woman must fit into all of the discussed classifications to be identified as being at risk of having an AEP, while under the regression analyses, every significant variable identifies a greater likelihood that a woman is at risk of an AEP.

Alcohol consumption status: Level of alcohol consumption is perhaps the most important identification factor for Project CHOICES, in that the program identifies women at risk of an AEP who report drinking four or more drinks on any day in a week, and/or eight or more drinks during the week. The program uses this measure because four or more drinks at a time is considered "binge drinking" by CDC, and eight or more drinks per week is CDC's definition of a heavy drinker. In my regression, however, I used the report of any alcohol consumption since the

U.S. Surgeon General has repeatedly warned about no known safe level of alcohol consumption during pregnancy. The literature was varied in identifying women's alcohol consumption levels; some studies reviewed any alcohol consumption, while others also included reports on binge drinking.

Age: Project CHOICES interveners identify adult women in their most fertile years as potentially being at risk for an AEP; that is, the program includes all women between the ages of 18-44. The median age of participants was 28 (Floyd, R.L. et. al., 2007). In both my regression and those discussed in the literature review, pregnant women in higher age ranges were more likely than women in lower age ranges to report any alcohol consumption, with women age 40 and above being most likely to report drinking during pregnancy. Although fertility declines with age, FASDs can be more severe in children born to older mothers (Chiodo et. al., 2010).

Race/Ethnicity: Large minority populations reside in the areas of the initial Project CHOICES locations, and each of the locations reported substantial application of the intervention techniques on African American, Hispanic, and American Indian women. The greatest minority participation rate was among non-Hispanic African Americans, who were 45% of the total population of participants (Floyd, R.L. et. al., 2007). Although the program did collect participant demographic data, Project CHOICES does not use race or ethnicity as an identifying factor for being at risk of having an AEP. In my regression, I found that race is a predictor for alcohol use: among the significant race variables, whites were more likely than Hispanics to report consumption, and African Americans were more likely than whites were to report it. The literature comports with the findings that whites and African Americans report more consumption, but also adds that American Indian women are more likely than whites or African Americans to report consumption.

Marital status: Project CHOICES did not use marital status as an indicator for AEP risk, although about half (51.4%) of participants were single (Floyd, R.L. et. al., 2007). Marital status was significant variable in both my regression and the literature, however. In my study, I found that married women were 67% less likely than single women were to report consuming alcohol during pregnancy. I found divided studies on the predictive ability of marital status in my review of the literature; some studies found that married women were less likely to report drinking during pregnancy than unmarried women, but other studies found no significant difference.

Education: Project CHOICES did not use educational attainment as a risk factor, but the participants were divided between grades 1-11 (25.2%), high school diploma or GED attainment (39.9%) or one or more years of college (34.6%) (Floyd, R.L. et. al., 2007). Various levels were significant in my regression and in the literature review. My regression found that at 90% confidence (and higher in some cases), women of all higher education levels (some high school, high school graduate, some college, and college graduate) were less likely to report drinking than those who received elementary school or lower education. However, the middle levels (high school graduate, some college) were least likely to report consumption in relation to elementary or less (77.2% and 78.5%, respectively), whereas some high school and college graduates or above were respectively only 67.1% and 64.2% less likely than elementary or less. In other words, while women with the lowest levels of education were most likely to report drinking, women at the highest level of education were more likely to drink than those in the middle were. This finding somewhat contradicts the literature, which generally found that women with higher education levels (some college or above) were more likely to drink than women with high school or below.

Employment:. Project CHOICES did not use employment as a risk factor, but some of the locations where the program ran precluded formal employment (i.e., county jails). Other

locations, such as healthcare clinics for poor or uninsured individuals, were more likely to be used by women who either were not employed and therefore could not pay for (or have insurance for) other healthcare, or who were employed in lower wage jobs. However, in my regression, employed women were about 45% more likely to report alcohol consumption during pregnancy than unemployed women were. This aligns with the literature, which found that employed pregnant women – especially those with higher incomes – were more likely to report alcohol consumption than unemployed women were.

Contraceptive use: Because Project CHOICES interveners were concerned with preventing AEPs, they identified as at-risk those women who were non-pregnant, presumably fertile, reported no contraceptive use or ineffective contraceptive use, and reported that they did not want to become pregnant. My regression, on the other hand, included only women who already reported being pregnant, whether or not their pregnancy was planned, unplanned, or desired. The literature review found that women reported ceasing or decreasing alcohol consumption upon their recognition of pregnancy, but these pregnancies by definition had already become AEPs.

Health insurance coverage: Although Project CHOICES did not formally identify health insurance status as an AEP risk factor, the program locations may have attracted uninsured or underinsured women. Locations included health clinics for indigent individuals and health programs in county jails. Since the literature did not sufficiently cover health insurance access as a predictive factor, I included it as a variable in my regression. At 95% confidence, I found that women with health insurance were about 62% less likely to report alcohol consumption during pregnancy than were women without health insurance.

Comparing Intervention Techniques

After identifying at-risk women, Project CHOICES practitioners employ a brief intervention technique to help reduce the likelihood that identified women have an AEP. In order to assess the efficacy of Project CHOICES, it is appropriate to compare the brief intervention technique to programs designed to prevent alcohol use. In this subsection, first I review the Project CHOICES intervention process. Next, I compare this intervention strategy to intervention techniques for other anti-alcohol programs discussed in the literature review. I reviewed intervention approaches in programs aimed at teens to prevent initial alcohol use, and alcohol-abuse recovery programs designed to curb alcohol use by alcoholics. These programs are similar to the Project CHOICES approach in that they both aim to address alcohol use in at-risk populations, who could experience stronger, more negative consequences from alcohol consumption than the general population. For teens, negative consequences would include drinking illegally and potentially becoming alcohol dependent at a young age; for alcoholics, consequences would include furthering their addiction and associated health problems; for at-risk women, the consequence would be experiencing an AEP.

Project CHOICES Intervention Technique

As mentioned in the previous chapter, Project CHOICES practitioners employ a "motivational interviewing" intervention strategy via counseling sessions. Motivational interviewing is a client-centered counseling approach where the counselor expresses empathy with the client, manages a client's resistance to change negative behaviors without confronting the client, and provides support to the client's ability to change their behavior (Ceperich, S.D. & Ingersoll, K., 2011). The program used this style of counseling in four counseling sessions and a follow-up appointment to a contraceptive provider. During the counseling sessions, Project CHOICES counselors sought to accomplish the following: 1) assess women's alcohol and contraceptive use patterns; 2) provide counseling about alcohol use during pregnancy; 3) provide

advice about alcohol intake reduction and referral to community treatment centers for those identified as alcohol-dependent drinkers; and 4) provide advice about contraception methods and services. Table 4.5 describes each of these directives in further detail. The goal of this intervention technique was to change either or both of their risky behaviors that contributed to the likelihood of having an AEP, namely, reducing or eliminating alcohol consumption and starting to use contraception effectively (Ceperich, S.D. & Ingersoll, K., 2011).

Table 4.5: Features of the Project CHOICES Motivational Intervention during Counseling Sessions

1) In Depth Assessment	• Interview to determine alcohol consumption patterns and contraceptive behaviors • Personalized feedback provided regarding number of drinks per week, money spent on alcohol, calories consumed from alcohol, pregnancy risk, alcohol consumption temptation, and ineffective contraception temptation
2) Counseling	• Discuss participant's perceived level of importance for her to reduce alcohol intake and use contraception • Discuss participant's perceived confidence in ability to reduce alcohol intake and use contraception • Discuss participant's perceived level of readiness to reduce alcohol intake and use contraception
3) Alcohol Intake Advice or Referral	• Informational brochures about alcohol and health provided • For heavy drinkers, provide advice and information during counseling session to reduce drinking • For alcohol-dependent participants, referral to community treatment centers
4) Contraceptive Advice	• Informational brochures about contraception provided • Referral to contraception provider, including a scheduled appointment

Sources: Ceperich, S.D. & Ingersoll, K. (2011); Floyd, R.L. et. al. (2007).

Similarities between Project CHOICES intervention and those of other programs: The school-based intervention programs designed to prevent teens from drinking have some similar approaches to Project CHOICES. The most successful school-based strategies target individual students (that is, they enhance an individual student's knowledge or skills about alcohol use, rather than addressing environmental factors that could lead to alcohol use within the student population). This comports with the Project CHOICES model closely; Project CHOICES does

not attempt to change external factors in order to change women's behaviors. The most effective student programs draw from a social influences model, and counteract media messages and peer pressure about alcohol consumption. This reflects the Project CHOICES motivational interviewing strategy, which provides personalized feedback and advice to women based on their self-reported perceived barriers to reducing alcohol consumption, which often includes pressure from peers or partners. Both types of programs provide information about alcohol consumption consequences and potential dangers to participants, and both provide advice on alcohol avoidance. Finally, both the school-based programs and Project CHOICES provided extensive and substantial training to the facilitators or counselors. There also exist a few similarities between some successful alcohol treatment programs and aspects of Project CHOICES. Some of these programs, most notably Alcoholics Anonymous, emphasize community-based management rather than in-patient clinical care. This includes counseling sessions and discussions about addiction and ability to quit, rather than medical treatment.

Differences between Project CHOICES intervention and those of other programs: The successful school-based intervention programs described in the literature review are also different from the Project CHOICES intervention methods in several ways. They use peer facilitation, meaning that volunteer students guide, coach, or encourage at-risk students, whereas Project CHOICES intervention counseling sessions are one-on-one and led by a trained practitioner. Successful student programs account for participant age, and include several measures to be culturally appropriate. Project CHOICES does not emphasize age or cultural messaging in its efforts to assist participants. Among alcohol-abuse community programs, there is a significant emphasis on group counseling and discussion, whereas Project CHOICES counselors treated participants in one-on-one sessions.

Conclusion

Under the regression analysis section, I justified my reasons for choosing the binomial logit model over the linear-linear model, in that I acquired the greatest number of significant variables with it. I also tested the linear-linear equation and explained my reasons for rejecting it as inappropriate for this regression. Using my preferred regression form, I reported my corrected results. Under the case study section, I reviewed the features of the Project CHOICES program and interventional model, as well as how they compare to other alcohol consumption programs and the results of my regression analysis. In Chapter 5, I discuss the significant variables that resulted from my preferred regression, compare the signs I predicted with actual outcomes, and interpret the results from my regression as it relates to the thesis policy question. I also incorporate the results of my regression and case study with recommendations for policy makers.

Chapter 5

CONCLUSION

In this final chapter, I discuss the significant variables from my regression in comparison to my expected outcome. I also evaluate the results of my regression and case study as they relate to my policy question. Finally, I provide policy recommendations for AEP prevention programs, discuss study weaknesses, and offer ideas for further research opportunities.

Significant Variables and Expected Results Compared to Outcomes

Below, I discuss the significant variables from my preferred binomial logit regression described in the previous chapter. Those significant variables were: *age, Hispanic, African American, married, widowed, health insurance, some high school, high school graduate, some college, college graduate, employment, Delaware,* and *New York.* I review the significant regression results, 90% confidence intervals, and odds ratios as a percentage. I compare the signs I predicted during my discussion of my analytical model to the outcome of the regression.

Table 5.1: Regression Results, Confidence Intervals, and Odds Ratios of Significant Variables when Dependent Variable is One for Drinking while Pregnant and Zero for Not Drinking

Significant Variables	Regression Coefficients (binomial logit)	90% Confidence Interval	Odds Ratio – 1 (as a percentage)
Age	0.0556	0.0254 to 0.0858	5.7% higher
Hispanic	-0.7603	-1.3888 to -0.1317	53.2% lower
African American	-0.5836	-1.1388 to -0.0283	44.2% lower
Married	-1.1117	-1.6213 to -0.6021	67.1% lower
Widowed	3.2327	0.5718 to 5.8935	2434.7% higher
Health Insurance	-0.9889	-1.4954 to -0.4824	62.8% lower
Some High School	-1.1120	-2.1717 to -0.0523	67.1% lower
High School Grad	-1.4822	-2.4483 to -0.5160	77.2% lower
Some College	-1.5362	-2.4903 to -0.5821	78.5% lower
College Grad	-1.0267	-1.9875 to -0.0659	64.2% lower
Employment	0.3741	0.0270 to 0.7212	45.4% higher
Delaware*	1.0846	0.0304 to 2.1388	195.8% higher
New York*	1.0765	0.1890 to 1.9639	193.4% higher
Constant: -1.1516			

*Reference variable is California.

Age: I predicted a positive sign for age; that is, I expected that as a woman's age rises, her likelihood of reporting alcohol consumption during pregnancy would also rise. I expected this because the literature consistently indicated that the older a woman became, the more likely she was to report alcohol consumption during pregnancy (CDC, 2002; Praeger et. al, 1984). One particular study found that the oldest group of pregnant women, ages 40 to 44, was the most likely amongst age groups ranging from ages 18-44 to report drinking while pregnant (Morris et. al, 2008). My regression bears out this prediction, as the results indicate that with each year that a woman's age increases between the ages of 18-44, she is 5.7% more likely than the previous year to report alcohol consumption during pregnancy. My results indicate that this variable is significant at 99%, making age one of the most critical factors in predicting a pregnant woman's self-reported consumption behavior.

Hispanic: I predicted a negative sign for women identifying themselves as Hispanic, meaning that I expected pregnant Hispanic women to be less likely to report alcohol consumption than white women. My results aligned with this prediction: in my regression, Hispanic women were 52.3% less likely than white were women to report consumption. This finding supports the literature, which found that Hispanics were less likely to report drinking during pregnancy than were white women (Perreira and Cortes, 2006); however, the likelihood for reporting drinking increased when women were born in the United States rather than born in another country. This may be because foreign-born women came from countries where people had less access to alcohol, or were less likely to use it, than in the United States (Bakhireva et. al. 2009).

African American: Because the literature had conflicting results on African American women's behavior, I did not predict a sign. In my regression, African American women were 44.2% less likely than white women were to report alcohol consumption during pregnancy, which comports with the findings of Perreira and Cortes (2006), who found that African Americans had

a 41% lower reporting likelihood than whites had. However, rates of FASDs in the US are higher among blacks than among whites, leading some researchers to question the results of these findings. They also postulated that although more whites might drink during pregnancy, the black women who report drinking during pregnancy may be more alcohol dependent (Ebrahim et. al., 1998). Most of the literature found that whites were the most likely race category to report consumption. Some of the literature found no significant variables among race categories.

Married: I predicted a negative sign for married women, and my regression confirmed this prediction. Married women were 67.1% less likely than single women were to report drinking while pregnant. The literature generally supports this finding, revealing that unmarried women of all subcategories were more likely to drink during pregnancy than married women were. Researchers provided several possible reasons for this finding, including that unmarried women might be more likely to attend social events where alcohol is served than married women (CDC, 2009) or that married women might have more emotionally supportive partners who encourage them to abstain from alcohol during pregnancy (Perreira and Cortes, 2006).

Widowed: I predicted a positive sign for widowed women, because I believed that widowed women between the ages of 18-44 would probably have a lifestyle more reflective of that of single women than of married women. This is because studies that included marital status as a variable often combined several categories of unmarried women, including "separated," "divorced," "widowed," and "single" into a single "unmarried" category, and those studies found that unmarried women were more likely to drink than married women (Tsai and Floyd, 2004; CDC, 2004 & 2009). My regression seemed to confirm this prediction, revealing that widowed women were over 2000% more likely than single women to report drinking during pregnancy. This huge odds ratio likely resulted from a very small sample size: out of over 2400 observations, only five women reported being widows.

Health Insurance: I predicted that women with access to health insurance would have a negative sign, and my regression bore out this prediction in that such women were 62.8% less likely than were women without health insurance to report drinking while pregnant. This aligns with my expectation that pregnant women with health insurance can better access prenatal care, treatment for alcoholism, and other services that help address drinking during pregnancy. Although the literature did not discuss health insurance access as a factor in alcohol consumption during pregnancy, I expected lower alcohol consumption reporting among women with health insurance, since health insurance access improves health outcomes (Institute of Medicine, 1993).

Some High School: I did not predict a sign for women with some high school education, because I was unsure if women with low levels of education would report higher or lower consumption than women with the lowest level of education (elementary or less, which was the reference variable). I found that women who had dropped out of high school were 67.1% less likely to report consumption than women whose highest level of education was 8th grade. In this case, my regression results depart from the literature, which found that women with lower levels of educational attainment were less likely to report alcohol consumption than those with higher levels (CDC, 2009; Phares et. al., 2004); however, I did not find any literature that broke down education levels below "some high school." This finding was only significant at the 90% confidence interval.

High School Graduate: I also did not predict a sign for high school graduates for the same reason that I did not predict one for "some high school," above. I found that high school graduates were 77.2% less likely than women with elementary or less to report alcohol consumption during pregnancy. This result is significant at the 95% level, indicating a better model fit than for high school dropouts.

Some College: In accordance with the literature, I expected a positive sign for this variable. However, under my regression, women who reported completing some college were 78.1% less likely to report alcohol consumption during pregnancy than women with a maximum education of the eighth grade. An explanation may be as follows: Much of the literature only found that those with college degrees or greater levels of education drank more; they did not explicitly state that those with some college experienced higher drinking levels (CDC, 2009; Phares et. al., 2004). Another possible explanation is that individuals reporting "some college" might be younger and still attending college classes. Since a greater age predicts greater levels of drinking, women with greater ages may not be strongly represented in this variable. Most such women would probably not be married, which does comport with the finding that unmarried women are more likely to report alcohol consumption than married women.

College Graduate: I predicted that the college graduate variable would have a positive sign in relation to the reference variable, but I was incorrect. Instead, I found that they were 64.2% less likely to report alcohol consumption than women who completed elementary school or less. This finding considerably departs from the literature, which consistently found that women with high levels of education were more likely to report consumption than were women with low levels of education. Although my findings did not comport with the literature, I found that college graduates were still more likely than women with some college, high school completion, or some high school to report drinking while pregnant. A possible explanation is that I divided levels of education into more categories than researchers in the literature did, whose lowest educational categories were "some high school" or "high school or less." Then, I could have compared larger sample sizes to one another. If I had divided the education levels in that manner, I might have acquired a different result. Researchers who found that higher education levels led to a greater likelihood of reporting drinking alcohol speculated that this may have

resulted from higher incomes earned; however, I controlled for high income and did not find it to be a significant variable. Because of these confusing findings, I recommend further research below.

Employment: My predicted positive sign matches my results, which point to greater consumption among employed women. In my regression, I found that employed women were 45.4% more likely to report alcohol consumption than unemployed women. This aligns with the literature, which indicated that employed women may have had more disposable income to spend on alcohol (Phares et. al, 2004). However, this study did not separately control for income level. My study did control for income levels, but they were not significant independent variables. Therefore, I speculate that employed women reporting alcohol consumption might have something to do with the year from which this data was derived (2010). Although economists had declared the Great Recession "over" in 2009, the unemployment rate was still at 10%, and many of those who had jobs were often underemployed, had experienced wage cuts, or were worried about losing their jobs (French et. al., 2011). Researchers found that amid these experiences, employed individuals in states with high unemployment reported more drinking days than in states with lower unemployment (French et. al., 2011). Therefore, perhaps pregnant employed women in 2010 reported higher levels of alcohol consumption than their unemployed counterparts in part because they were trying to forget their economic worries but had the disposable income to pay for alcohol. In order to test this idea, future researchers could review the data on employed pregnant women with time-series data both before and after the Great Recession, to determine if drinking patterns aligned with economic downturns.

States (Delaware and *New York)*: I did not predict a sign for any of the states as the literature did not break down alcohol consumption by state of residence. However, between the two states that were significant, women in Delaware were 195.8% more likely, and women in

New York were 193.4% more likely than were women in California to report alcohol consumption. This may have resulted from the fact that I did not control for some demographic variables. One such variable is whether a woman was foreign born: According to 2012 census estimates, while 27.2% of Californians are foreign-born, only 8.3% of Delawareans are (US Census, 2012). As discussed above, the literature indicates that foreign-born women are less likely than US-born women are to report alcohol consumption (Bakhireva et. al. 2009; Perreira and Cortes 2006). However, that does not explain the difference in New York women's reports, since 21.8% of women are foreign-born in that state. This difference may also be attributable to variables for which I did not control. Examples might include health care policy differences, such as AEP screening requirements, or education policy differences, such as substance abuse education or sex education in K-12 schools. To understand these results more thoroughly, future researchers should include such variables in their studies.

Summarized Findings: I correctly predicted the signs for *age, Hispanic, married, health insurance* and *employment*, meaning that the results of the regression supported the findings of the literature. I did not predict any signs for *African American, some high school, high school graduate,* or any of the *states,* either because the literature was conflicting or inconclusive, or because the literature did not cover the variable. I incorrectly predicted the signs of *some college* and *college graduate* because my findings did not comport with the literature. These findings influenced my recommendations for policy changes and for further study described below.

Case Study Comparisons and Conclusions

In general, Project CHOICES uses a very broad set of identification factors to determine whether a woman is at risk of having an AEP. The factors do not formally include the variables I found to be significant predictors of whether or not a woman would drink during pregnancy --

race, employment, education level, health insurance status, or marital status. However, the Project CHOICES locations, such as health clinics for indigent women and county jails, may have allowed the program to reach large numbers of women with some of the characteristics found to be significant in the regression analyses. In these locations, they are likely to be reaching women without health insurance, with very low levels of educational attainment (i.e., elementary or less), and who are unmarried. Among significant variables, Project CHOICES is least likely to be reaching women with high levels of educational attainment, who were more likely to report drinking during pregnancy in my regression and in the literature review. This may be less of a function of the identification factors that Project CHOICES uses to find at-risk women, and more likely a function of the program's locations in areas that do not cater to college students or high-income earners. Additionally, Project CHOICES' single greatest limiting identification factor is the fact that primarily they identify at-risk women as those who are heavy and/or binge drinkers (four or more drinks per day and/or eight or more drinks per week). Whereas the literature indicates that no level of alcohol consumption is known to be safe for a fetus, Project CHOICES focuses only on the most prolific drinkers who are not using birth control effectively. However, the alcohol consumption factor in Project CHOICES excludes many moderate drinkers who may also be at risk of having an AEP due to their birth control use, and who might benefit from the intervention techniques in the program. Although my regression and many in the literature focus on any drinking during pregnancy, it is unrealistic and infeasible to recommend that Project CHOICES extend its motivational strategy to all women; therefore, I recommend that the program administrators explore an initial extension to moderate drinkers who fit the rest of the identification criteria.

The Project CHOICES intervention strategy includes many features of successful anti-alcohol programs, but it excludes several aspects of these programs. The program uses

previously proven intervention techniques with regard to one-on-one counseling and individual knowledge and skill enhancement. However, Project CHOICES fails to include some strategies that may reach more women who seek assistance for alcohol dependence, particularly peer counseling, group discussion sessions, and age-appropriate or culturally appropriate messaging. Given that the women who Project CHOICES identifies as at-risk are by definition heavy or binge drinkers, it may be useful for program practitioners to incorporate peer or group counseling formats into their intervention strategies. The Project CHOICES intervention method might also achieve greater success with messaging tailored to its most frequent participants. I discuss comprehensive programmatic changes in the next section.

Policy Implications and Areas of Further Study

The significant results of my regression, as well as the findings of my case study provide evidence for a number of policy changes at the programmatic, state and federal levels. My results indicate that policy makers who wish to reduce drinking among pregnant women should focus on targeting, as well as addressing certain external factors that could lead to lower drinking rates among pregnant women. With the combined results of this regression analysis and case study, policy makers and practitioners can adjust their current programs, or better target their outreach efforts, to help change the behavior of those groups of women who are at greatest risk for consuming alcohol during pregnancy. I discuss these potential courses of action for policy change and research below.

Age, race, and marital status are three personal characteristic variables that policy makers and practitioners should take into account when determining how to identify women at risk of having an AEP. Given that the older a woman gets, the more likely she is to report consuming alcohol during pregnancy, policy makers may wish to develop public message campaigns that

specifically reach out to older mothers, warning them of the dangers of consuming alcohol while pregnant. My findings support this recommendation; I attained a 99% confidence level for my findings that for each year that a woman's age increases, she is 5.7% more likely to report alcohol consumption than the previous year (specifically, I found the narrow confidence interval range of 0.0254 to 0.0858 with a coefficient of 0.0556). Similarly, policy makers may want to target white women for public messaging, since all significant race variables were less likely than whites were to report alcohol consumption. However, before policy makers move in this direction, they may wish to commission further research first to confirm these findings. This is because these variables were only significant at the 90% confidence level, and my confidence intervals were wider. Specifically, African American women were less likely to report drinking during pregnancy than were white women within the confidence range of -1.1388 to -0.0283, with a coefficient of -0.5836; my confidence interval for Hispanic women was -1.3888 to -0.1317 with a coefficient of -0.7603. Additionally, policy makers should particularly focus on targeting public information campaigns to unmarried pregnant women, who are significantly more likely to drink than are married women. I am confident of these results, since I attained a significance at 99% with a confidence interval of -1.6213 to -0.6021 with a coefficient of -1.1117. If policy makers had resources available to apply to only one messaging campaign, I would recommend that they focus on targeting older, unmarried women, as my results were the most consistent with the

In my case study, I learned that Project CHOICES identified at-risk women primarily by whether they reported heavy alcohol consumption; however, the program might have reached more at risk women if it had included additional risk factors such as age, race, and marital status both for identification and treatment purposes. In particular, they may have wished to take special note of their clients who were age 35 and older, the most prevalent races in their client group, and whether they were unmarried. Additionally, Project CHOICES did not use age- or

culturally-tailored messaging for its clients, although other anti-alcohol programs were more successful at reducing alcohol use when they did so (Stigler et. al., 2009). For instance, Project CHOICES could develop additional strategies to reach those women in the 35-44 age group, since they were most likely to report alcohol consumption during pregnancy. Additionally, although the regression and literature indicated that white women are most likely to report alcohol consumption during pregnancy, Project CHOICES serves mostly African American women: nearly 50% of the women Project CHOICES identified as being at risk of having an AEP were African American (Floyd et. al., 2007). Therefore, to improve its success rate with the population it serves most frequently, Project CHOICES practitioners should develop materials within the intervention strategy that best reaches this population. Similarly, about half the program's participants were unmarried; Project CHOICES should attempt to meet the unique needs of these women. As policy makers look to modify and expand Project CHOICES and develop other anti-AEP programs, they should ensure that the programs take age, race, and marital status into greater account to change the alcohol consumption behaviors of more women.

Education level clearly played a role in reports of alcohol consumption; however, I recommend further research before spending public dollars on programmatic changes. My regression results found that while women with the lowest levels of education were most likely to drink, women at the highest level of education are more likely to drink than women with mid-level educations. Specifically, I found at the 90% confidence level that women of all higher education levels (some high school, high school graduate, some college, and college graduate) were less likely to report drinking than those who received elementary school or lower education. However, the middle levels (high school graduate, some college) were least likely to report consumption in relation to elementary or less (77.2% and 78.5%, respectively), whereas some high school and college graduates or above were respectively only 67.1% and 64.2% less likely

than elementary or less. However, the literature found that college graduates were most likely to report alcohol consumption during pregnancy (CDC, 2009; Perreira and Cortes, 2006; Phares et. al., 2004). Because of these conflicting findings, I recommend that researchers study further the implications of how women with very little and very extensive education are most likely to report consumption. Perhaps researchers could accomplish this through follow-up interviews with these women to understand their reasons for drinking during pregnancy, with a special emphasis on how their education levels play a role in their consumption patterns. Given that Project Choices practitioners implemented the program in locations with mostly low income, low education populations, they clearly hope to reach women to reflect the population of the area. Therefore, I do not recommend changes to that program regarding education level, and I do not recommend policy changes until further research helps determine why education level plays a role in reports of alcohol consumption.

With regard to changeable characteristics, women's employment and health insurance status both played roles in likelihood of reporting alcohol consumption. Policy makers and providers should pay special attention to the needs of employed women, who are more likely to report drinking during pregnancy than women who do not work. At the 90% confidence level, I found a narrow interval of 0.0270 to 0.7212 with a coefficient of 0.3741. My research does not conclusively determine why this is the case; therefore, I recommend further research that controls for different types and circumstances of employment. For instance, future research should focus on whether women are self-employed or employed by an organization, employed hourly or with a salary, and have employment benefits or not. Performing such a study could help policy makers have a greater understanding of which types of employed women are more likely to be at risk of having an AEP, whether the relationship between employment and alcohol consumption is causal, and what policy steps could reduce consumption among employed women. Secondly, my

regression shows that women who lack health insurance are more likely to report drinking during pregnancy. I am somewhat confident of these results, since I attained a 95% confidence interval of -1.4954 to -0.4824 with a coefficient of -0.9889. My research does not conclusively determine why this is the case; future research should control for more variables that might account for these findings. For instance, future research should control for women who have health insurance have jobs that provide them that insurance, women who are unemployed but access insurance through their employed partners, and women who access it some other way (through the government, for instance). If subsequent research finds the relationship between health insurance and lower rates of alcohol consumption during pregnancy to be causal, that would indicate a policy need to ensure that pregnant women and women who may become pregnant have access to health insurance. Responding to the variety of concerns related to poorer health outcomes associated with no health insurance access, federal policy makers created and passed the federal Affordable Care Act in an attempt to ensure that more people living in the United States have access to health insurance. At the state level, California policy makers passed a law requiring health insurers to offer maternity coverage in all plans (SB 222 and AB 210, 2011). These combined efforts could result in greater health insurance access with maternity benefits, resulting in lower AEP numbers.

Study Weaknesses

Data Weaknesses

Because of the data used, there are several weaknesses, which may have led to biased or skewed results and which may be useful to correct in future research. BRFSS surveyors collect data monthly in all states, and they interview over 350,000 adults annually by telephone with random digit dialing (CDC, 2012). Unfortunately, using BRFSS data creates some weaknesses in the study. Because my sample includes women who are currently pregnant, the study does not

capture the duration of a woman's pregnancy. That is, women who consume alcohol later in their pregnancies (after they take the survey) are not included. Further, women who are pregnant but do not know are not included in this study. Because this is a survey, it is reliant upon self-reporting, meaning that women might under- or over-report, by mistake or possibly because they are reluctant to share answers. Additionally, the BRFSS only surveys participants who are 18 and older, so pregnant women under age 18 are not included. Therefore, for future research, it may be useful to use data that addresses some of these concerns.

Study Design Weaknesses

I designed the regression portion of my study to determine which characteristics could best predict whether women drink during pregnancy. The research indicates that many demographic and lifestyle characteristics have effects on pregnant women's drinking habits, but that policy makers and service providers might be able to target women with these characteristics to help improve their behaviors and the health outcomes of their children. Because of the several weaknesses in the study, further research should include more variables and a larger sample size.

Additionally, the study suffered from the way in which I divided some variables. As discussed above, by using the "elementary or less" reference variable for education, I attained confusing results about education as a causal factor for drinking during pregnancy. In retrospect, I think that it is unlikely that women who attained a maximum of eighth grade education would behave very differently from high school dropouts. Therefore, I might have received clearer results if I had combined these two variables and used as a reference variable women who had attained an education level of "some high school or less." Similarly, I acquired some strange results from my broad causal factor of marital status, with widowed women reporting alcohol consumption much more often than single women did. However, there were very few widowed women ages 18-44 in my study, and they are likely to be such a small part of the population in the

US that their numbers would probably not warrant a special program or public information campaign to target them, regardless of regression results. Therefore, I should have combined this variable with the variables of "divorced" and "separated," since these are probably more reflective of the situation that widows experience.

My case study of Project Choices also suffered from a number of study weaknesses. First, I could not perfectly compare the success of Project Choices to my regression, since Project Choices dealt with non-pregnant women and my study dealt with pregnant women. Second, because Project Choices did not use very many variables in its identification of at-risk women, I found it difficult to directly compare that program's identification factors to my significant regression results and draw conclusions from that information. Third, whereas my regression focused on any alcohol consumption, Project Choices only considered a woman "at risk" if she drank heavily. I might have been able to draw stronger conclusions if I had reviewed a program that identified light to moderate drinking as problematic for women who did not want to get pregnant but did not use effective contraception.

Opportunities for Future Research

Given the many weaknesses in my study, there exist many opportunities to build and improve upon my work here. While cross-sectional data such as my regression provides some useful information about a point in time, time-series data would be useful to determine trends in alcohol consumption by pregnant women over several years. Future research could explore several years of BRFSS data on pregnant women, thus increasing the sample size as well as showing which characteristics predicting women's drinking patterns are changing over time. Alternatively or additionally, policy makers could benefit from the results of a regression that includes more variables related to health care access and health status, so that they could better

serve uninsured and underserved women. Such studies, which increase the number of potentially significant variables, might help control for omitted variable bias from which my study likely suffers.

Given the limitations on my case study, other researchers might wish to look at other types of programs that include anti-AEP components, and they may want to compare them in different ways. Future researchers may also want to perform case studies on programs or health care providers serving drinking pregnant women to understand successful techniques used to help women quit drinking and stop exposing fetuses to alcohol. Additionally, other researchers may want to look more closely at how state of residence plays a role in determining pregnant women's alcohol consumption patterns. They might find particular cultural or policy choices that encourage pregnant women to abstain from alcohol, or they might uncover insufficient governmental support for pregnant women. Other states could then replicate successful programs. Finally, and more broadly, researchers should continue to try to pinpoint whether or not there is any safe level of alcohol consumption during pregnancy, in order to help programs like Project Choices better identify truly at-risk women.

Closing Thoughts

In spite of extensive research revealing the dangers of alcohol consumption during pregnancy, and in spite of public health efforts to curb such consumption, pregnant women continue to drink, potentially harming themselves and their children. With this study, I have attempted to determine which factors can predict whether a woman reports alcohol consumption, in order to help policy makers make decisions that will encourage more pregnant women to avoid alcohol. I have also attempted to discuss the positive and negative features of one such program, in order to help policy makers and practitioners more successfully reach women at risk of having

AEPs. Finally, I provided suggestions for policy changes and further research that could help policy makers broadly reduce AEPs and FASDs, which would result in healthier mothers and children.

APPENDIX A: Major Regression-Based Studies Included in Literature Review

Publication date, Authors	Location, N (Sample size), Years of data	Population examined in sample	Method of statistical analysis	Findings	Conclusions/Implications
(2009), Bakhireva et. al.	New 155 2009	Pregnant Latinas, both foreign born and US citizens	Chi-square test and logistic regression in univariate and multivariable analyses	US born Latinas were 3.21 times more likely to engage in binge drinking in the periconceptional period (95% confidence interval [CI]: 1.16, 8.88). Those who spoke mostly English at home were also at an increased risk of binging (CI: 1.26, 10.46) independent of other factors.	Generally, Latinas are considered a lower-risk group for drinking during pregnancy, but the problem may be bigger than currently thought. It's important to determine why foreign born Latinas drink less, and try to apply those lessons to US citizens to minimize alcohol use in pregnancy in this population.
(2002), CDC	USA 107,141 1991-1999	Women age 18-44	Linear regression	Pregnant women who reported any alcohol use were more likely to be >30 years, employed, and unmarried. Non-pregnant women who reported any alcohol use had similar employment and marital status as pregnant women. Both were more likely to be white and to have higher education levels than women who did not engage in this behavior.	All women of childbearing age should be warned about the adverse effects of alcohol use, especially high-risk drinking patterns (i.e., binge drinking and frequent drinking), and health-care providers should learn effective techniques for screening for, and intervening with, binge and frequent drinkers.
(2009), CDC	USA 533,506 1991-2005	Women age 18-44	Logistic regression; adjusted odds ratios	The prevalence of alcohol use/binge drinking among pregnant and non-pregnant women of childbearing age did not change substantially from 1991 to 2005. Pregnant women who reported alcohol use were white, older, more educated, employed, and unmarried.	All women of childbearing age should be warned about the adverse effects of alcohol use, especially high-risk drinking patterns (i.e., binge drinking and frequent drinking), and health-care providers should learn effective techniques for screening for, and intervening with, binge/frequent drinkers.
(1998), Ebrahim et.al.	USA 103,923 1991-1995	Women age 18-44	Multiple logistic regression	From 1991 and 1995, the prevalence of binge drinking among pregnant women increased significantly from 0.7% (95% confidence interval 0.2-	Healthcare providers for women of childbearing age should take steps to address the recent rise in reported binge drinking during pregnancy, and keep in mind the risk

				0.9) to 2.9% (95% confidence interval 2.2-3.6). Amongamong non-pregnant women, prevalence changed little (11.3% vs 11.2%). Pregnant women were one fifth (prevalence rate ratio 0.2, 95% confidence interval 0.1-0.2) as likely as nonpregnant women to binge drink. Binge drinking reduction was smallest among pregnant black women.	factors for binge drinking.
(2008) Morris et al	USA 280,126 2001-2005	Non-Hispanic black and white women, ages 18- 44, pregnant and non -pregnant	Binary logistic regression	Pregnant whites averaged 79.5% fewer drinks per month than non-pregnant whites women, and 85.4% less binge drinking. Pregnant blacks averaged 58.2% fewer drinks per month than non-pregnant blacks and 64.0% less binging. Compared to black women, white women appear to reduce drinks per month by 38% more, and have 33% greater reduction in binge occasions.	Although white women are more likely to drink during pregnancy than black women, black women who do drink are less likely to reduce drinks once pregnant. Both populations should be targeted according to these results.
(2006), Perreira et. al.	US Cities 4,185 2005	Pregnant women	Logit analyses	Blacks were 41% less likely than whites to drink during pregnancy; Hispanics were 58% less likely to drink than whites. Paternal alcohol use was associated strongly with maternal alcohol use.	Policy makers need to include fathers in the discussion about how to reduce pregnant women's drinking patterns.
(2004), Phares et. al.	Alabama, Colorado, Florida, Hawaii, Illinois, Maine, Nebraska, and North Carolina 40,356 2000-2001	New mothers	Simple logistic regression	The highest prevalence of alcohol consumption during pregnancy was reported amongst women 35 years and older, non-Hispanic women, women who attained greater than a high school education, and women with higher incomes.	The report described the prevalence of negative behaviors but did not seek to determine their underlying causes; therefore, further research should be done to determine why certain women are at the highest risk of engaging in such behaviors and how to reduce behaviors.

(1984), Prager et. al.	USA 7,021 1980	Married mothers of live and stillborn infants	Logistic regression	Typically, pregnant drinkers were over 25, white, and better educated. However, the reduction in drinking during pregnancy was more pronounced than reductions in another negative behavior during pregnancy, smoking.	This report described negative behaviors but did not seek to determine underlying causes. Further research is needed.
(2004), Tsai, Floyd	USA 4,404 2002	Women ages 18-44	logistic regression	Over half of women who did not use birth control (and therefore might become pregnant) reported alcohol use and 12.4% reported binge drinking. Greater binge-drinking prevalence was observed among younger women, non-Hispanic whites, current smokers, unmarried women, and impaired drivers.	Authors found a need for continued efforts to inform all women of childbearing age about negative outcomes related to alcohol consumption during pregnancy. They determined that primary-care screening of alcohol use for all women is essential to reduce negative health outcomes for mother and baby.

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