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The association between adverse childhood experiences and alcohol use during pregnancy in a representative sample of adult women

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Abstract

Background—The impact of adverse childhood experiences (ACEs) on adult alcohol consumption is well-established, but little is known about the association with alcohol use during pregnancy.

Methods—Using data from the 2010 Nevada Behavioral Risk Factor Surveillance System (BRFSS), we assessed the relationship between ACEs and alcohol use during pregnancy in a representative sample of 1,987 adult women. An established ACEs scale was used to assess a range of childhood physical, emotional, and sexual abuse and household dysfunction (range 0–8). Weighted logistic regression was used to assess the relationship between ACE scores and alcohol use during pregnancy after controlling for drinking before pregnancy and other covariates.

Results—Six percent of participants reported drinking alcohol during pregnancy. After controlling for race/ethnicity, age, employment status, smoking status, and pre-pregnancy alcohol use, increasing ACEs were positively associated with higher odds of alcohol use during pregnancy (1 ACE: AOR= 2.92; 95% CI= 1.08, 7.87), (2–3 ACEs: AOR=3.52; 95% CI=1.46, 8.48), and (4 or more ACEs: AOR= 4.79; 95% CI=2.14, 10.72). Pre-pregnancy drinking was also strongly associated with alcohol use during pregnancy (AOR= 11.95; 95% CI=5.02, 28.43).

Conclusions—We found evidence of a dose-response relationship between ACEs and alcohol use during pregnancy that remained even after controlling for pre-pregnancy drinking and other covariates. Screening women of childbearing age as well as pregnant women for ACEs may be an effective way to identify and address many of the emotional, behavioral, and physical sequelae of childhood adversity.

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Introduction

Alcohol use during pregnancy is associated with adverse maternal and infant health outcomes including low birth weight (Patra, Bakker, Irving, Jaddoe, Malini & Rehm, 2011), preterm delivery (O’Leary, Nassar, Kurinczuk & Bower, 2009; Patra, Bakker, Irving, Jaddoe, Malini & Rehm, 2011), fetal alcohol spectrum disorders (FASD) (Centers for Disease Control and Prevention [CDC, 2015]), and fetal death (Andersen, Andersen, Olsen, Grønbæk & Strandberg-Larsen, 2012). While many women stop using alcohol when they find out they are pregnant (Harrison & Sidebottom, 2009), recent data demonstrate that an estimated 7.6% of pregnant women in the United States reported alcohol use in the past 30 days (CDC, 2012). The identification of factors associated with alcohol use during pregnancy is critical to guide the development of effective public health prevention efforts.

Research has consistently demonstrated that women who use alcohol during pregnancy are older (Alvik, Heyerdahl, Haldersen, & Lindeman, 2006b; Harrison & Sidebottom, 2009; Meschke, Holl & Messelt, 2013; Palma et al., 2007), have higher income (Alvik et al., 2006a; McLeod, Pullon, Cookson, & Cornford, 2002; Palma et al., 2007; Zammit, Skouteris, Wertheim, Paxton, & Milgrom, 2008), and report higher rates of depression (Harrison & Sidebottom, 2009; Meschke, Holl & Messelt, 2013), intimate partner violence (Choi et al, 2014; Denton, Adinoff, Lewis, Walker, & Winhusen, 2014; Harrison & Sidebottom, 2009; Leonardson, Loudenburg, & Struck, 2007; Meschke, Hellerstedt, Holl, & Messlet, 2008), smoking (Alvik et al., 2006b; Harrison & Sidebottom, 2009; Meschke, Holl & Messelt, 2013; Ethen et al., 2009) and pre-pregnancy alcohol use (Alvik et al., 2006; Ethen et al., 2009; Harrison & Sidebottom, 2009; Palma et al., 2007; Zammit et al., 2008). An emerging area of research also suggests that a history of childhood stressors, such as physical, sexual, and emotional abuse may influence alcohol use among pregnant women.

A prospective study with sexually abused females referred by child protective service agencies found that this group reported higher rates of alcohol use during pregnancy compared to community controls (Noll, Schulkin, Trickett, Susman, Breech & Putman, 2007). Recent unadjusted analysis of the Nurse’s Health Study II data showed that a combined measure of childhood physical, emotional, and sexual abuse was associated with increased prevalence of alcohol use during pregnancy in a dose-response fashion (Roberts, Lyall, Rich-Edwards, Ascherio, & Weisskopf, 2013). Furthermore, a study with pregnant women seeking care in an urban emergency department found that childhood physical abuse and sexual abuse were both associated with alcohol use during pregnancy after adjusting for age, race, education, and current abuse (Nelson, Uscher-Pines, Staples & Grisso, 2010).

Such studies highlight the potential impact of childhood abuse on adult risk behaviors such as alcohol use during pregnancy, but do not fully account for context in which childhood abuse occurs. For example, research has shown that childhood sexual abuse is associated with multiple forms of childhood adversity including physical and emotional abuse, physical and emotional neglect, domestic violence, and other types of household dysfunction (Anda et al., 1999; Dong, Anda, Dube, Giles & Felitti, 2003; Leeners, Stiller, Block, Gorres, & Rath, 2010). The interrelatedness of childhood stressors suggests that evaluating the

cumulative impact of childhood adversity may be more important than isolating single risk factors such as sexual abuse (Dong et al., 2004).

Research assessing multiple forms of adverse childhood experiences (ACEs) has consistently shown that there is a strong graded relationship between ACEs and early initiation of alcohol use, heavy and binge drinking, and alcohol dependence among adults in the U.S. (Dube, Anda, Felitti, Edwards, & Croft, 2002; Dube et al., 2006; Pilowsky, Keyes, & Hasin, 2009; Rothman, Edwards, Heeren, & Hingson, 2008); however, to our knowledge only one study has investigated the cumulative impact of ACEs on alcohol use during pregnancy. A recent prospective study with young women attending health centers found a dose response relationship between seven ACEs that occurred before the age of 16 and alcohol use during pregnancy (Chung, Nurmohamed, Mathew, Elo, Coyne, & Culhane, 2010). While this study complements previous research investigating the impact of single types of childhood adversity, it is important to note that no studies have controlled for pre-pregnancy alcohol use which is perhaps the strongest predictor of alcohol use during pregnancy (Skagerstrom, Chang, & Nilsen, 2011).

Given the demonstrated relationship between ACEs and alcohol use and abuse among adult women (Dube et. al., 2002), there is a need for studies that explore whether the relationship between ACEs and alcohol use during pregnancy is independent from pre-pregnancy alcohol use. There is also a need for studies that assess the cumulative effects of multiple childhood stressors, rather than only focusing on single forms of childhood adversity. To address these limitations, we used the ACEs module developed by the CDC and tested the hypothesis that there is a dose-response relationship between ACEs and alcohol use during pregnancy that is independent of pre-pregnancy alcohol use and other covariates.

Material and methods

Participants and procedures

Data from Nevada's 2010 Behavioral Risk Factor Surveillance System (BRFSS) was used for this study. The BRFSS is an annual health survey that is conducted in all 50 states, the District of Columbia, and three territories on behalf of the CDC. Using Random Digit Dialing techniques, adults who were aged 18 years or older and had a landline were randomly selected to participate. Trained interviewers administered a telephone survey that included standardized national questions, optional modules, and state-added questions to assess emerging public health issues. In 2010, 3,913 Nevadans participated in the BRFSS (a 51% response rate). After excluding all surveys completed by males and women who reported they had never been pregnant, the final sample size of eligible women for this study was 1,987.

Measures

Outcome: Alcohol use during pregnancy—In 2010, the Nevada BRFSS included a state-added variable that assessed alcohol use during pregnancy. Women who were or had been pregnant were asked “Upon learning you were pregnant, about how many days per week did you have at least one drink of any alcoholic beverage?” Possible responses were:

drank every day, drank 3 to 6 days a week, drank 1 to 2 days a week, did not drink, and drank less than 1 day a week. Due to a small number of responses in the alcohol use categories, responses were dichotomized as alcohol use during pregnancy versus no alcohol use during pregnancy.

Exposure: Adverse Childhood Experiences (ACEs)—In 2010, Nevada added the BRFSS ACEs module. This module was developed based on the scale used in the original ACEs study conducted by the CDC and Kaiser Permanente which has been shown to have high test-retest reliability (Dube, Williamson, Thompson, Felitti, & Anda, 2004). The BRFSS ACEs module includes 11 questions that assess 8 areas of abuse and household dysfunction before the age of 18. Measures of abuse include physical abuse (1 variable), verbal abuse (1 variable), and sexual abuse (3 variables). Measures of household dysfunction include living with someone with a mental health problem (1 variable), living with someone who abused substances (2 variables), incarceration of a family member (1 variable), witnessing domestic violence (1 variable), and parental separation or divorce (1 variable). Consistent with previous research, positive responses to the eight ACEs were added together to provide an overall ACE score, with sexual abuse measured with a positive response to one of three questions and living with someone who abused alcohol or drugs with a positive response to one of two questions; ACE scores ranged from 0 to 8 (Ford et al., 2011). Participants were categorized into four groups by ACE score: 0 ACEs, 1 ACE, 2–3 ACEs and 4 or more ACEs. Appendix A lists the BRFSS ACE categories and questions.

Covariates

Sociodemographic Characteristics: Participant's age at time of interview was categorized in three groups: 18–34 years, 35–54 years and 55 years and older. Race and ethnicity were assessed with two separate questions and included non-Hispanic white, Hispanic, non-Hispanic black, non-Hispanic multiracial, non-Hispanic Asian, non-Hispanic other, and non-Hispanic Native Hawaiian/Pacific Islander. Education was assessed by asking participants their highest level of education; responses were dichotomized as less than a high school diploma or general educational degree (GED) versus high school diploma/GED or higher. Current employment was assessed at the time of the survey and responses were dichotomized into “employed” versus “unemployed.” Likewise, annual household income was assessed at the time of the survey and categorized in three groups: less than \$25,000, \$25,000 to less than \$50,000, and \$50,000 or more.

Depression: Lifetime depression was assessed by asking participants if a doctor or other healthcare provider ever told them they had a depressive disorder including depression, major depression, dysthymia, or minor depression. To assess current depression, the Patient Health Questionnaire-8 (PHQ-8) was used. This 8 item questionnaire assesses how many days over the past two weeks the participants experienced depressive symptoms. Each answer is assigned a score depending on the number of days they had depressive symptoms (0–1 days = 0, 2–6 days = 1, 7–11 days = 2, and 12–14 days = 3) and a total score is calculated (range 0–24). A score of 10 or greater was used to dichotomize participants into two groups: “currently depressed” and “not depressed”. The PHQ-8 cutoff of 10 or higher has been validated by comparison to the DSM-IV diagnostic algorithm with accuracy of

96.5% for detecting any level of depressive disorder (Kroenke, Strine, Spitzer, Williams, Berry, & Mokdad, 2009).

Smoking: Participants were asked if they smoked at least 100 cigarettes in their entire life. Those who smoked at least 100 cigarettes in their life were asked if they currently smoke cigarettes every day, some days, or not at all. As recommended by the CDC (CDC, 2009) and used in previous research investigating ACEs and substance use (Ford et al., 2011), participants who reported they had smoked at least 100 cigarettes in their life and currently smoked every day or some days were categorized as current smokers. Those who smoked at least 100 cigarettes in their life, but did not currently smoke were categorized as former smokers. Participants who smoked less than 100 cigarettes in their life were categorized as non-smokers. Current or former smokers were combined into a “smokers” category and were compared to “non-smokers.”

Pre-pregnancy alcohol use: In 2010, a state-added question that measured alcohol use the month before pregnancy was included in the Nevada BRFSS. Women were asked how much beer, wine, or liquor they usually drank per week in the month before they knew they were pregnant. One or more drinks were dichotomized as “yes” and no drinks as “no”.

Data Analysis

All analyses were conducted with SAS, Version 9.2. To account for non-response bias and increase generalizability of the results, data were weighted (CDC, 2010). The weighted chi-square test was used to assess the relationship between alcohol use during pregnancy and race/ethnicity, age, education, income, employment, lifetime depression, current depression, smoking status, pre-pregnancy alcohol use, individual ACE items, and the overall ACE score. Finally, a weighted logistic regression was conducted to account for the complex sampling design. The final model assessed the association between the cumulative number of ACEs and alcohol use during pregnancy controlling for pre-pregnancy alcohol use and other covariates that were significant ($p < .05$) in the bivariate analysis. Adjusted Odds Ratios (AOR) and 95% Confidence Intervals (CI) were calculated.

Results

Descriptive characteristics for the study population are shown in Table 1. Approximately 70% of participants were white and 15.8% were Hispanic, which is reflective of Nevada’s adult population (U.S. Census Bureau, 2015). At the time of the interview, 26.9% of participants were 18–34 years, 38.4% were 35–54 years, and 34.7% were 55 and older. Most participants (91.6%) had obtained a high school diploma or GED, 53.9% were unemployed, and 26.7% reported an annual income of less than \$25,000 a year. About one fifth (21.1%) of the participants had been depressed during their life and 12.9% were currently depressed. Almost half (45.8%) of the sample was classified as a current or former smoker, 19.7% reported pre-pregnancy alcohol use, and 6.4% reported alcohol use during pregnancy. The prevalence of individual ACEs included: sexual abuse (21.8%), physical abuse (20.7%), verbal abuse (31.1%), living with someone with a mental health problem (21.5%), living with someone who abused substances (34.9%), incarceration of a family member (7.7%),

witnessing domestic violence (20.4%), and parental separation or divorce (32.7%). Just over one third (36.2%) of participants had an ACE score of 0 (no exposure), 19.2% experienced 1 ACE, 23.0% 2–3 ACEs, and 21.6% 4 or more ACEs.

Factors associated with alcohol use during pregnancy are presented in Table 2. Women who used alcohol during pregnancy were more likely to be non-Hispanic white (86.4% vs. 70.9%; $p=.003$), 55 years or older (52.7% vs. 33.4%; $p=.033$), unemployed (65.9% vs. 52.1%; $p=.036$), classified as smokers (72.6% vs. 44.2%; $p<.001$), and report pre-pregnancy alcohol use (72.4% vs 16.9%; $p<.001$) compared to women who did not report alcohol use during pregnancy. Women who reported alcohol use during pregnancy also were more likely to report the following ACEs: physical abuse (31.2% vs. 19.7%; $p=.048$), verbal abuse (46.7% vs. 30.1%; $p=.011$), living with someone with a mental health problem (33.2% vs. 20.9 %; $p=.047$), living with someone who abused substances (51.2% vs. 34.3%; $p=.010$), having a family member who had been incarcerated (18.6% vs. 6.9%; $p=.015$), and witnessing domestic violence (32.0% vs. 19.9%; $p=.050$). Furthermore, women who used alcohol during pregnancy also had higher overall ACE scores than women who did not drink during pregnancy: 0 ACEs (16.3% vs. 37.6%), 1 ACE (15.3% vs. 18.9%), 2–3 ACEs (30.4% vs. 22.9%), and 4 or more ACEs (38.0% vs. 20.6%) ($p<.001$).

After controlling for sociodemographic characteristics and other covariates, a graded relationship between ACEs and alcohol use during pregnancy was observed (1 ACE: AOR=2.92, 95% CI= 1.08, 7.87), (2–3 ACEs: AOR= 3.52, 95% CI= 1.46, 8.48), and (4 or more ACEs: AOR= 4.79; 95% CI=2.14, 10.72). Pre-pregnancy alcohol use remained a strong predictor of alcohol use during pregnancy (AOR = 11.95, 95% CI = 5.02, 28.43) (Table 3).

Discussion

Our results add to the growing body of literature demonstrating that ACEs are related to alcohol use during pregnancy (Chung et al., 2010; Roberts et al., 2013; Nelson et al., 2010) and demonstrate the importance of assessing multiple forms of childhood adversity, rather than only focusing on single childhood stressors. Using an established ACEs scale, we found evidence of a dose-response relationship between ACEs and alcohol use during pregnancy that remained even after controlling for pre-pregnancy alcohol use and other covariates. This suggests that the impact of ACEs on alcohol use during pregnancy is not simply a result of pre-pregnancy drinking patterns.

The mechanism by which childhood adversity influences alcohol use during pregnancy is not clear, but the cumulative impact of ACEs can disrupt neurocognitive development during formative years (Anda et al., 2006; Teicher, Andersen, Polcari, Anderson, Navalta & Kim, 2003), limiting a person's ability to cope with ongoing stressors (Dube et al., 2006), and increasing reactivity to stress during adulthood (Chu et al., 2013; Dong et al., 2004; Heim & Nemeroff, 2001). The influence of ACEs on perceived stress (Nelson et al., 2010) and anxiety (Agrati et al., 2015; Buist, Gotman & Yonders, 2011) during pregnancy may contribute to use of alcohol as a coping mechanism (Choi et al, 2014).

As expected, we found a strong relationship between pre-pregnancy alcohol consumption and alcohol use during pregnancy which supports previous research (Alvik et al., 2006b; Ethen et al., 2009; Harrison & Sidebottom, 2009; Palma et al., 2007; Zammit et al., 2008). While we were interested in controlling for prenatal alcohol use to better understand the independent relationship between ACEs and alcohol use during pregnancy, it is important to note that pre-pregnancy alcohol use may actually moderate the relationship between ACEs and alcohol use during pregnancy. A recent longitudinal study in South Africa found that women with a history of childhood trauma (physical abuse, sexual abuse, emotional abuse, and neglect) increased their risky alcohol consumption after becoming pregnant regardless of their pre-pregnancy alcohol use levels (Choi et al., 2014). The cultural context of using alcohol during pregnancy in South Africa is likely different from that in the U.S., but this study highlights the need for prospective studies with adequate power to explore the complex relationships between ACEs, prenatal alcohol consumption, and alcohol use during pregnancy. Such research could inform the development of interventions that address risky alcohol use in the pre-conception period as well as during pregnancy.

Our findings should be considered in relation to research that has demonstrated an association between childhood sexual abuse and other ACEs and pregnancy complications (Leeners et al., 2010), pregnancy complaints (Lukasse, Schei, Vangen & Oian, 2009), premature delivery (Leeners, Rath, Block, Gorres, and Tschudin, 2014; Noll et al., 2007; Stevens-Simon, Kaplan, & McAnarney, 1993), and fetal death (Hillis, Anda, Dube, Felitti, Marchbanks, & Marks, 2004). The observed relationships between ACEs and adverse pregnancy outcomes may be mediated or moderated by alcohol use during pregnancy and this should continue to be explored in future research. Furthermore, there is a need for research that evaluates the impact of ACEs on multiple pregnancy health behaviors and health outcomes that may be interrelated.

There are several study limitations. First, we had to dichotomize the measure of alcohol use during pregnancy and this crude measure could not differentiate between levels of consumption. However, the prevalence of alcohol use during pregnancy in our study was similar to recent national estimates (CDC, 2012). Second, a validated measure of alcohol use frequency was not used to document pre-pregnancy alcohol use. The inability to differentiate high versus low risk alcohol consumption in the preconception period may have resulted in incomplete control of this important confounding variable. Third, previous research demonstrates that alcohol use during pregnancy is an underreported behavior (Alvik et al., 2006a; Comasco et al., 2009; Henderson, Gray, & Brocklehurst, 2007). While underreporting of the outcome in our study is likely, we have no reason to believe that this differs by the exposure (ACEs) so our measure of association would be underestimated, not overestimated. Fourth, lifetime prevalence of smoking and lifetime and current prevalence of depression were assessed, but we did not have measures of these variables during pregnancy. Misclassification of these covariates, as well as unmeasured covariates such as domestic violence, could have contributed to residual confounding. Fifth, the response rate for this study was 51% and there was potential for selection bias. Sixth, the use of a cross-sectional design did not allow us to establish temporality and causal inference is not possible. Finally, while a representative sample of women in Nevada was obtained, the results may not be generalizable to other states.

Implications for practice and/or policy

In summary, we found a strong graded relationship between ACEs and alcohol use during pregnancy that remained after controlling for pre-pregnancy alcohol use and other covariates. Our study supports research demonstrating that ACEs are strong risk factors for pregnancy risk behaviors such as alcohol use (Chung et al., 2010; Roberts et al., 2013; Nelson et al., 2010) as well as a wide range of adverse pregnancy and birth outcomes (Leeners et al., 2014; Leeners et al., 2010; Lukasse et al., 2009; Noll et al., 2007; Hillis et al., 2004; and Stevens-Simon, 1993). Furthermore, research has shown that childhood adversity is associated with an increase in perceived stress, anxiety, and depression among pregnant and post-partum women (Agrati et al., 2015; Buist et al., 2011; Buist & Janson, 2001; Madigan et al., 2014; Nelson et al., 2010) and post-partum stress may be heightened for women who consumed alcohol during pregnancy and gave birth to child with FASD (Paley, O'Connor, Frankel & Marquardt, 2006; Watson, Coons & Hayes, 2013). Routine ACEs screening among women of childbearing age as well as pregnant women may be an effective way to identify and address many of the emotional, behavioral, and physical sequelae of childhood adversity.

The BRFSS ACEs module is easy to administer and could be adapted for use in a variety of health care settings to identify women at risk for unfavorable pregnancy and post-partum health outcomes. Screening for ACEs could identify women who may benefit from stress management programs as well as trauma-focused interventions that have been shown to be effective for treating substance abuse disorders as well as posttraumatic stress disorders (van Dam, Vedel, Ehring & Emmelkamp, 2012). Additionally, ACE screening could be combined with ongoing alcohol screening and brief intervention programs as a way to better understand the context and needs of women who report risky alcohol use before and during pregnancy.

For routine ACE screening in health care settings to be effective, provider barriers to screening must first be addressed. In contrast to screening for intimate partner violence, screening for ACEs has received little attention in medical education (Weinreb, Savageau, Candib, Reed, Fletcher & Hargraves, 2010). There is a need to increase provider awareness about the impact of ACEs on health outcomes across the lifespan, including the preconception, pregnancy and post-partum period. In addition, training programs to increase provider confidence in asking sensitive questions about childhood are warranted (Weinreb et al., 2010). Finally, for ACEs screening to have an impact on improving maternal and infant health outcomes, it must be coupled with appropriate referrals to evidence-based interventions that are designed to build resilience among women and families who have experienced childhood adversity.

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Appendix A: BRFSS ACEs Module

Experienced Sexual Abuse

How often did anyone at least 5 years older than you or an adult, ever touch you sexually?

Answers: Never; Once; More than once; Don't know/Not sure; Refused

How often did anyone at least 5 years older than you or an adult, try to make you touch them sexually?

Answers: Never; Once; More than once; Don't know/Not sure; Refused

How often did anyone at least 5 years older than you or an adult, force you to have sex?

Answers: Never; Once; More than once; Don't know/Not sure; Refused

Experienced Physical Abuse

Before age 18, how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking. Would you say—

Answers: Never; Once; More than once; Don't know/Not sure; Refused

Experienced Verbal Abuse

How often did a parent or adult in your home ever swear at you, insult you, or put you down?

Answers: Never; Once; More than once; Don't know/Not sure; Refused

Substance Abuse in Household

Did you live with anyone who was a problem drinker or alcoholic?

Answers: Yes; No; Don't know/Not sure; Refused

Did you live with anyone who used illegal street drugs or who abused prescription medications?

Answers: Yes; No; Don't know/Not sure; Refused

Mental Illness in Household

Did you live with anyone who was depressed, mentally ill, or suicidal?

Answers: Yes; No; Don't know/Not sure; Refused

Parental Separation or Divorce

Were your parents separated or divorced?

Answers: Yes; No; Don't know/Not sure; Parents not married; Refused

Domestic Violence in Household

How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?

Answers: Never; Once; More than once; Don't know/Not sure; Refused

Family Member Incarcerated

Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?

Answers: Yes; No; Don't know/Not sure; Refused

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Table 1

Descriptive characteristics of a representative sample of 1,987 adult women, 2010.

Characteristics	n (%) [*]
Race/Ethnicity [‡]	
white [†]	1585 (69.7)
Hispanic	166 (15.8)
black [†]	61 (5.6)
multiracial [†]	55 (2.4)
Asian [†]	38 (3.5)
other [†]	26 (1.4)
Native Hawaiian/Pacific Islander [†]	3 (1.4)
Age	
18–34 years	206 (26.9)
35–54 years	644 (38.4)
55 years and older	1137 (34.7)
Education	
Less than high school diploma/GED	164 (8.4)
High school diploma/GED or higher	1821 (91.6)
Income	
Less than \$25,000	489 (26.7)
\$25,000 to less than \$50,000	474 (26.2)
\$50,000 or more	693 (47.1)
Employment Status	
Employed	830 (46.1)
Not Employed	1150 (53.9)
Lifetime Depression	
Yes	398 (21.1)
No	1441 (78.9)
Current Depression	
Yes	205 (12.9)
No	1526 (87.1)
Smoking Status	
Smokers	1020 (45.8)
Non-smokers	963 (54.2)
Pre-Pregnancy Alcohol Use	
Yes	369 (19.7)
No	1250 (80.2)
Alcohol Use During Pregnancy	
Yes	150 (6.4)
No	1591 (93.6)
Individual ACEs	

Characteristics	n (%) [*]
Experienced Sexual Abuse	
Yes	381 (21.8)
No	1405 (78.2)
Experienced Physical Abuse	
Yes	386 (20.7)
No	1418 (79.3)
Experienced Verbal Abuse	
Yes	587 (31.1)
No	1201 (68.9)
Mental Illness in Household	
Yes	373 (21.5)
No	1422 (78.5)
Substance Abuse in Household	
Yes	630 (34.9)
No	1180 (65.1)
Family Member Incarcerated	
Yes	115 (7.7)
No	1697 (92.3)
Domestic Violence in Household	
Yes	360 (20.4)
No	1428 (79.6)
Parental Separation or Divorce	
Yes	554 (32.7)
No	1251 (67.3)
Total ACE Score	
Score 0/No Exposure	601 (36.2)
Score 1	341 (19.2)
Score 2–3	404 (23.0)
Score 4+	356 (21.6)

^{*} Weighted percentage

[†] Non-Hispanic

[‡] Missing data: Race/ethnicity (20); education (2); income (331); employment status (7); lifetime depression (148); current depression (256); smoking status (4); drinking before pregnancy (368); alcohol use during pregnancy (246); mental health in household (192); substance abuse in household (177); family member incarcerated (175); parental separation or divorce (182); domestic violence in household (199); experience physical abuse (183); experience verbal abuse (199); experience sexual abuse (201); ACE score (285)

Table 2

Characteristics associated with drinking during pregnancy in a representative sample of adult women, 2010

Characteristics	<u>Alcohol Use During Pregnancy (n=1741)[†]</u>		p-value
	Yes (%) [*]	No (%) [*]	
Race/Ethnicity			0.003
white (Non-Hispanic)	129 (86.4)	1281 (70.9)	
other	15 (8.8)	170 (13.8)	
Hispanic	6 (4.8)	124 (15.3)	
Age			0.033
18–34 years	10 (22.4)	163 (25.5)	
35–54 years	27 (24.9)	558 (41.1)	
55 years and older	113 (52.7)	870 (33.4)	
Education			0.856
Less than high school diploma/GED	8 (7.9)	129 (8.5)	
High school diploma/GED or higher	142 (92.1)	1461 (91.5)	
Income			0.523
Less than \$25,000	50 (32.9)	372 (25.8)	
\$25,000 to less than \$50,000	34 (23.8)	392 (27.6)	
\$50,000 or more	50 (43.3)	579 (46.6)	
Employment Status			0.036
Employed	51 (34.1)	692 (47.9)	
Not Employed	99 (65.9)	895 (52.1)	
Lifetime Depression			0.092
Yes	41 (30.7)	341 (20.9)	
No	109 (69.3)	1247 (79.1)	
Current Depression			0.714
Yes	18 (12.2)	182 (13.7)	
No	120 (87.8)	1307 (86.3)	
Smoking Status			<.001
Smokers	108 (72.6)	777 (44.2)	
Non-smokers	41 (27.4)	811 (55.8)	
Pre-Pregnancy Alcohol Use			<.001
Yes	86 (72.4)	274 (16.9)	
No	21 (27.6)	1209 (83.1)	
Individual ACEs			
Experienced Sexual Abuse			0.122
Yes	38 (31.0)	330 (21.3)	
No	112 (69.0)	1240 (78.7)	
Experienced Physical Abuse			0.048
Yes	36 (31.2)	338 (19.7)	
No	114 (68.8)	1243 (80.3)	
Experienced Verbal Abuse			0.011

Characteristics	Alcohol Use During Pregnancy (n=1741) [†]		
	Yes (%) [*]	No (%) [*]	p-value
Yes	64 (46.7)	504 (30.1)	
No	84 (53.3)	1068 (69.9)	
Mental Illness in Household			0.047
Yes	43 (33.2)	319 (20.9)	
No	106 (66.8)	252 (79.1)	
Substance Abuse in Household			0.010
Yes	61 (51.2)	554 (34.3)	
No	89 (48.8)	1030 (65.7)	
Family Member Incarcerated			0.015
Yes	15 (18.6)	96 (6.9)	
No	135 (81.4)	1490 (93.1)	
Domestic Violence in Household			0.050
Yes	34 (32.0)	319 (19.9)	
No	114 (68.0)	1249 (80.1)	
Parental Separation or Divorce			0.916
Yes	36 (33.5)	493 (32.7)	
No	113 (66.5)	1088 (67.3)	
Total ACE Score			<.001
Score 0/No Exposure	33 (16.3)	545 (37.6)	
Score 1	30 (15.3)	296 (18.9)	
Score 2–3	45 (30.4)	347 (22.9)	
Score 4+	36 (38.0)	313 (20.6)	

^{*} Weighted column percentages

[†] Missing data: Alcohol use during pregnancy (246)

Table 3

Factors independently associated with alcohol use during pregnancy in a representative sample of adult women, 2010

Characteristics	<u>Alcohol Use During Pregnancy*</u>	
	AOR	(95% CI)
Race/Ethnicity		
white (Non-Hispanic)	1.00	(referent)
Hispanic	0.42	(0.09, 2.03)
other	0.88	(0.36, 2.18)
Age		
18–34 years	1.00	(referent)
35–54 years	0.48	(0.16, 1.46)
55 years and older	1.38	(0.44, 4.33)
Employment Status		
Employed	1.00	(referent)
Not Employed	1.73	(0.83, 3.61)
Smoking Status		
Smokers	1.88	(0.89, 3.98)
Non-smokers	1.00	(referent)
Pre-Pregnancy Alcohol Use		
Yes	11.95	(5.02, 28.43)
No	1.00	(referent)
ACE Score		
Score 0/No Exposure	1.00	(referent)
Score 1	2.92	(1.08, 7.87)
Score 2–3	3.52	(1.46, 8.48)
Score 4+	4.79	(2.14, 10.72)

* Multivariate logistic regression simultaneously adjusted for all variables listed.