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**CME Objective**

After studying this article, you should be able to:

- Screen patients with mental or substance use disorders for sexual minority status and adverse childhood experiences so that interventions can be tailored appropriately

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# Sexual Orientation, Adverse Childhood Experiences, and Comorbid *DSM-5* Substance Use and Mental Health Disorders

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**ABSTRACT**

**Objective:** To assess the relationships between adverse childhood experiences (ACEs) and comorbid *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (*DSM-5*) substance use and mental health disorders across 5 sexual orientation subgroups: lesbian/gay, bisexual, unsure, discordant heterosexual (ie, heterosexual-identified with same-sex attraction or behavior), and concordant heterosexual.

**Methods:** Data were from the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions-III, a cross-sectional, nationally representative survey of non-institutionalized US adults. Data were collected in households via structured diagnostic face-to-face interviews; the overall response rate was 60.1%. The sample included 36,309 US adults aged 18 years and older.

**Results:** Sexual minorities (gay, lesbian, bisexual), especially bisexual women, reported the highest prevalence of ACEs and comorbid substance use and mental health disorders. Approximately 43.8% of bisexual women reported 4 or more ACEs, and 38.0% of bisexual women reported comorbid substance use and mental health disorders. Multivariable regression analyses indicated a curvilinear relationship between ACEs and comorbid substance use and mental health disorders, and sexual minorities consistently had a higher ACE mean than concordant heterosexual respondents. The majority of sexual minorities with high levels of ACEs had comorbid substance use and mental health disorders.

**Conclusions:** Sexual minorities are exposed to more ACEs than their heterosexual counterparts in the US. We found evidence that US sexual minorities are at higher risk of comorbid substance use and mental health disorders. These findings reinforce the importance of identifying exposure to ACEs and developing trauma-informed interventions to treat comorbidities in those exposed to multiple ACEs, especially sexual minorities.

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## Clinical Points

- Sexual minorities have greater risk of adverse childhood experiences, substance use disorders, and mental health disorders. Understanding the relationships among these factors is important for the development of screening and intervention strategies.
- If patients report high levels of adverse childhood experiences, screening for comorbid substance use and mental health disorders is recommended, particularly among sexual minorities. Trauma-informed intervention should be considered.

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There is evidence that adverse childhood experiences (ACEs) are more prevalent among sexual minorities than heterosexual individuals.<sup>1–6</sup> For example, sexual minority women reported higher rates of childhood sexual abuse than heterosexual women.<sup>2</sup> Furthermore, the prevalence of different types of abuse and victimization varies within the sexual minority population. In a national study, gay and lesbian adults were more likely to experience childhood physical abuse, while bisexual adults had a higher likelihood of experiencing intimate partner violence and housing adversity.<sup>4</sup> The presence of ACEs can lead to stress and epigenetic changes that may contribute to the development of substance use disorders (SUDs) and mental health disorders.<sup>2,7–10</sup>

There is evidence that sexual minority adults with ACE exposure have a higher prevalence of substance use and mental health disorders relative to heterosexual adults.<sup>2,4,11–15</sup> For instance, sexual minorities who report childhood adversity had a higher risk of subsequent alcohol use, tobacco use, suicidality, and depressive symptoms relative to heterosexual individuals.<sup>4</sup> Additionally, psychological abuse by parents is more common among sexual minorities than heterosexual individuals.<sup>1</sup> This excess childhood stress may lead to increased anxiety and depression in adulthood.

To date, SUDs and mental health disorders have been examined primarily as individual disorders rather than considered together as comorbid substance use and mental health (SU/MH) disorders (ie, the co-occurrence of at least 1 SUD and at least 1 mental health disorder). It is estimated that approximately half of people who have an SUD will experience a mental health disorder at some point in their lives, and vice versa.<sup>16,17</sup> Comorbid SU/MH disorders create challenges in health assessments and

treatment.<sup>18</sup> Understanding the associations between ACEs and comorbid SU/MH disorders may ease these difficulties for clinicians treating sexual minority patients by creating a new path of detection and treatment. For example, if ACEs are more prevalent among sexual minorities with comorbid SU/MH disorders, clinicians who are aware of their patient's ACE exposure could evaluate for SUD and mental health disorder symptoms and guide them to trauma-informed treatment plans.

Despite evidence indicating increased risk for ACEs, stress, substance use, and mental health disorders among sexual minorities, few studies have examined the relationship between ACEs and comorbid SU/MH disorders in a nationally representative sample of US sexual minority adults. To help fill this gap, the present study aimed to (1) estimate the prevalence of ACEs (eg, physical abuse, emotional neglect, sexual abuse) and comorbid SU/MH disorders (eg, alcohol use disorder and mood disorder) based on sexual orientation among US adults and (2) examine and compare the relationships between ACEs and comorbid SU/MH disorders between heterosexual and sexual minority adults.

## METHODS

### Study Design

We analyzed data from the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III), which is the primary source of information regarding *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5) SUDs among the general civilian noninstitutionalized population aged 18 years or older in the US. The NESARC-III included the National Institute on Alcohol Abuse and Alcoholism Alcohol Use Disorder and Associated Disabilities Interview Schedule-5 (AUDADIS-5), a fully structured diagnostic interview of mental health, substance use, and other health conditions conducted with individuals in households. The household, person, and overall response rates were 72%, 84%, and 60%, respectively. Supplementary Table 1 presents estimated demographic characteristics of the target NESARC-III population. The NESARC-III sample design, response rates, and weighting procedures are described elsewhere.<sup>19</sup> All study procedures received full human subjects review and institutional review board approval.

### Measures

**Sociodemographic characteristics** included age, sex, race, educational attainment, personal income, employment status, relationship/marital status, health insurance status, metropolitan statistical area, and US Census geographical region.

**Sexual orientation.** We assessed the 3 major dimensions of sexual orientation:

- Sexual identity was assessed by asking: “Which of the categories on the card best describes you?”

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Heterosexual (straight), gay or lesbian, bisexual, or not sure.”

- Sexual attraction was assessed using the following question: “People are different in their sexual attraction to other people. Which category on the card best describes your feelings? Only attracted to females, mostly attracted to females, equally attracted to females and males, mostly attracted to males, or only attracted to males.”
- Sexual behavior was assessed by asking: “Have you had sex in the last 12 months?” and “During the last 12 months, did you have sex with only males, only females, or both males and females?”

Our sexual orientation categories of lesbian or gay, bisexual, and unsure were based solely on responses to the sexual identity question. We also created a category of respondents who self-identified as heterosexual and reported same-sex attraction or behavior (discordant heterosexual). We distinguish this group from the heterosexual-identified respondents who reported no same-sex attraction or behavior (concordant heterosexual).

**Adverse childhood experiences.** All ACE questions were from an extensive battery of questions about respondents’ experiences before they were age 18 (specific items are available at <https://www.niaaa.nih.gov/research/nesarc-iii>).<sup>20–26</sup> Response categories ranged from never to very often, and each response was recoded as a binary variable indicating whether or not the respondent had experienced the ACE in question. These yes/no variables were summed to produce a scaled score (0–10), with higher scores indicating more types of ACEs.

**Psychological and physical abuse** were defined using questions from the Conflict Tactics Scale (CTS). For psychological abuse, questions asked if parents or caregivers living in the home swore at, insulted, or said very hurtful things to respondents; threatened to hit or throw something at respondents but didn’t; and acted in any other way that made respondents afraid that they would be physically hurt or injured. For physical abuse, the occurrence of pushing, grabbing, shoving, slapping or hitting, and hitting so hard that respondents had marks or bruises or were injured was ascertained.

**Physical and emotional neglect** were also assessed using CTS questions. Physical neglect was defined by reports that respondents were made to do chores too difficult or dangerous for someone their age; were left unsupervised when they were too young to be alone; went without things they needed (eg, clothing); went hungry or were not provided with regular meals; and had parents or caregivers fail to get them medical treatment when they were sick or hurt. The emotional neglect items evaluated the presence of family members who provided validation, support, and community for the respondent.

**Childhood sexual abuse** was defined using 4 questions that asked about sexual experiences (eg, touching, fondling, attempting intercourse, intercourse) with an adult or

any other person that respondents did not want, or that happened when respondents were too young to know what was happening.<sup>19</sup>

**Parental/caregiver interpersonal violence** involved having a battered mother or female caregiver. It was defined using 4 CTS questions to assess whether the respondent’s father, stepfather, or foster or adoptive father or their mother’s boyfriend engaged in violent behaviors (eg, pushing, hitting, slapping, threatening with a knife or gun) toward their mother, stepmother, or foster or adoptive mother or their father’s girlfriend.

Respondents were also asked whether they experienced any of the following before they were 18 years of age: a parent or other adult with whom they lived had an alcohol or drug problem, went to jail or prison, was treated or hospitalized for a mental illness, or attempted or committed suicide. Parent divorce or permanent separation was also assessed.

**DSM-5 substance use disorders.** All SUD measures were assessed using the AUDADIS-5. *DSM-5* alcohol use disorder was based on past-year presence of at least 2 of the 11 *DSM-5* criteria (eg, craving, tolerance, withdrawal). *DSM-5* alcohol use disorder criteria scales have demonstrated excellent reliability (intraclass correlation coefficient [ICC] = 0.9). Similarly, *DSM-5* tobacco use disorder was based on past-year presence of at least 2 of the 11 *DSM-5* criteria. Reliability and validity of the *DSM-5*-based diagnosis of tobacco use disorder has been established in prior psychometric studies.<sup>27</sup> *DSM-5* other drug use disorder included substance-specific diagnoses for 9 substances: cannabis, cocaine, heroin, hallucinogens, inhalants, prescription opioids, prescription sedatives/tranquilizers, prescription or illicit stimulants, and other drugs. Other drug use disorder diagnoses required affirmative responses to 2 or more of the 11 *DSM-5* past-year criteria. The test-retest reliability and validity of each SUD diagnosis range from fair to good, and dimensional criteria scales (ICC = 0.5–0.9, respectively) range from fair to excellent.<sup>28–30</sup>

**DSM-5 mental health disorders** were assessed using the AUDADIS-5 and included past-year anxiety disorders (ie, agoraphobia, generalized anxiety disorder, panic, social and specific phobias), past-year mood disorders (ie, bipolar, dysthymia, major depressive disorder), past-year eating disorders (ie, anorexia nervosa, binge-eating disorder, bulimia nervosa), lifetime personality disorders (ie, antisocial personality disorders, borderline, schizotypal), and past-year posttraumatic stress disorder (PTSD). Consistent with the *DSM-5*, all these diagnoses excluded substance- and illness-induced disorders. Acceptable reliability and validity of the *DSM-5*-based AUDADIS-5 diagnoses of anxiety, mood, eating, personality, and posttraumatic stress disorders have been established.<sup>31,32</sup>

**Comorbid substance use and mental health disorder** included the following measures: alcohol use disorder, tobacco use disorder, other substance use disorder, mood disorder, anxiety disorder, personality disorder, PTSD, eating disorder, and attempted suicide. We used 2 measures of past-year comorbid SU/MH disorder. One outcome is continuous,

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Table 1. Weighted Prevalence Estimates of Adverse Childhood Experiences, Based on Sexual Orientation<sup>a</sup>

	Women				Men					
	Lesbian (n = 265), % (95% CI)	Bisexual (n = 422), % (95% CI)	Not Sure (n = 130), % (95% CI)	Discordant Heterosexual <sup>b</sup> (n = 1,294), % (95% CI)	Concordant Heterosexual <sup>c</sup> (n = 17,845), % (95% CI)	Gay (n = 321), % (95% CI)	Bisexual (n = 144), % (95% CI)	Not Sure (n = 69), % (95% CI)	Discordant Heterosexual <sup>b</sup> (n = 782), % (95% CI)	Concordant Heterosexual <sup>c</sup> (n = 14,228), % (95% CI)
ACEs										
Physical abuse	45.5 (38.2–53.1)	47.5 (41.0–54.0)	51.6 (39.8–63.2)	42.1 (38.9–45.4)	32.9 (41.6–34.3)	48.9 (42.2–55.6)	50.5 (41.8–59.2)	54.5 (37.6–70.5)	39.8 (35.0–44.8)	39.0 (37.1–40.2)
Sexual abuse	28.2 (22.2–35.1)	35.1 (29.8–40.9)	28.9 (19.7–40.2)	20.9 (18.1–23.9)	15.3 (14.5–16.1)	15.9 (11.7–21.1)	21.9 (14.4–31.8)	25.2 (13.6–41.9)	13.5 (10.7–17.0)	5.3 (4.8–5.8)
Psychological abuse	55.0 (48.2–61.5)	63.7 (57.6–69.4)	61.6 (51.3–70.9)	52.0 (48.1–56.0)	41.6 (40.2–43.1)	58.5 (51.6–65.2)	56.4 (47.2–65.3)	66.7 (50.5–79.7)	46.8 (42.2–51.5)	46.1 (44.7–47.5)
Emotional neglect	10.8 (7.7–15.0)	15.3 (11.6–19.9)	25.2 (17.0–35.5)	10.8 (8.7–13.3)	8.5 (7.9–9.0)	7.5 (4.8–11.4)	12.7 (6.6–23.0)	14.9 (8.3–25.4)	9.2 (7.2–11.9)	6.8 (6.4–7.4)
Physical neglect	38.6 (32.0–45.6)	46.8 (40.2–53.5)	53.2 (40.9–65.1)	41.0 (37.4–44.8)	30.6 (29.6–31.6)	38.2 (31.9–45.0)	45.5 (36.0–55.4)	65.5 (51.1–77.5)	41.6 (37.2–46.1)	37.8 (36.6–39.0)
Domestic violence	24.0 (18.9–29.9)	28.7 (23.3–34.8)	28.2 (19.9–38.2)	25.4 (22.4–28.6)	18.9 (18.0–19.7)	25.2 (20.1–31.1)	26.4 (18.5–36.2)	21.0 (11.5–35.3)	19.5 (16.0–23.6)	16.1 (15.2–17.0)
Substance use problems	34.7 (27.7–42.4)	34.0 (27.4–41.3)	37.1 (28.0–47.2)	29.9 (26.9–33.1)	26.0 (24.9–27.0)	32.1 (27.0–37.7)	34.8 (25.7–45.2)	28.6 (16.8–44.3)	24.3 (21.0–27.9)	22.7 (21.8–23.6)
Mental illness	10.2 (6.9–14.7)	14.0 (10.7–18.0)	9.2 (5.7–14.5)	10.2 (8.2–12.6)	7.6 (7.2–8.2)	8.2 (5.0–13.1)	9.7 (4.8–18.7)	10.4 (4.0–24.5)	7.8 (5.8–10.5)	5.7 (5.3–6.1)
Incarceration	13.1 (9.4–17.8)	17.1 (13.6–21.4)	22.6 (15.5–31.7)	11.2 (9.3–13.4)	7.6 (7.1–8.1)	11.1 (7.4–16.2)	12.7 (5.9–25.0)	8.8 (4.0–18.5)	7.6 (5.7–10.1)	7.1 (6.6–7.7)
Divorce/separation	26.3 (20.8–32.7)	29.4 (24.4–35.0)	15.9 (9.5–25.2)	24.2 (21.5–27.1)	20.0 (19.2–20.8)	22.6 (17.6–28.6)	26.4 (17.0–38.5)	18.4 (8.4–35.5)	21.1 (17.9–24.7)	19.6 (18.7–20.6)
Mean ACEs (0–10)	2.8 (2.5–3.1)	3.3 (2.9–3.6)	3.4 (2.9–3.8)	2.6 (2.5–2.8)	2.1 (2.0–2.1)	2.7 (2.4–2.9)	3.0 (2.5–3.4)	3.0 (2.5–3.6)	2.3 (2.1–2.5)	2.0 (2.0–2.1)
No. of ACEs										
No experiences	18.4 (13.2–25.1)	16.1 (11.9–21.4)	11.5 (6.4–19.7)	23.7 (20.4–27.3)	29.8 (28.7–30.9)	17.6 (12.7–23.9)	22.2 (15.0–31.7)	7.2 (2.8–17.2)	23.4 (19.4–27.9)	26.3 (25.1–27.2)
1 experience	16.0 (11.5–21.8)	16.0 (12.1–20.8)	16.9 (9.6–28.0)	17.6 (15.3–20.3)	21.1 (20.3–22.0)	19.5 (13.8–26.9)	15.0 (9.4–23.1)	13.2 (6.2–26.1)	23.2 (19.6–27.1)	21.2 (20.4–22.0)
2–3 experiences	31.6 (25.0–38.9)	24.2 (19.1–30.1)	25.6 (16.8–37.1)	25.1 (22.0–28.4)	26.5 (25.6–27.4)	31.7 (25.1–39.2)	21.1 (14.3–30.0)	43.8 (31.1–57.3)	27.4 (23.6–31.5)	32.0 (21.0–33.1)
4+ experiences	34.1 (27.7–41.0)	43.8 (36.3–51.6)	46.0 (36.3–56.0)	33.7 (30.1–37.5)	22.6 (21.7–23.6)	31.1 (25.1–37.9)	41.7 (32.5–51.5)	35.8 (22.3–30.3)	26.1 (22.3–30.3)	20.5 (19.6–21.5)

<sup>a</sup>No shading denotes association of  $P < .001$ ; light gray shading denotes association of  $P < .01$ ; medium gray shading denotes no association.

<sup>b</sup>Discordant heterosexual refers to individuals who identified as heterosexual with same-sex attraction and/or same-sex behavior.

<sup>c</sup>Concordant heterosexual refers to individuals who identified as heterosexual without same-sex attraction or same-sex behavior.

Abbreviations: ACEs = adverse childhood experiences, CI = confidence interval, SE = standard error.

calculated as the sum of the SUDs and mental health disorders listed above (0–9). The other outcome is categorical, with 6 mutually exclusive categories: (a) no SU/MH disorder; (b) 1 SUD; (c) 1 MH disorder; (d) multiple SUDs; (e) multiple MH disorders; and (f) comorbid SU/MH disorders. For this categorical measure, we also created a binary outcome indicating whether comorbid SU/MH disorders were present. The other 5 categories were coded as 0.

**Data Analysis**

All statistical analyses were design-based in that they explicitly accounted for the complex sample design features of the NESARC-III. All computed estimates incorporated final NESARC-III survey weights, which accounted for unequal probabilities of selection and differential nonresponse across the NESARC-III sample. All sampling variance estimates were computed using Taylor series linearization to account for stratification, cluster sampling, and unequal weighting inherent in the NESARC-III sample design. All analyses employed the svy: commands in Stata version 15.1 (StataCorp LLC, College Station, Texas).

We first estimated the prevalence of each individual ACE, in addition to means and frequency distributions for the ACE counts, separately for each of the sexual orientation subgroups. We examined differences in ACE outcomes across subgroups for men and women separately using design-based Rao-Scott  $\chi^2$  tests of association and design-adjusted Wald tests (for means). We conducted similar descriptive analyses of the prevalence of SUDs, mental health disorders, and comorbid SU/MH disorders. Given the number of tests performed, we only considered associations at or lower than the 0.01 level as significant.

Next, we conducted multivariable analyses for the overall sample to examine relationships between the number of ACEs and comorbid SU/MH disorders for each sexual orientation subgroup, adjusting for other relevant covariates. Concordant heterosexual adults were set as the reference group, and we also considered bisexual adults as the reference group to enable additional comparisons. We first fit a linear regression model predicting the summed SU/MH disorders comorbidity scale (0–9) as a function of number of ACEs (0–10), the number of ACEs squared (allowing for a quadratic relationship), sexual orientation, race/ethnicity, age, education, income, employment status, marital status, health insurance, urban location, and region of the US. To examine whether the relationships varied across the sexual orientation groups, we tested interactions between both ACE count and squared ACE count and sexual orientation subgroup using design-adjusted Wald tests. We also fit a logit model to the binary indicator of comorbid SU/MH disorders (ie, presence or absence of comorbid disorders) using the same covariates. We examined diagnostics for the

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Table 2. Weighted Prevalence Estimates of Past-Year Substance Use Disorders, Mental Health Disorders, and Comorbidities, Based on Sexual Orientation<sup>a</sup>

	Women						Men					
	Lesbian (n = 265) % (95% CI)	Bisexual (n = 422) % (95% CI)	Not Sure (n = 130) % (95% CI)	Discordant Heterosexual <sup>b</sup> (n = 1,294) % (95% CI)	Concordant Heterosexual <sup>c</sup> (n = 17,845) % (95% CI)		Gay (n = 321) % (95% CI)	Bisexual (n = 144) % (95% CI)	Not Sure (n = 69) % (95% CI)	Discordant Heterosexual <sup>b</sup> (n = 782) % (95% CI)	Concordant Heterosexual <sup>c</sup> (n = 14,228) % (95% CI)	
Substance use disorders	24.9 (20.2–30.1)	29.7 (24.0–36.0)	26.3 (18.0–36.7)	19.3 (16.3–22.6)	9.2 (8.5–9.9)	26.6 (21.7–32.3)	31.4 (21.7–43.1)	23.7 (12.7–40.0)	14.8 (12.2–18.0)	17.5 (16.7–18.4)		
Alcohol use disorder	27.3 (20.9–34.7)	36.3 (30.3–42.7)	33.6 (24.3–44.3)	21.6 (18.9–24.5)	16.2 (15.3–17.1)	30.0 (23.4–37.5)	40.8 (30.4–52.1)	27.5 (15.6–43.7)	19.2 (16.3–22.5)	23.3 (22.2–24.4)		
Tobacco use disorder	7.9 (4.4–13.9)	11.3 (7.5–16.7)	13.2 (7.3–22.8)	7.3 (5.4–9.8)	2.4 (2.1–2.7)	7.1 (4.3–11.3)	10.3 (5.8–17.9)	6.8 (2.0–20.8)	5.7 (4.0–8.2)	4.8 (4.4–5.2)		
Other substance use disorder	42.5 (35.7–49.6)	52.6 (45.4–59.7)	41.9 (32.2–52.3)	35.2 (31.7–38.9)	22.6 (21.6–23.6)	46.9 (39.7–54.3)	49.6 (38.1–61.2)	37.4 (24.3–52.7)	30.2 (26.9–33.7)	34.1 (33.0–35.2)		
Any substance use disorder	23.7 (18.7–29.5)	34.9 (29.2–41.2)	36.7 (27.0–47.7)	22.5 (19.7–25.5)	15.0 (14.2–15.8)	20.3 (15.5–26.0)	21.8 (13.6–33.1)	14.9 (7.0–29.0)	11.9 (9.7–14.6)	9.2 (8.7–9.8)		
Mental health disorders	21.1 (15.5–27.9)	32.5 (27.4–38.0)	33.7 (25.2–43.5)	22.1 (19.2–25.3)	16.0 (15.2–16.8)	23.0 (16.6–30.9)	20.2 (13.8–28.6)	25.4 (15.4–38.9)	10.4 (7.9–13.6)	8.7 (8.1–9.3)		
Mood disorder	20.2 (15.5–25.8)	40.6 (34.3–47.2)	43.4 (33.2–54.2)	21.7 (18.9–24.9)	10.7 (10.0–11.4)	21.4 (17.0–26.6)	37.4 (26.1–50.2)	24.3 (14.9–37.0)	13.8 (10.7–17.4)	14.3 (13.4–15.3)		
Personality disorder	7.4 (4.6–11.6)	21.0 (15.5–27.7)	15.3 (9.7–23.3)	8.9 (7.3–10.8)	5.6 (5.1–6.1)	6.2 (3.9–9.8)	10.3 (5.5–18.4)	11.5 (5.0–24.1)	4.2 (2.9–6.1)	3.0 (2.6–3.4)		
PTSD	0.9 (0.3–2.6)	3.1 (1.5–6.3)	8.3 (3.6–18.0)	2.1 (1.4–3.1)	1.5 (1.3–1.8)	1.0 (0.3–3.6)	2.5 (0.6–9.7)	0.0 (0.0–0.0)	1.5 (0.8–3.1)	0.4 (0.3–0.6)		
Eating disorder	13.1 (9.0–18.6)	24.6 (19.9–30.0)	22.8 (14.0–34.8)	9.2 (7.6–11.1)	5.9 (5.4–6.5)	15.1 (11.6–19.5)	17.5 (10.4–27.9)	7.5 (4.0–13.5)	4.4 (3.1–6.3)	3.2 (2.9–3.6)		
Attempted suicide	48.8 (42.5–55.1)	65.8 (59.8–71.4)	60.6 (49.4–70.7)	42.7 (39.1–46.3)	31.6 (30.5–32.7)	43.8 (37.4–50.4)	56.7 (45.0–67.8)	46.1 (32.6–60.3)	27.3 (23.5–31.4)	23.9 (22.8–25.0)		
Any mental health disorder/suicide attempt	1.5 (1.3–1.7)	2.3 (2.1–2.6)	2.3 (1.8–2.9)	1.3 (1.2–1.8)	0.8 (0.8–0.9)	1.5 (1.3–1.7)	1.9 (1.5–2.4)	1.4 (0.9–1.9)	0.9 (0.7–1.0)	0.8 (0.8–0.9)		
Mean substance use and mental health disorders (0–9)	33.2 (27.5–39.4)	19.5 (15.0–25.0)	31.5 (21.7–43.2)	43.6 (40.1–47.2)	57.3 (56.1–58.5)	36.7 (30.4–43.5)	27.0 (18.5–37.6)	37.2 (23.6–53.2)	55.6 (51.7–59.4)	54.7 (53.5–56.0)		
Substance use and mental health disorders (categories)	13.8 (9.4–19.8)	12.1 (8.9–16.3)	7.4 (3.0–16.8)	11.7 (9.8–13.9)	9.6 (9.1–10.2)	16.6 (11.8–22.8)	9.0 (4.8–16.4)	10.8 (5.7–19.5)	14.1 (11.2–17.6)	16.8 (16.0–17.6)		
No SUDs or mental health disorders	18.1 (13.5–23.7)	11.9 (8.1–17.0)	11.4 (6.6–18.9)	11.3 (9.0–14.2)	12.9 (12.2–13.6)	8.4 (5.1–13.7)	13.4 (7.8–22.2)	16.3 (7.3–32.5)	10.3 (8.1–13.0)	7.7 (7.2–8.3)		
One SUD only	4.2 (2.0–8.5)	2.5 (1.4–4.6)	0.6 (0.1–2.5)	2.1 (1.4–3.1)	1.5 (1.3–1.8)	2.9 (1.6–5.2)	7.2 (2.9–16.7)	5.9 (0.9–31.6)	3.1 (2.0–4.7)	4.7 (4.3–5.1)		
One mental health disorder only	6.3 (3.5–11.0)	16.0 (11.9–21.3)	15.3 (9.3–24.1)	9.9 (8.2–12.0)	7.2 (6.8–7.8)	7.9 (4.4–13.9)	10.0 (5.1–18.5)	9.1 (4.2–18.6)	4.0 (2.7–5.9)	3.4 (3.1–3.8)		
Multiple SUDs	24.5 (19.2–30.7)	38.0 (31.2–45.2)	34.0 (24.5–44.9)	21.4 (18.4–24.8)	11.5 (10.7–12.3)	27.4 (21.4–34.4)	33.3 (24.0–44.3)	20.8 (11.4–34.7)	13.0 (10.2–16.4)	12.7 (12.0–13.9)		
Multiple mental health disorders												
Comorbid SU/MH disorders												

<sup>a</sup>No shading denotes association of  $P < .001$ ; medium gray shading denotes no association. Substance use disorders consisted of past-year DSM-5 alcohol use disorder, past-year DSM-5 tobacco use disorder, and past-year DSM-5 other drug use disorder involving cannabis, sedatives, prescription opioids, cocaine, prescription and illicit stimulants, hallucinogens, inhalants/solvents, club drugs, heroin, or other drugs. Mental health disorders consisted of past-year DSM-5 anxiety disorders (ie, agoraphobia, generalized anxiety disorder, panic, social and specific phobias), past-year DSM-5 mood disorders (ie, bipolar, dysthymia, major depressive disorder), past year DSM-5 PTSD, past-year DSM-5 eating disorders (ie, anorexia nervosa, binge-eating disorder, and bulimia nervosa), DSM-5 personality disorders (ie, antisocial personality disorders, borderline, and schizotypal), and lifetime attempted suicide.

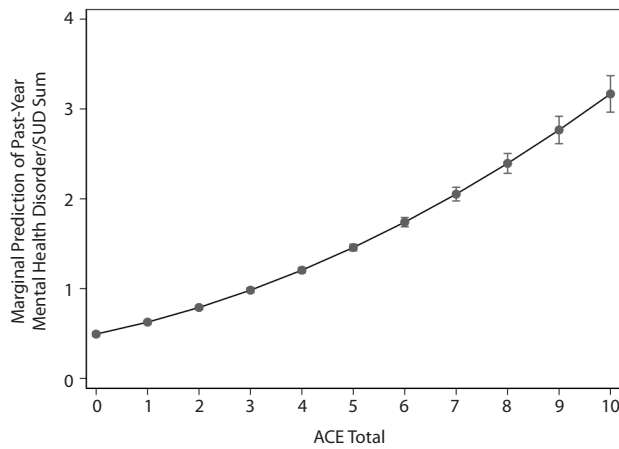
<sup>b</sup>Discordant heterosexual refers to individuals who identified as heterosexual with same-sex attraction and/or same-sex behavior.

<sup>c</sup>Concordant heterosexual refers to individuals who identified as heterosexual without same-sex attraction or same-sex behavior.

Abbreviations: CI = confidence interval; DSM-5 = *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition; PTSD = posttraumatic stress disorder; SE = standard error; SUD = substance use disorder; SU/MH disorders = substance use and mental health disorders.

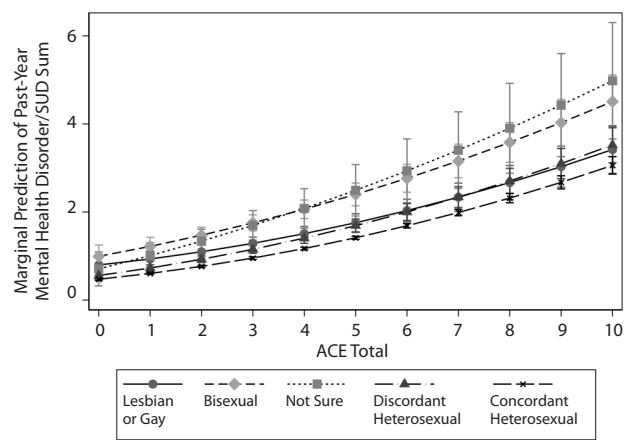
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**Figure 1. Marginal Predicted Means of the Comorbid Substance Use Disorders (SUDs) and Other Mental Health Disorders Scale as a Function of Adverse Childhood Experiences (ACEs), Overall<sup>a</sup>**



<sup>a</sup>Error bars indicate 95% CI.

**Figure 2. Marginal Predicted Means of the Comorbid Substance Use Disorders (SUDs) and Other Mental Health Disorders Scale as a Function of Adverse Childhood Experiences (ACEs), by Sexual Orientation Subgroups<sup>a</sup>**



<sup>a</sup>Error bars indicate 95% CI.

linear regression model and tested the fit of the logit model using a design-adjusted version of the Hosmer-Lemeshow goodness of fit test.<sup>33</sup> Finally, we employed the margins and marginsplot commands in Stata to plot marginal predicted values for each outcome variable as a function of ACE count and sexual orientation subgroup, in addition to 95% confidence intervals for the predicted values (computed using design-adjusted standard errors based on the delta method for each predicted value).

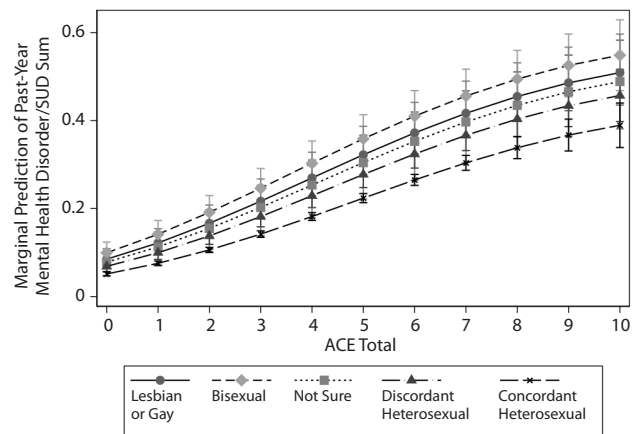
**RESULTS**

Table 1 presents weighted prevalence estimates of ACEs separately for subgroups defined by sex and sexual orientation. Among women, we found significant associations based on sexual orientation and each ACE outcome at the 0.001 level. Bisexual women and women unsure of their sexual identity consistently reported more ACEs than concordant heterosexual women. Among men, we found fewer significant associations, including no associations for parental mental illness, incarceration, or divorce/separation. Bisexual men and men unsure of their sexual identity tended to have the highest prevalence of ACEs.

Table 2 presents weighted prevalence estimates of SUDs and mental health disorders, separately for subgroups defined by sex and sexual orientation. Among women, bisexual women and women unsure of their sexual identity had a higher prevalence of each SUD and mental health disorder and the highest prevalence of comorbid SU/MH disorders (38% and 34%, respectively). All associations were significant at the 0.001 level for women. Among men, the associations that emerged were very similar to those among female sexual orientation subgroups.

In the multivariable linear regression model, we found a curvilinear relationship between ACE count and the comorbidity scale (Figure 1, Supplementary Table 2); as the

**Figure 3. Marginal Predicted Probabilities of Having Comorbid Substance Use Disorders (SUDs) and Other Mental Health Disorders as a Function of Adverse Childhood Experiences (ACEs), by Sexual Orientation Subgroups (%)<sup>a</sup>**



<sup>a</sup>Error bars indicate 95% CI.

number of ACEs increased, the comorbidity scale increased in an accelerating fashion (Figure 1). This relationship changed slightly depending on the sexual orientation subgroup, with a marginally ( $P < .05$ ) significant interaction between ACE count and sexual orientation subgroup (Figure 2, Supplementary Table 3). Similar relationships emerged for both men and women. Figure 3 shows a similar trend for marginal predicted probabilities of comorbid SU/MH disorders as a function of ACEs; we found no significant interactions in this model (Supplementary Table 4). Collectively, these results suggest a curvilinear relationship between the number of ACEs and comorbid SU/MH disorders, with bisexual and lesbian or gay subgroups being at higher risk than both heterosexual subgroups. We also found evidence of bisexuals having significantly

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higher means than nearly every other subgroup (with “not sure” being the exception) on the comorbidity scale when adjusting for ACEs, suggesting that these individuals may be at highest risk overall.

## DISCUSSION

This is the first nationally representative study to examine the relationships among sexual orientation, ACEs, and comorbid SU/MH disorders in the US. Sexual minority women, especially bisexual women, report more ACEs than heterosexual women. This may explain, at least in part, the consistently higher rates of SUDs and mental health disorders among sexual minority women relative to concordant heterosexual women. Indeed, bisexual women and women unsure of their sexual identity had higher levels of ACEs and comorbid SU/MH disorders than every other sexual orientation subgroup. These findings are consistent with those of studies conducted in the general population<sup>1-5</sup> and suggest that greater exposure to childhood adversity is a potent contributor to sexual minorities’ disproportionately high rates of health problems in adulthood.<sup>11-13</sup>

Few studies have examined associations of ACEs and individual mental health disorders across sexual orientation subgroups. Some researchers have asserted that substance use is a way of self-medicating to cope with trauma.<sup>8,10,22</sup> We found evidence for a curvilinear relationship between ACEs and comorbid SU/MH disorders. Among lesbian, gay, bisexual, and unsure adults, the count of comorbid SU/MH disorders accelerated as the number of reported ACEs increased at a greater rate than both heterosexual groups, and comorbid SU/MH disorders were common among sexual minorities who experienced high levels of ACEs. At least 1 study has found that substance use more often co-occurs with psychological distress among sexual minorities, particularly bisexual women, than heterosexual adults.<sup>34</sup> Compared with heterosexual women, substance use among sexual minority women tends to occur earlier, escalate more steeply, and be more persistent during the transition to young adulthood.<sup>35,36</sup> Earlier and heavier exposure to substance use among sexual minority women increases their risk for mental and physical health problems.

Health care providers should be aware that sexual minority adults report higher rates of both ACEs and comorbid SU/MH disorder than heterosexual adults. Knowing these disparities, ACEs among sexual minority patients should alert clinicians to the increased likelihood of comorbid SU/MH disorders and potentially the need to involve health professionals who can treat SUDs and psychiatric comorbidities. Approaches such as screening, brief intervention, and referral to treatment (SBIRT) would be appropriate upon discovery of ACE exposure. SBIRT can include brief interventions for those with mild SUDs and referrals to specialized substance use treatment programs for those with moderate/severe SUDs. Similarly, individuals who present with SUDs should be screened for ACEs and referred to trauma-informed treatment as appropriate.

Results of this study should be evaluated in light of its strengths and limitations. The major strength is the nationally representative sample with large enough sexual minority subgroups to permit subgroup analyses. The NESARC-III includes reliable and valid measures of ACEs and SU/MH disorders, the latter based on *DSM-5* criteria. Limitations included the cross-sectional data, which precluded causal inferences and tests of mediating effects. The exclusion of particular sexual identities, such as asexual or pansexual identity, is another limitation of the NESARC-III measures. There were also no gender identity questions, including transgender or nonbinary identities, and gender identity could be a confounder for ACEs, comorbid SU/MH disorders, or sexual identity. Additionally, there are several different approaches for measuring adverse childhood experiences that warrant more attention, and sexual minority-specific factors such as family rejection and internalized homophobia were not assessed in the NESARC-III.<sup>37</sup> Finally, the prevalences of SUD and mental health disorders were likely underestimated in the NESARC-III because high-risk groups of currently institutionalized individuals (eg, incarcerated adults) were not included in the sample.

## CONCLUSIONS

The present study provides compelling evidence that sexual minority adults are exposed to higher levels of ACEs than heterosexual adults. The majority of sexual minority adults, particularly bisexual adults, with high levels of ACEs had comorbid SU/MH disorders. These findings reinforce the need for early screening for ACEs and delivering trauma-informed interventions to treat comorbid SU/MH disorders in individuals exposed to high levels of ACEs. Given higher rates of ACEs, SUDs, and mental health disorders among sexual minority adults, screening and early intervention are especially important.

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**Author contributions:** All authors take responsibility for the integrity of the data and accuracy of the data analysis. All authors have contributed, reviewed, and approved this manuscript.

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**Supplementary material:** Available at [PSYCHIATRIST.COM](http://PSYCHIATRIST.COM).

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## POSTTEST

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to take this Posttest and complete the Evaluation. A \$10 processing fee is required.

1. According to this article, which sexual minority group is especially likely to have a history of sexual abuse or psychological abuse?
  - a. Gay men
  - b. Bisexual women
  - c. Lesbian women
  - d. Bisexual men
2. According to this article, which sexual minority individuals are especially likely to have comorbid mental health and substance use disorders?
  - a. Gay men
  - b. Bisexual women
  - c. Lesbian women
  - d. Bisexual men
3. A new patient, Jessica, is 29 years old and comes to you with complaints of anxiety and frequent mood swings. To determine the most appropriate treatment plan for Jessica, you should screen her for all of the following *except*:
  - a. Substance use
  - b. Sexual minority status
  - c. Number of sexual partners in the past year
  - d. Adverse childhood experiences

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## **Supplementary Material**

**Article Title:** Sexual Orientation, Adverse Childhood Experiences, and Comorbid *DSM-5* Substance Use and Mental Health Disorders

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### **List of Supplementary Material for the article**

1. [Table 1](#) Weighted Estimated Demographic Breakdown of the NESARC-III Population
2. [Table 2](#) Weighted Regression Analysis of Scaled Total Number of Mental Health and Substance Use Disorders as a Function of ACE Totals and Sociodemographics
3. [Table 3](#) Weighted Regression Analysis of Scaled Total Number of Mental Health and Substance Use Disorders as a Function of ACE Totals, Sexual Orientation, the ACE Total x Sexual Orientation Interaction, and Sociodemographics
4. [Table 4](#) Weighted Adjusted Odds Ratios for Having Comorbid Mental Health and Substance Use Disorders, Considering ACE Totals, the Sexual Orientation × ACE Total Interaction, and Sociodemographics as Predictors

### **Disclaimer**

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary Table 1. Weighted Estimated Demographic Breakdown of the NESARC-III Population

	% (95% CI)
<b>Sex</b>	
Male	48.1 (47.5, 48.7)
Female	51.9 (51.3, 52.5)
<b>Race</b>	
White	66.2 (64.7, 67.7)
Black/African American	11.8 (10.6, 13.2)
Hispanic	14.7 (13.5, 16.1)
Other	7.3 (6.4, 8.3)
<b>Age</b>	
18-29	21.7 (21.0, 22.4)
30-44	25.7 (25.1, 26.4)
45-64	35.0 (34.4, 35.7)
65+	17.6 (16.9, 18.3)
<b>Educational Attainment</b>	
High School or Less	34.8 (33.4, 36.2)
Some College	37.1 (36.2, 38.4)
College Degree or Higher	28.2 (26.6, 29.7)
<b>Income</b>	
<\$20,000	22.8 (21.8, 23.8)
\$20,000-\$34,999	18.9 (18.2, 19.6)
\$35,000-\$69,999	27.2 (26.6, 27.9)
>\$70,000	31.1 (29.8, 32.4)
<b>Relationship/Marital Status</b>	
Not Married	48.8 (47.8, 49.9)
Married	51.2 (50.2, 52.4)
<b>Employment Status</b>	
Working Full Time	42.4 (41.4, 43.5)
Not Working Full Time	57.6 (56.5, 58.7)
<b>Health Insurance Status</b>	
Has Health Insurance	81.9 (81.0, 82.7)
Does Not Have Health Insurance	21.3 (18.4, 24.5)
<b>Urbanicity</b>	
Urban	78.8 (75.5, 81.6)
Rural	21.3 (18.4, 24.5)
<b>Census Region</b>	
Northeast	18.2 (17.3, 19.3)
Midwest	21.5 (20.6, 22.4)
South	37.1 (35.3, 38.8)
West	23.2 (21.5, 25.1)

Supplementary Table 2. Weighted Regression Analysis of Scaled Total Number of Mental Health and Substance Use Disorders as a Function of ACE Totals and Sociodemographics

	Number of Mental Health and Substance Use Disorders	Number of Mental Health and Substance Use Disorders
	Coefficient (SE)	Coefficient (SE)
Number of ACEs	0.118 (0.011)***	0.118 (0.011)***
Squared Total Number of ACEs	0.015 (0.002)***	0.015 (0.002)***
<b>Sex</b>		
Male	REF	REF
Female	-0.047 (0.017)*	-0.047 (0.017)*
<b>Sexual Orientation</b>		
Gay or Lesbian	0.331 (0.072)***	-0.477 (0.122)***
Bisexual	0.807 (0.097)***	REF
Not Sure	0.774 (0.182)***	-0.033 (0.207)
Discordant Heterosexual	0.177 (0.037)***	-0.631 (0.104)***
Concordant Heterosexual	REF	-0.807 (0.097)***
<b>Race/Ethnicity</b>		
White	REF	REF
Black/African American	-0.297 (0.031)***	-0.297 (0.031)***
Hispanic	-0.364 (0.025)***	-0.364 (0.025)***
Other Race/Ethnicity	-0.213 (0.031)***	-0.213 (0.031)***
<b>Age Category</b>		
18-29	0.654 (0.027)***	0.654 (0.027)***
30-44	0.671 (0.026)***	0.671 (0.026)***
45-64	0.519 (0.023)***	0.519 (0.023)***
65+	REF	REF
<b>Educational Attainment</b>		
High School or Less	REF	REF
Some College	0.006 (0.018)	0.006 (0.018)
College Degree or Higher	-0.187 (0.020)***	-0.187 (0.020)***
<b>Income Category</b>		
19,999 or less	REF	REF
\$20,000-\$34,999	-0.109 (0.020)***	-0.109 (0.020)***
\$35,000-\$69,999	-0.207 (0.025)***	-0.207 (0.025)***
>\$70,000	-0.293 (0.029)***	-0.293 (0.029)***
<b>Employment Status</b>		
Fully Employed	-0.187 (0.020)***	-0.187 (0.020)***
Not Fully Employed	REF	REF
<b>Marital Status</b>		
Not Married	REF	REF
Married	-0.292 (0.018)***	-0.292 (0.018)***

<b>Health Insurance Status</b>		
No Health Insurance	REF	REF
Has Health Insurance	0.018 (0.024)	0.018 (0.024)
<b>Urbanicity</b>		
Urban	REF	REF
Rural	0.028 (0.025)	0.028 (0.025)
<b>Census Region</b>		
Northeast	REF	REF
Midwest	0.004 (0.031)	0.004 (0.031)
South	-0.004 (0.029)	-0.004 (0.029)
West	0.008 (0.028)	0.008 (0.028)
<b>Constant / Intercept</b>	0.522 (0.043)***	1.33 (0.110)***

Significance Values: \*p<0.01, \*\*p<0.005, \*\*\*p<0.001; REF = reference category

NOTE: Interactions between sex and the two ACE terms were tested and not found to be significant, suggesting that these estimated relationships of ACE with the outcomes hold for both males and females (statistically).

Supplementary Table 3. Weighted Regression Analysis of Scaled Total Number of Mental Health and Substance Use Disorders as a Function of ACE Totals, Sexual Orientation, the ACE Total x Sexual Orientation Interaction, and Sociodemographics

	Number of Mental Health and Substance Use Disorders	Number of Mental Health and Substance Use Disorders
	Coefficient (SE)	Coefficient (SE)
Number of ACEs	0.118 (0.011)***	0.211 (0.039)***
Squared Total Number of ACEs	0.014 (0.002)***	0.014 (0.002)***
<b>Sexual Orientation</b>		
Gay or Lesbian	0.324 (0.114)*	-0.198 (0.166)
Bisexual	0.522 (0.128)***	REF
Not Sure	0.235 (0.194)	-0.286 (0.222)
Discordant Heterosexual	0.085 (0.048)	-0.436 (0.139)**
Concordant Heterosexual	REF	-0.522 (0.128)***
<b>Interaction between Sexual Orientation and ACE Total</b>		
Gay or Lesbian	0.003 (0.032)	-0.089 (0.050)
Bisexual	0.093 (0.037)	REF
Not Sure	0.169 (0.080)	0.076 (0.087)
Discordant Heterosexual	0.038 (0.020)	-0.055 (0.042)
Concordant Heterosexual	REF	-0.093 (0.037)
<b>Sex</b>		
Male	REF	REF
Female	-0.047 (0.017)*	-0.047 (0.017)*
<b>Race/Ethnicity</b>		
White	REF	REF
Black/African American	-0.297 (0.031)***	-0.297 (0.031)***
Hispanic	-0.365 (0.025)***	-0.365 (0.025)***
Other Race/Ethnicity	-0.215 (0.031)***	-0.215 (0.031)***
<b>Age Category</b>		
18-29	0.652 (0.027)***	0.652 (0.027)***
30-44	0.669 (0.026)***	0.669 (0.026)***
45-64	0.517 (0.023)***	0.517 (0.023)***
65+	REF	REF
<b>Educational Attainment</b>		
High School or Less	REF	REF
Some College	0.006 (0.018)	0.006 (0.018)
College Degree or Higher	-0.189 (0.020)***	-0.189 (0.020)***
<b>Income Category</b>		
\$19,999 or less	REF	REF
\$20,000-\$34,999	-0.109 (0.020)***	-0.109 (0.020)***
\$35,000-\$69,999	-0.205 (0.025)***	-0.205 (0.025)***
>\$70,000	-0.292 (0.028)***	-0.292 (0.028)***
<b>Employment Status</b>		

Fully Employed	-0.186 (0.016)***	-0.186 (0.016)***
Not Fully Employed	REF	REF
<b>Marital Status</b>		
Not Married	REF	REF
Married	-0.294 (0.017)***	-0.294 (0.017)***
<b>Health Insurance Status</b>		
No Health Insurance	REF	REF
Has Health Insurance	0.017 (0.024)	0.017 (0.024)
<b>Urbanicity</b>		
Urban	REF	REF
Rural	0.028 (0.025)	0.028 (0.025)
<b>Census Region</b>		
Northeast	REF	REF
Midwest	0.004 (0.031)	0.004 (0.031)
South	-0.005 (0.029)	-0.005 (0.029)
West	0.008 (0.028)	0.008 (0.028)
<b>Constant / Intercept</b>	0.533 (0.043)***	1.054 (0.127)***

Significance Values: \*p<0.01, \*\*p<0.005, \*\*\*p<0.001; REF = reference category

Supplementary Table 4. Weighted Adjusted Odds Ratios for Having Comorbid Mental Health and Substance Use Disorders, Considering ACE Totals, the Sexual Orientation × ACE Total Interaction, and Sociodemographics as Predictors

	Comorbid Mental Health and Substance Use Disorders (Binary: Comorbid or not)	Comorbid Mental Health and Substance Use Disorders (Binary: Comorbid or not)
	AOR <sup>†</sup> (SE)	AOR <sup>†</sup> (SE)
Number of ACEs	1.565 (0.038)***	1.563 (0.079)***
Squared Total Number of ACEs	0.983 (0.003)***	0.983 (0.003)***
<b>Sexual Orientation</b>		
Gay or Lesbian	2.492 (0.546)***	1.186 (0.364)
Bisexual	2.102 (0.452)**	REF
Not Sure	1.538 (0.663)	0.732 (0.331)
Discordant Heterosexual	1.602 (0.211)**	0.762 (0.198)
Concordant Heterosexual	REF	0.476 (0.102)**
<b>Interaction between Sexual Orientation and ACE Total</b>		
Gay or Lesbian	0.896 (0.049)	0.897 (0.066)
Bisexual	0.999 (0.047)	REF
Not Sure	1.008 (0.097)	1.009 (0.103)
Discordant Heterosexual	0.956 (0.028)	0.957 (0.049)
Concordant Heterosexual	REF	1.001 (0.047)
<b>Sex</b>		
Male	REF	REF
Female	0.870 (0.039)**	0.870 (0.039)**
<b>Race/Ethnicity</b>		
White	REF	REF
Black/African American	0.568 (0.035)***	0.568 (0.035)***
Hispanic	0.508 (0.036)***	0.508 (0.036)***
Other Race/Ethnicity	0.604 (0.055)***	0.604 (0.055)***
<b>Age Category</b>		
18-29	5.176 (0.488)***	5.176 (0.488)***
30-44	5.623 (0.525)***	5.623 (0.525)***
45-64	4.123 (0.399)***	4.123 (0.399)***
65+	REF	REF
<b>Educational Attainment</b>		
High School or Less	REF	REF
Some College	0.981 (0.044)	0.981 (0.044)
College Degree or Higher	0.573 (0.039)***	0.573 (0.039)***
<b>Income Category</b>		
\$19,999 or less	REF	REF
\$20,000-\$34,999	0.822 (0.044)***	0.822 (0.044)***
\$35,000-\$69,999	0.647 (0.039)***	0.647 (0.039)***
>\$70,000	0.585 (0.049)***	0.585 (0.049)***



<b>Employment Status</b>		
Fully Employed	0.779 (0.033)***	0.779 (0.033)***
Not Fully Employed	REF	REF
<b>Marital Status</b>		
Not Married	REF	REF
Married	0.516 (0.028)***	0.516 (0.028)***
<b>Health Insurance Status</b>		
No Health Insurance	REF	REF
Has Health Insurance	1.024 (0.059)	1.024 (0.059)
<b>Urbanicity</b>		
Urban	REF	REF
Rural	1.049 (0.070)	1.049 (0.070)
<b>Census Region</b>		
Northeast	REF	REF
Midwest	0.978 (0.075)	0.978 (0.075)
South	1.004 (0.066)	1.004 (0.066)
West	0.961 (0.071)	0.961 (0.071)
<b>Archer-Lemeshow GOF<sup>†</sup> Test [F-Value (P-Value)]</b>	0.83 (P=0.591)	0.83 (P=0.591)

Significance Values: \*p<0.01, \*\*p<0.005, \*\*\*p<0.001; REF = reference group

NOTE: Interactions between sex and the two ACE terms were tested and not found to be significant, suggesting that these estimated relationships of ACE with the outcomes hold for both males and females (statistically).

<sup>†</sup>AOR=Adjusted Odds Ratio, GOF=Goodness of Fit