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The Effect of Adverse Childhood Experience on Clinical Diagnosis of a Substance Use Disorder: Results of a Nationally Representative Study

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Abstract

Background—Substance abuse is one of the most common health outcomes associated with adverse childhood experience, and poses a significant public health threat.

Objectives—The purpose of this study is to demonstrate a relationship between adverse childhood experience and a substance use disorder using nationally representative data, as well as to test whether religion moderates this relationship.

Methods—We conducted a secondary analysis using data from the National Longitudinal Study of Adolescent to Adult Health ($n = 11279$). Three types of adverse childhood experiences were considered; physical, emotional and sexual abuse. Logistic regression was used to determine if risk for developing an alcohol use, cannabis use, or other drug use disorder in adulthood increased as exposure to multiple types of adverse childhood experiences increased, while controlling for prior substance use and other demographic variables that have shown associations with substance use. Additionally, religiosity was investigated as a possible moderator of the relationship between adverse childhood experience and substance abuse.

Results—The likelihood of developing a substance use disorder later in life increased as the score on the adverse childhood experience index increased. While religiosity did significantly reduce the likelihood of developing a substance use disorder, no moderating effects were observed.

Conclusions/Importance—This study underscores the long-term consequences of exposure to childhood adversity.

Keywords

Adverse Childhood Experience; Religiosity; Substance Abuse; Resilience; Abuse; National Longitudinal Study of Adolescent to Adult Health

INTRODUCTION

Substance abuse poses a significant public health threat to the United States. In 2006, the Centers for Disease Control and Prevention (CDC) estimated excessive alcohol use was

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directly responsible for 88,000 deaths and cost the U.S. \$223.5 billion (Esser et al., 2014). Furthermore, among adults aged 20–64, excessive drinking was responsible for 1 in 10 deaths, resulting in 2.5 million years of potential life lost each year from 2006–2010 (Stahre, Roeber, Kanny, Brewer, & Zhang, 2014). While alcohol is one of the most commonly abused substances in the U.S., illicit drug use also has a tremendous negative impact on society. In 2007 drug abuse cost the U.S. at least \$193 billion due to healthcare and crime costs, lost productivity, and premature death, and in 2010, there were 40,393 drug-induced deaths in the U.S (National Drug Intelligence Center [NDIC], 2011). Given the scope of the public health burden related to substance abuse, and the morbidity and mortality associated with it, research identifying the factors contributing to the development of substance use disorders, as well as constructs that promote resilience, is needed.

In 1998, the CDC along with Kaiser Hospital in San Diego released the landmark Adverse Childhood Experience (ACE) study documenting a link between adverse childhood experiences and subsequent adult health outcomes. One of the most striking findings of the ACE study was that individuals who experienced four or more types of adverse childhood experiences were at a four to twelve-fold increased risk of developing alcohol or drug abuse problems (Felitti et al., 1998). Other studies have also reported a strong relationship between exposure to severe stress in childhood and substance abuse, however, much of the published evidence linking adverse childhood experiences to substance abuse outcomes has originated from clinical samples (Bennett & Kemper, 1994; Downs & Harrison, 1998; Dube, Felitti, Dong, Chapman & Giles, 2003; Green et al., 2010). In addition, because most studies linking adverse childhood experiences with adult outcomes are conducted retrospectively, they have lacked the ability to control for the influence of confounding factors that might account for the effects attributed to adverse childhood experiences, such as prior substance use. One study, using data from the National Epidemiologic Survey on Alcohol and Related Conditions demonstrated that individuals reporting two or more adverse childhood experiences, compared to those reporting none were at a significantly increased risk for developing alcohol dependence even after controlling for prior binge drinking (Pilowsky, Keyes, & Hasin, 2009). While this study used both nationally representative data and controlled for prior alcohol use, they did not consider how adverse childhood experiences affect the development of other drug use disorders.

Another area that has received scant attention in the research linking adverse childhood experiences and substance abuse is resilience. Developing a more concrete understanding of what promotes resilience provides insight into the mechanisms that underlie positive outcomes subsequent to exposure to adverse experiences. In a meta-analysis of quantitative studies, Koenig (2001) found positive associations between religiosity and several resilience characteristics such as optimism, social support and an active coping style. In this meta-analysis 79 out of 100 studies reported a significant positive correlation between religion and positive emotions as well as general psychological well-being. Furthermore, religiosity has been associated with positive outcomes in populations exposed to chronic or traumatic stress (Williams, Larson, Buckler, Heckman, and Pyle, 1991). Diner and colleagues demonstrated religiosity aided in adaptive coping through improving self-efficacy in adults, and providing reassurance that problematic life-events can be overcome (Diner, Suh, Lucas, & Smith, 1999). Additionally, a great deal of research has shown an association between religiosity

and reduced substance use in adolescence (Kendler, Liu, Gardner, McCullough, Larson, & Prescott, 2005; Piedmont, 2004; Robinson, Bolton, Rasic, & Sareen, 2012; Wallace, & Williams, 1997). Analyses of national samples such as the Monitoring the Future Study have also shown an association between higher levels of religiosity and lower rates of alcohol abuse, cannabis use, and tobacco use among adolescents (Wallace, Brown, Bachman, & LaVice, 2003). Since individuals who experience adverse childhood experiences are likely to be at an increased risk for substance abuse, and religiosity both protects against substance abuse, and buffers the impact of stress, it is plausible to predict religiosity might reduce the negative impact of adverse childhood experiences on adult substance abuse outcomes.

The purpose of this study is to determine if exposure to adverse childhood experiences predicts the subsequent development of an alcohol use, cannabis use, or other drug use disorder in adulthood, and to investigate the possible moderating effects of religiosity in a nationally representative sample. The present study hypothesizes: 1) A positive relationship between exposure to adverse childhood experiences and the likelihood of being diagnosed with an alcohol-use, cannabis-use, or other drug disorder in adulthood; and 2) Religiosity will moderate the effect of adverse childhood experiences on adulthood substance use such that the effect of adverse childhood experiences on developing an alcohol, cannabis, or other drug use disorder will be reduced for more religious individuals compared to less religious individuals.

METHODS

This secondary analysis uses the restricted use dataset from the National Longitudinal Study of Adolescent to Adult Health (Add Health) and was approved by the IRB at the corresponding authors institution. The Add Health study used a multistage, stratified cluster sampling design to ensure the sample was reflective of the United States adolescent population (i.e. 12–18) in regards to urbanicity, region, school size, school type (public, private) and ethnicity (Udry & Bearman, 1998). A stratified sample of 80 high schools were selected along with an additional 52 feeder schools (middle and junior high) for inclusion. Wave I of the Add Health study began in 1994 when participants were aged 12–18 and was followed one year later by Wave II data collection. Wave III was completed between 2001 and 2002 when participants were between the ages of 18–26 and Wave IV was completed in 2007 and 2008 while participants were between the ages of 24 and 32. Only adolescents who participated in Wave I, III, and IV and had valid data for each of the studied variables (including sample weights) were included in the present analyses $n=11,279$. In order to address potential substance-use-related attrition between Waves I and IV, we compared participants who completed Wave I, III, and IV to those who dropped out after Wave I on measures of past-year alcohol, cannabis, and other drug use from the Wave I survey. We found no differences in alcohol use between these groups; however, survey respondents who dropped out after Wave I were more likely to report both cannabis ($p<0.05$) and other drug use ($p<0.05$).

Study Measures

Participant Demographics and Early Substance Use—Respondent age, gender, race/ethnicity, past-year heavy use of alcohol, and lifetime use of cannabis (yes/no) and other drugs (yes/no) was obtained from Wave I of the Add Health survey. Participants were asked to indicate the number of times in the past year they consumed five drinks in a row (0 = “Never”, 6 = “Every day or almost every day”). Other drug use at Wave I was measured by responses to three questions regarding lifetime cocaine use, inhalant glue or solvent use, and other illegal drug use. These three questions were combined into a single other drug use variable with an affirmative response to any of these questions defined as past year drug use.

Lifetime Diagnosis of a Substance Use Disorder—Data from constructed variables in Wave IV of the Add Health survey were used to indicate lifetime diagnosis of an alcohol, cannabis, or other drug use disorder. The questions used in the construction of these variables were specifically designed to reflect the diagnostic criteria indicated in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV). In line with DSM-IV criteria, two constructs were involved in determining lifetime diagnosis of a substance use disorder: *substance dependence* and *substance abuse*. Questions about substance dependence were asked with dichotomous (Yes, No) responses indicating whether or not one engaged in a certain substance dependence behavior corresponding to each of the diagnostic criteria outlined in the DSM-IV for substance dependence, such as tolerance, withdrawal, etc. An answer of “yes” to three or more of the substance dependence questions was indicative of substance dependence, consistent with the DSM-IV criteria. Substance abuse symptoms were measured by questions about functional impairment related to substance use, and continued use despite consequences. Response categories included “never”, “1 time” or “more than 1 time.” An answer of “more than 1 time” to one of the substance abuse questions was indicative of the presence of one symptom of alcohol abuse, consistent with DSM-IV criteria. In the present analysis, a variable was created to reflect either the presence or absence of any type of substance use disorder, either abuse or dependence.

Adverse Childhood Experiences—Adverse childhood experiences were measured retrospectively in Wave IV using three questions concerning emotional, physical and sexual abuse (e.g., “Before your 18th birthday, how often did a parent or other adult caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?”, “Before your 18th birthday, how often did a parent or adult caregiver hit you with a fist, kick you, or throw you down on the floor, into a wall, or down stairs?”, “How often did a parent or other adult caregiver touch you in a sexual way, force you to touch him or her in a sexual way, or force you to have sexual relations?”). Response categories regarding emotional, physical and sexual abuse questions included: “this never happened”, “one time”, “two times”, “three to five times”, “six to ten times”, and “more than ten times”. We created an adverse childhood experience index using these three questions from the Add Health survey. Specifically, we considered a positive response to each question (a value of 1) for respondents who indicated having experienced emotional abuse more than ten times, physical abuse more than twice, and any experience of sexual abuse. Thus, the adverse

childhood experience index could range from 0–3 where one point was given for each of the three types of abuse experienced to reflect the additive effects of multiple forms of abuse.

Religiosity—In the present study, a religiosity index was created using responses to two questions: “In the past 12 months, how often did you attend religious services?” and “In the past 12 months, how often did you attend special (youth or young adult) activities (i.e., classes, choir, other groups)?” Response options ranged on a six-point Likert-type scale from never to more than once a week. An additive index of religiosity was created by summing responses from each of the two questions to create an index ranging from 0–12. Previous secondary analyses of the Add Health data have used a similar method to measure religiosity, creating an index assessing attendance at religious services and activities, as well as importance of religion (Rostosky, Danner, & Riggle, 2007; Rostosky, Regnerus, & Wright, 2003). While not included in the religiosity index, two additional items related to religiosity were also explored in this study: importance of religion and frequency of prayer. Neither of these items were significantly associated with lifetime diagnosis of any type of substance use disorder in bivariate or multivariate analysis, and thus were not included in the final models.

Data related to religiosity came from Wave III of the Add Health survey. Participants were aged 18–26 in Wave III, the period of emerging adulthood. This developmental period has been shown to be a time when individuals develop self-autonomy, self-identity and solidify religious beliefs and attitudes (Good, & Willoughby, 2006). Furthermore, using information about religiosity reported after the age of 18 is less likely to be influenced by parental beliefs.

Data Analysis

We used the SPSS (ver. 22) Complex Samples procedure to conduct weighted analyses with parameter and variance estimates that have been adjusted for the complex sampling design of the Add Health survey. Samples were weighted to match the demographic trends of the U.S. population when the first Wave of data was collected in 1994. Three separate multivariate logistic regression models were utilized to test the relationship between adverse childhood experience as well as religiosity and the three (i.e., alcohol, cannabis, and other drugs) lifetime substance use disorder diagnosis measures, while controlling for the following covariates: age, gender, race/ethnicity, education, and prior alcohol, cannabis and other drug use. First, we conducted bivariate analyses to determine if there were independent associations between adverse childhood experience, religiosity, model covariates and the three dependent variables. Only variables significantly associated with each outcome ($p < 0.05$) were included in the multivariate logistic regression model. To determine if religiosity moderated the effect of adverse childhood experience on the lifetime diagnosis of a substance use disorder, we created an interaction term between adverse childhood experience index and the religiosity index and included the term in each multivariate regression model. Both the adverse childhood experience and religiosity indices were grand mean centered (Aiken & West, 1991).

RESULTS

Table 1 presents sample characteristics and demographic information for the participants included in these analyses ($n = 11,279$).

Alcohol Use Disorder

Results from the bivariate analyses (columns 2–4) and multivariate regression (last three columns) for lifetime diagnosis of an alcohol use disorder (AUD) are presented in Table 2. Results of the multivariate regression indicated men were more likely to have an AUD than women while Hispanic, African American and Asian participants were less likely to have an AUD relative to whites. Age was negatively associated with the odds of having an AUD. Higher levels of education and Wave 1 substance use were also associated with the increased odds of having an AUD. Controlling for model covariates, each one-unit increase in the adverse childhood experience scale was associated with 34% higher odds of developing an AUD in adulthood. Furthermore, religiosity decreased the probability of having an AUD by 10%. The interaction between religiosity and adverse childhood experience was not significantly associated with having an AUD.

Cannabis Use Disorder

Results from the bivariate analyses and multivariate regression for lifetime diagnosis of a cannabis use disorder (CUD) are presented in Table 3. Similar to the model predicting AUD, age was negatively associated with the odds of having a CUD while men were more likely than women to have a CUD. Race and ethnicity were not significantly associated with a CUD. Participants with a graduate degree or higher were less likely to have a CUD than participants who did not graduate from high school. Wave I substance use also increased the likelihood of having a CUD. A one-unit increase in the adverse childhood experience scale was associated with 47% higher odds of developing a CUD in adulthood. Finally, religiosity decreased the likelihood of having a CUD by 8%. The interaction between religiosity and CUD was not significant.

Other Drug Use Disorder

Table 4 displays the bivariate and multivariate logistic regression results for a lifetime diagnosis of an other drug use disorder (DUD). Higher age was associated with a higher probability of being diagnosed with a DUD. Hispanic origin was not significantly associated with the probability of developing a DUD. Men were more likely to have a lifetime diagnosis of a DUD than women, while African Americans were less likely to report a DUD compared to whites. The probability of developing a DUD was lower for all levels of education relative to participants who did not graduate from high school. Substance use at Wave I (heavy alcohol use, cannabis use, or other drug use) increased the likelihood of developing a DUD. Adverse childhood experience significantly increased the likelihood of having a DUD, after controlling for the effect of model covariates. Each one-unit increase in the adverse childhood experience scale was associated with 41% higher odds of developing a DUD in adulthood. Religiosity decreased the probability of developing a DUD by 11%. Religiosity did not significantly moderate the effect of adverse childhood experience on the probability of having a DUD.

DISCUSSION

This study explored the relationship between adverse childhood experiences and lifetime diagnosis of an alcohol, cannabis, or other drug use disorder. The results of each logistic regression model provided support for the first study hypothesis. Specifically, after controlling for model covariates, there was a significant increase in the risk of developing any type of substance use disorder, as a function of reported childhood adverse experiences. These results indicate a positive relationship between adverse childhood experiences and substance abuse where each one unit increase in the adverse childhood experience scale was associated with at least a 34% increase in the odds of developing a clinically significant substance use disorder in adulthood. The positive relationship between adverse childhood experiences and substance abuse observed in this study is consistent with other research documenting this relationship (Felitti, et al., 1998; Dube, et al., 2003). Additionally, this study demonstrated the effects of adverse experiences on all types of substance abuse remained, even after adjusting for previous substance use. This finding is particularly important because substance use in adolescence is one of the strongest predictors of substance use disorders in adulthood (Merline, O'Malley, & Schulenberg, 2004; Patrick, Schulenberg, & O'Malley, 2011).

Another notable finding in this study was that religiosity was associated with reduced odds for developing any type of substance use disorder. While the effect was modest (8–11% reduction), it still suggests religiosity may be an important resilience factor. Because substance use disorders were measured as a lifetime diagnosis, and religiosity was assessed at Wave III, it is possible that adverse childhood experiences may lead to alcohol or other drug problems, which in turn may result in religiosity. While it is impossible to establish a temporal relationship between religiosity and onset of a substance use disorder in this study, other nationally representative studies have shown religiosity is associated with a reduction in adolescent and early adult substance abuse. A previous study using the Add Health data showed that religiosity was a significant protective factor reducing the odds of binge drinking by 9%, cannabis use by 20%, and cigarette smoking by 13%, only in heterosexual adults (Rostosky, et al., 2007). Data from the Monitoring the Future study also demonstrated higher levels of religiosity reduced alcohol abuse, cigarette smoking and cannabis use (Wallace, et al., 2003). The convergence of evidence from multiple large, nationally representative samples documenting an association between religiosity and reduced substance use highlights this construct as an important resilience factor.

Although religiosity was negatively associated with the probability of developing any type of substance use disorder, it did not moderate the effect of adverse childhood experiences on the likelihood of developing a substance use disorder; thus, the second hypothesis in this study was not supported. While it is possible religiosity does not moderate the effect of adverse childhood experiences on substance abuse outcomes, there may be alternative explanations for our results. For example, it is possible the scale used to measure religiosity in this study did not fully measure aspects of religiosity that may lead to protective effects of trauma, such as the more spiritual dimensions of religiosity.

Even though our hypothesis was not supported, one of the major strengths of this study lies in the novelty of investigating if religiosity is associated with positive outcomes in those exposed to trauma early in life. There is little research investigating the influence of religiosity on the relationship between exposure to childhood trauma and substance abuse; thus, future research is needed to help further explain this important relationship. An additional strength of this study is that the effects of previous alcohol, cannabis and other drug use were controlled for in our logistic regression models, isolating the effects of adverse childhood experience from any risk related to early onset of substance use. Because of the longitudinal nature of the Add Health study, information regarding substance use was assessed during early adolescence, rather than retrospectively, increasing the accuracy of these substance use measures. Finally, the average age of participants was 16 at Wave I and 28 at Wave IV. Thus, this study captures the age range when substance abuse is most likely to develop (Patrick, Schulenberg, & O'Malley, 2011).

While this study has several strengths, there are also limitations. First, because the questions related to adverse childhood experiences were asked in Wave IV, it is possible some recall bias may exist. Second, the data used in this study are not representative of the current US population, but are weighted according to older data, limiting the generalizability of the findings. Another limitation of the study is related to the limited information provided about religiosity. It is possible the questions used to construct the religiosity scale in this study did not accurately capture the multidimensional nature of the construct.

Another potential limitation is this sample likely included people who were diagnosed with a substance use disorder prior to their inclusion in the Add Health study at Wave I. Although the Add Health study asked respondents with substance use disorders (SUD) to indicate the age of their first alcohol, cannabis, and drug use diagnosis, 36–65% of the data for these questions were missing. Utilizing the available data, we ran an additional three models (i.e., alcohol, cannabis, other drug use disorder) after removing participants who reported a SUD at an age prior to their inclusion in the Add Health study. There were no appreciable differences between our reported results and the results of these models in which participants with a SUD diagnosis were removed. Lastly, because of the cross-sectional nature of the study, no definitive temporal relationship between religiosity and substance use diagnosis can be determined. Despite these limitations, using a nationally representative sample and controlling for important covariates lends strong support to the positive relationship between adverse childhood experiences and multiple forms of substance abuse.

Recognizing how early life adversity impacts health throughout the lifespan is important for healthcare practitioners who can use this information to shape intervention efforts. Research has shown substance abuse treatment using a trauma-informed approach has led to better treatment outcomes, such as greater symptom reduction and increased retention in treatment (Amaro, Chernoff, Brown, Arévalo, & Gatz, 2007). Although exposure to adverse childhood events has significant implications for substance abuse treatment, it has historically not been routinely assessed in treatment settings leading to under-recognition and improper treatment (Davidson, 2001). This study draws attention to the idea that adult health conditions such as substance abuse may be prevented by focusing efforts towards primary prevention of childhood physical, emotional and sexual abuse, as well as other adverse childhood

experiences (Alpert, 2010). By establishing a strong positive relationship between early life adversity and substance abuse in a large, population based sample, this study emphasizes the importance of a trauma-informed approach to substance abuse treatment.

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GLOSSARY

Adverse Childhood Experience (ACE)

Potentially traumatic event that can have negative, lasting effects on health and well-being, such as physical, emotional or sexual abuse.

Religiosity

A comprehensive sociological term used to refer to the numerous aspects of religious activity, dedication, and belief. In this study, religiosity was measured by attendance at church and religious activities.

Substance Abuse

Pathological use of alcohol or drugs, characterized by impairment in social or occupational functioning.

Substance Dependence

An adaptive state that develops from repeated drug administration, and which results in withdrawal upon cessation of drug use

National Longitudinal Study of Adolescent to Adult Health (Add Health)

A longitudinal study of a nationally representative sample of adolescents in grades 7–12 in the United States during the 1994–95 school year. The Add Health cohort has been followed into young adulthood with four in-home interviews, the most recent in 2008.

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Table 1

Descriptive Statistics and Sample Characteristics

	Mean (SD)	n	%
Age			
Wave I	16.06 (1.71)	11279	
Wave IV	28.92 (1.73)	11279	
Sex			
Male	48.7 (0.7)	5076	48.7
Female	51.3 (0.7)	6203	51.3
Of Hispanic Origin			
Yes		1713	11.3
No		9566	88.7
Race			
White		6862	71.7
African-American		2215	14.2
American Indian		115	0.9
Asian		716	3.4
Multiracial		548	3.9
Other		823	5.9
Education			
Less than high school		751	7.8
High school graduate		2797	25.7
Some college		3837	33.5
College graduate		2922	25.3
Graduate degree or higher		972	7.7
Wave I Heavy Alcohol Use			
Never		8465	74.2
1–2 days in the past 12 months		1039	9.5
Once a month or less		655	5.8
1 or 2 days a week		497	4.6
2 or 3 days a week		388	3.7
3 to 5 days a week		155	1.5
Every day or almost every day		80	0.7
Wave I Cannabis Use			
Never		8386	74.3
One or more times		2893	25.7
Wave I Other Drug Use			
Never		10078	89.1
One or more times		1201	10.9
Religiosity Index (0–12)	2.80 (3.02)	11279	
Adverse Childhood Experience (ACE) Index	0.29 (0.04)	11279	
0 ACEs		8936	79.8

	Mean (SD)	n	%
1 type of ACE		1551	13.1
2 types of ACEs		680	6.1
3 types of ACEs		112	1.0
Experienced emotional abuse (10× or more)		1299	11.6
Experienced physical abuse (2× or more)		1409	12.1
Experienced sexual abuse (1× or more)		539	4.6
Experienced both emotional and physical abuse		636	5.8
Experienced both emotional and sexual abuse		187	1.6
Experienced both physical and sexual abuse		193	1.8
Lifetime Alcohol Use Disorder		2801	27.7
Lifetime Cannabis Use Disorder		1304	12.7
Lifetime Other Drug Use Disorder		761	7.5

Notes: Ns are unweighted; means and percentages are weighted. N = 11279.

Table 2Bivariate and Multivariate Regression for Lifetime Diagnosis of an Alcohol Use Disorder[^]

Variable	Bivariate Analysis			Multivariate Analysis		
	OR	95%CI	Sig.	Adjusted OR	95%CI	Sig.
Age	0.91	0.87 – 0.95	***	0.82	0.79 – 0.86	***
Sex (reference = female)						
Male	1.75	1.57 – 1.96	***	1.88	1.66 – 2.12	***
Hispanic Origin (reference = non-Hispanic)						
Hispanic	0.70	0.55 – 0.89	**	0.71	0.52 – 0.99	*
Race (reference = White)						
African American	0.28	0.22 – 0.35	***	0.35	0.28 – 0.44	***
American Indian	0.88	0.51 – 1.51	NS	0.88	0.46 – 1.65	NS
Asian	0.53	0.33 – 0.84	*	0.56	0.36 – 0.87	**
Multiracial	1.05	0.82 – 1.34	NS	1.04	0.79 – 1.37	NS
Other	0.57	0.44 – 0.74	***	0.80	0.56 – 1.15	NS
Education (reference = less than high school)						
High school graduate	1.73	1.34 – 2.25	***	2.28	1.71 – 3.03	***
Some college	2.13	1.64 – 2.78	***	2.99	2.21 – 4.04	***
College graduate	2.42	1.86 – 3.17	***	3.92	2.83 – 5.43	***
Graduate degree or higher	1.75	1.25 – 2.45	**	3.35	2.34 – 4.78	***
Wave I Heavy Alcohol Use (reference = no)	1.32	1.21 – 1.34	***	1.22	1.16 – 1.29	***
Wave I Cannabis Use (reference = no)	1.99	1.71 – 2.30	***	1.65	1.40 – 1.94	***
Wave I Other Drug Use (reference = no)	2.41	2.00 – 2.91	***	1.44	1.19 – 1.74	***
Religiosity Index	0.89	0.86 – 0.91	***	0.90	0.88 – 0.93	***
Adverse Childhood Experience (ACE) Index	1.33	1.22 – 1.45	***	1.34	1.22 – 1.47	***
Adverse Childhood Experiences X Religiosity	--	--	--	1.01	0.98 – 1.05	NS

[^] n = 11279.

* p < 0.05,

** p < 0.01.

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Table 3Bivariate and Multivariate Regression for Lifetime Diagnosis of a Cannabis Use Disorder[^]

Variable	Bivariate Analysis			Multivariate Analysis		
	OR	95%CI	Sig.	Adjusted OR	95%CI	Sig.
Age	0.91	0.87 – 0.96	**	0.81	0.76 – 0.85	***
Sex (reference = female)						
Male	2.31	2.02 – 2.66	***	2.47	2.14 – 2.85	***
Hispanic Origin (reference = non-Hispanic)						
Hispanic	0.98	0.76 – 1.27	NS	--	--	--
Race (reference = White)						
African American	0.76	0.56 – 1.04	NS	--	--	--
American Indian	1.29	0.60 – 2.75	NS	--	--	--
Asian	0.62	0.32 – 1.18	NS	--	--	--
Multiracial	1.26	0.89 – 1.77	NS	--	--	--
Other	0.76	0.56 – 1.03	NS	--	--	--
Education (reference = less than high school)						
High school graduate	0.81	0.63 – 1.06	NS	1.02	0.77 – 1.35	NS
Some college	0.93	0.73 – 1.19	NS	1.27	0.96 – 1.68	NS
College graduate	0.57	0.40 – 0.82	*	0.94	0.65 – 1.35	NS
Graduate degree or higher	0.46	0.29 – 0.72	*	0.94	0.58 – 1.52	NS
Wave I Heavy Alcohol Use (reference = no)	1.25	1.17 – 1.33	***	1.08	1.02 – 1.16	*
Wave I Cannabis Use (reference = no)	2.87	2.35 – 3.51	***	2.52	2.05 – 3.09	***
Wave I Other Drug Use (reference = no)	2.81	2.17 – 3.60	***	1.56	1.20 – 2.03	**
Religiosity Index	0.88	0.85 – 0.91	***	0.92	0.88 – 0.95	***
Adverse Childhood Experience (ACE) Index	1.46	1.32 – 1.63	***	1.47	1.31 – 1.65	***
Adverse Childhood Experiences × Religiosity	--	--	--	1.04	1.00 – 1.08	NS

[^] n = 11279.

* p < 0.05,

** p < 0.01.

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Table 4Bivariate and Multivariate Regression for Lifetime Diagnosis of a Drug Use Disorder[^]

Variable	Bivariate Analysis			Multivariate Analysis		
	OR	95%CI	Sig.	Adjusted OR	95%CI	Sig.
Age	0.96	0.91 – 1.01	NS	--	--	--
Sex (reference = female)						
Male	1.48	1.22 – 1.80	***	1.37	1.10 – 1.72	**
Hispanic Origin (reference = non-Hispanic)						
Hispanic	0.92	0.68 – 1.25	NS	--	--	--
Race (reference = White)						
African American	0.15	0.09 – 0.22	***	0.17	0.11 – 0.28	***
American Indian	1.10	0.51 – 2.33	NS	0.59	0.33 – 1.05	--
Asian	0.55	0.34 – 0.88	*	0.81	0.51 – 1.28	--
Multiracial	0.93	0.58 – 1.47	NS	0.73	0.45 – 1.19	--
Other	0.67	0.43 – 1.03	NS	0.58	0.37 – 0.89	*
Education (reference = less than high school)						
High school graduate	0.57	0.41 – 0.79	**	0.61	0.42 – 0.88	*
Some college	0.59	0.44 – 0.79	***	0.64	0.45 – 0.90	*
College graduate	0.24	0.16 – 0.36	***	0.31	0.20 – 0.49	***
Graduate degree or higher	0.17	0.09 – 0.32	***	0.23	0.11 – 0.47	***
Wave I Heavy Alcohol Use (reference = no)	1.35	1.27 – 1.44	***	1.12	1.03 – 1.21	*
Wave I Cannabis Use (reference = no)	3.54	2.82 – 4.44	***	1.92	1.48 – 2.48	***
Wave I Other Drug Use (reference = no)	4.81	3.79 – 6.11	***	2.34	1.80 – 3.04	***
Religiosity Index	0.81	0.77 – 0.86	***	0.89	0.84 – 0.94	***
Adverse Childhood Experience (ACE) Index	1.56	1.40 – 1.74	***	1.41	1.24 – 1.60	***
Adverse Childhood Experiences × Religiosity	--	--	--	1.00	0.95 – 1.06	NS

[^]
n = 11279.*
p <0.05,**
p <0.01.

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