



Adverse Childhood Experiences, Mental Health, and Risk Behaviors in Adulthood: Exploring Sex, Racial, and Ethnic Group Differences in a Nationally Representative Sample

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Abstract

This study examined sex, racial, and ethnic differences in the short- and long-term associations between adverse childhood experiences (ACEs), mental health, and risk behaviors in a nationally representative sample. Analysis was based on the National Longitudinal Study of Adolescent to Adult Health, a longitudinal cohort of U.S. adolescents followed in five waves of data collection from adolescence to adulthood. Analysis included design-based regression models to examine the associations between ACEs and proximal and distal outcomes (i.e., depression, suicidal ideation, number of sexual partners, binge drinking, current smoker) assessed in the transition to adulthood (mean age 21; 2001–2002) and adulthood (mean age 38; 2016–2018). Sex, racial, and ethnic interactions were included in regression models to examine effect modification in the association of ACEs, mental health, and risk behaviors. In this analytical sample (N = 9,690), we identified a graded association between ACEs and depression, suicide ideation, and current smoker status at both time points (i.e., mean age 21 and 38). Sex moderated the relationship between ACEs and depression at mean age 21, while race (i.e., American Indian versus White) moderated the relationship between ACEs and number of sexual partners at mean age 38. A greater number of cumulative traumatic experiences in childhood may amplify adverse health outcomes among women and adults of American Indian descent in particular.

Keywords Adverse childhood experiences · Sex differences · Racial disparities · Mental health · Risky behaviors

Introduction

Adverse childhood experiences (ACEs) include direct and indirect harmful and traumatic experiences in childhood such as emotional, physical, or sexual abuse, death of a loved

one, or witnessing violence. ACEs impact approximately half of all children in the United States (Felitti et al., 1998; Hughes et al., 2017; Mersky & Janczewski, 2018). However, ACEs are not homogeneously distributed in the population. A significantly higher number of ACEs are reported by girls/women compared with boys/men (Campbell et al., 2016). In addition, there are racial and ethnic disparities among those who experience ACEs, with those who identify their race as Black or American Indian, or their ethnicity as Latinx, having a greater likelihood of experiencing at least one ACE compared with White and non-Latinx samples (Roh et al., 2015; Sacks & Murphey, 2018). Such high prevalence of ACEs, particularly among women and those from racial and ethnic minority groups, is concerning since ACEs are associated with increased risk for myriad negative outcomes over one's lifespan (Felitti et al., 1998; Hughes et al., 2017). These negative outcomes include mental health and risk behaviors characterized by sex, racial, and ethnic disparities (Banta et al., 2014; Cornelius et al., 2020; Lee & Chen, 2017), namely, depression, suicide, risky sexual behavior, alcohol abuse and tobacco use. Examining the relationships among ACEs, mental health, and risk behaviors by sex,

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race, and ethnicity may foster the development of culturally-informed prevention and treatment interventions.

ACEs, Mental Health, and Risk Behaviors

ACEs have a strong dose–response relationship to depression; a greater number of ACEs amplifies the risk of future depression (Poole et al., 2017). Depression itself is a risk factor for risk behaviors such as suicide attempts (Poole et al., 2017). Epidemiological research consistently shows sex disparities in depression, with women more likely to be diagnosed with major depressive disorder than men (American Psychiatric Association, 2013). Likewise, racial and ethnic disparities exist with respect to depressive symptomatology and the likelihood of seeking help for those symptoms (Banks & Kohn-Wood, 2002; Kim et al., 2011; Riolo et al., 2005). Specifically, most research indicates lower rates of depressive symptomatology among adults identifying as Black compared with White and Latinx populations (Ege et al., 2015; Poole et al., 2017). Given that major depressive disorder is among the most common mental health diagnoses (American Psychiatric Association, 2013), and given the variability in presentation of associated symptomatology by sex, race, and ethnicity, identifying unique needs in screenings and interventions for this disorder is warranted.

The dose–response association between ACEs and self-directed violence – like suicidal attempts is also robust (Hughes et al., 2017). ACEs—particularly experiences of child maltreatment—are associated with suicidal ideation and attempts (Fuller-Thomson et al., 2016b). Overall, women present with greater risk for suicide attempts and higher levels of suicidal ideation (Lamis & Lester, 2013), while men tend to utilize more lethal methods and therefore present with greater risk for death by suicide (Miranda-Mendizabal et al., 2019). Rates of suicide also vary by race and ethnicity, with those who identify as American Indian and White consistently presenting with the higher rates of death by suicide, compared to Non-Hispanic Black, non-Hispanic Asian/Pacific Islander, and Latinx populations (Ivey-Stephenson et al., 2017). Due to observed differences, an examination of sex, race, and ethnicity on suicidal ideation in the context of ACEs is warranted.

The association between ACEs and sexual risk-taking is similarly strong (Hughes et al., 2017). Research indicates a strong dose–response relationship between ACEs and the likelihood of engaging in risky sexual behaviors such as casual sex (Alexander et al., 2018). Participation in risky sexual behavior varies across sex and racial and ethnic identity. Research broadly demonstrates that men are more likely to report engaging in risky sexual behavior compared with women (Fix et al., 2019; Silverstein et al., 2017). In addition, reported rates of risky sexual behavior are often higher among African American and Latinx Americans compared with

White Americans (Fix et al., 2019). However, the presence and type of ACE exposure may differentially impact participation in risky sexual behavior. For example, Abajobir et al. conducted a meta-analysis of associations between one specific ACE—child sexual abuse—and risky sexual behavior, with results suggesting female survivors of child sexual abuse were significantly more likely to engage in risky sexual behavior compared with male survivors (Abajobir et al., 2017). Thus, research examining the associations between ACEs and risky sexual behavior would benefit from the inclusion of sex, race, and ethnicity as moderators.

Research demonstrates moderate-to-large associations between ACEs and both heavy/problematic alcohol use and use of smoking tobacco in adulthood (Campbell et al., 2016; Hughes et al., 2017; Lee & Chen, 2017). Relative to people with fewer ACEs, those who experienced four or more ACEs demonstrated more binge and heavy drinking, and more tobacco smoking in adulthood (Campbell et al., 2016). Sex, racial and ethnic group differences appear in rates of binge drinking (Banta et al., 2014; Lee & Chen, 2017) and tobacco smoking (Cornelius et al., 2020). Broadly speaking, men are more likely to report binge drinking and tobacco use, and select racial and ethnic groups report comparatively higher rates of binge drinking (people who identify their ethnicity as Mexican) and tobacco smoking (people who identify their race as American Indian) compared with other racial and ethnic groups (Banta et al., 2014; Cornelius et al., 2020). As a result, we recommend that sex, race, and ethnicity be considered as moderators in research examining associations between ACEs and substance use.

Current Study

In the current study, we used data from the National Longitudinal Study of Adolescent to Adult Health (Add Health) to examine sex, race, and ethnic differences in the associations between ACEs, mental health, and risk behaviors at two points in time: in the transition to adulthood (mean age 21; 2001–2002) and at mid-adulthood (mean age 38; 2017–2018). The inclusion of proximal and distal outcomes allowed for the exploration of associations at two developmental periods, as stronger effects of ACEs could be concentrated at younger ages and lessen over time; there is also potential for a delayed effect where risk might be normative at younger ages but increase over time, perhaps among those with polyvictimization.

This study also included social identifiers, (i.e., sex, race, and ethnicity) to illuminate how ACEs contribute to disparities in depression and risk behaviors in early-to mid-adulthood. More research on the impact of ACEs on health outcomes for racial and ethnic minority groups is warranted (Reinert et al., 2015), particularly within underexamined populations including American Indian

and Asian American individuals. According to the Risk Exposure Theory, the disproportionate burden of social and environmental health risks in racial and ethnic minority communities is linked to a higher prevalence of adverse health outcomes (LaVeist, 2005). Therefore, a high prevalence of social and environmental risk factors in racial and ethnic minority communities may contribute to an increased risk exposure to adverse events experienced by children residing in such communities. Further, implicit bias by teachers, police officers and other adults who populate the social ecologies of children contributes to their misconstrual or misperception of the behavior of Black children as more aggressive than identical behavior displayed by White children (Gilliam et al., 2016). Relative to non-traumatized children, traumatized children are at risk of increased aggressive, anxious, and anti-social behavior (Van der Kolk, 2017). While these are common responses to child trauma, White adults may view traumatized Black and Latinx children as dangerous rather than as needing help (Rudd, 2014) and take punitive vs. restorative action—which may amplify adverse responses to childhood trauma. Informed by previous studies, the Risk Exposure Theory, and the concept of implicit bias, we hypothesized that the association between ACEs, mental health, and risk behaviors would be stronger for women compared with men and would be stronger for racial and ethnic minority participants compared with White participants.

Method

Sample

The Add Health cohort is a nationally representative sample of adolescents followed from ages 11 through 42 through five waves of data collection. Add Health participant recruitment was based on a stratified random sample of U.S. high schools. Wave 1 (1994–1995) included about 20,000 adolescents (11–21 years; $M = 15$ years) and their parents ($N = 17,670$). Subsequent waves consisted of interviews with adolescent participants from Wave 1. Wave 2 data collection occurred in 1996 ($N = 14,738$ participants; $M = 16$ years). Consistent with other investigators (Scheidell et al., 2017) we excluded Wave 2 from this study and used demographic information from Wave 1. Wave 3 data collection occurred in 2001–2002 ($N = 15,197$; $M = 22$ years; 77% response rate). Wave 4 data collection occurred in 2008–2009 ($N = 15,701$; $M = 28$ years; 80% response rate). Wave 5 data collection occurred in 2016–2018 ($N = 12,300$; $M = 38$ years; 69% response rate). The full analytical sample in this study includes those with complete information on race, and strata and sample weights in Waves 3 and 5 ($N = 9,690$).

Measures

Demographics Selection of control variables was informed by previous research with ACEs and risk behaviors (Campbell et al., 2016; Fuller-Thomson et al., 2016a). Control variables included age, educational status (coded dichotomously as high school diploma in Wave 3 and college degree in Wave 5), and marital status (coded dichotomously as married/cohabitating in Waves 3 and 5). Analyses with outcomes from Wave 5 also included sexual orientation with those who identified as bisexual or gay as control (coded dichotomously as bisexual, 100% gay, or mostly gay versus 100% or mostly heterosexual). As proxies for family socioeconomic background, we included parental educational attainment from Wave 1 and retrospective self-reports from Wave 5 of whether their family was better or worse off financially than the average family before the participant turned 16 years of age (range 1 = a lot worse off to 5 = a lot better off¹). Race and ethnicity was computed as recommended by Add Health (Add Health, 2020) using participant reports in Wave 1. U.S.-based race and ethnicity categories were Hispanic/Latinx, non-Hispanic Black, non-Hispanic Asian, non-Hispanic American Indian, non-Hispanic White, and non-Hispanic Other. Given the small sample in the non-Hispanic Other category ($N = 80$), these participants were excluded from analysis. Sex was coded as male or female.

Adverse Childhood Experiences and Polyvictimization

ACEs included eight types of traumatic events experienced in childhood informed by measures sourced from waves 1, 3, 4, and 5. Measures sourced from Waves 3–5 consisted of retrospective reports of traumatic events experienced before age 18. All ACEs were informed by participant report, with exception of “substance use in household”, which was based on parental report at Wave 1. Each ACE type was coded dichotomously (0 = No; 1 = Yes; (Dube et al., 2003). If more than one item informed a single ACE type (e.g., child sexual abuse), respondents were considered to be exposed to that ACE whether they responded “yes” to at least one of the items in that category (Dube et al., 2003; Felitti et al., 1998). A continuous measure of polyvictimization was also calculated by summing all ACEs types (range 0–8); this measure was recoded into five categories (0, 1, 2, 3, and 4 or more) to serve as a categorical measure of polyvictimization (Centers for Disease Control & Prevention, 2010; Dube et al., 2003). Individual ACE types are described below.

¹ Item was reverse coded.

Emotional Abuse In Wave 4 participants were asked to retrospectively report frequency parent/caregiver said hurtful things or made participant feel unwanted/unloved before they turned age 18. Response options were dichotomized as (0) less than six times and (1) six or more times (Quinn et al., 2016).

Physical Abuse In Waves 3 and 4 participants retrospectively reported on the frequency they were slapped, hit, kicked, or thrown by parent/caregiver before age 18. At both waves, response options were dichotomized as (0) less than six times and (1) six or more times (Quinn et al., 2016). Participants were defined as exposed to physical abuse if they reported experiencing physical abuse six or more times in at least one wave.

Sexual Abuse Child sexual abuse was a composite measure of experienced child sexual abuse or sexual assault before age 18 by a parent/caregiver or other adult. Child sexual abuse was a composite measure based on six items from Waves 3, 4, and 5 with participants' retrospective reports on being touched by or forced to touch a caregiver in a sexual way before 6th grade (one item; Wave 3); being touched by or forced to touch a caregiver in a sexual way before age 18 (one item; Wave 4); ever forced in a non-physical way to sexual activity by non-caregivers before age 18 (two items; Waves 4 and 5); and ever forced in a physical way to sexual activity by non-caregivers before age 18 (two items; Waves 4 and 5). Participants were defined as being exposed to child sexual abuse if they responded "yes" to at least one item across any wave (Fix et al., 2019). As suggested elsewhere, victimization items sourced across different time points increase measurement accuracy (Aalsma et al., 2002).

Family Member with a History of Attempted Suicide In Wave 1, family member with a history of attempted suicide was assessed with participant report on having at least one family member attempted suicide in the past 12 months. Response options were (0) No and (1) Yes.

Substance Abuse in the Household In Wave 1, participants' parents were asked to report on how frequently they had five or more drinks in a row in the past month. Response options were coded as (0) Never and (1) Once or more.

Parental Incarceration With survey items sourced from Wave 4, parental incarceration was assessed as having a biological mother/stepmother or a biological father/stepfather incarcerated before participants turned age 18.

Parental Death or Absence This measure was informed by four items from Wave 1: death of biological mother, death of biological father, if the child never resided with biological

mother, and if the child never resided with biological father (Craig, 2020). Participants were defined as exposed to parental death or absence if they responded "yes" to at least one of the four times.

Witnessed Violence In Wave 1, witnessed violence was assessed with participants' report on seeing someone shot or stabbed in the past 12 months at least once (Quinn et al., 2016).

Mental Health and Risk Behavior Outcomes

Outcomes were sourced from Waves 3 and 5 and described below.

Depression In Waves 3 and 5, depression was based on four items from the Center for Epidemiologic Studies Depression Scale (Radloff, 1977) assessing depressive symptoms in the past seven days (felt sad, could not shake off blues, felt depressed, felt happy/enjoyed life).² Response options ranged from 0 = never or rarely to 3 = most or all of the time. Scale scores were computed by summing the four items, resulting in a possible range of 0–12, with higher scores indicating higher depressive symptomatology. Cronbach's alpha = 0.78 and 0.82 for Waves 3 and 5, respectively.

Suicidal Ideation In both Waves 3 and 5, suicide ideation was assessed with the item "During the past 12 months, have you ever seriously thought about committing suicide." Response options were 0 = No and 1 = Yes.

Binge Drinking In both Waves 3 and 5, binge drinking was based on one item assessing frequency of daily drinks (five for men, four for women) consumed across the past 12 months. Response options ranged from 0 = none to 6 = every day/almost every day. Response options were dichotomized to indicate 0 = no versus 1 = any binge drinking (Popovici & French, 2013).

Number of Sexual Partners In Wave 3, number of sexual partners in the past 12 months was assessed continuously with the item "With how many different partners have you had vaginal intercourse in the past 12 months?" Responses ranged from 0 to 50 (we address limitations of this heteronormative focus on vaginal intercourse under Statistical Analyses, below). In Wave 5, participants were queried about male and female sexual partners separately. Wave 5 measure combined participants answers to both items, resulting in the total number of sexual partners in the past 12 months. Responses ranged from 0 to 130.

² Item was reverse coded.

Current Smoker In Waves 3 and 5, tobacco use was based on number of days participants had smoked cigarettes in the past 30 days. Participant responses were dichotomized to indicate (0) none versus (1) any cigarette use in the past 30 days.

Missing Data

Among the full analytical sample $N = 9,690$, the two variables with the highest proportion of missing data were parental education and substance abuse in the household (13% missing for each). Missing data across emotional abuse, physical abuse, sexual abuse, and parental incarceration ranged from 8.2% to 9.6%. All the remaining variables or measures were characterized by less than 3% missing data. To address the potential for bias, we used multiple imputation by chained equation (MICE) to impute 10 datasets. The imputation model included all independent, dependent, and covariate variables used in the analysis (White et al., 2011). Multiple imputation was conducted in Stata/SE 15.1.

Statistical Analysis

Analyses were conducted in three main steps, with a design-based approach, accounting for survey design in Waves 3 and 5 (cluster and strata) and sample weights across all analytical models. First, we used bivariate analysis to estimate sample weighted proportions and means across demographics, ACEs, and outcomes by sex, race, and ethnicity. We used bivariate regression models to assess the associations between demographics, ACEs, and outcomes with sex, race, and ethnicity (Tables 1 and 2). Second, bivariate regression models were built to investigate the dose–response association between a categorical variable of ACEs and each dependent variable in Waves 3 and 5 (Table 3). Third, interaction terms of sex by ACEs and race and ethnicity by ACEs (comparing Latinx, Black, Asian, and American Indian versus White) were added to multivariate regression models (Tables 4 and 5). To improve interpretability of the interaction terms, we used a continuous variable of ACEs in the interactions, as we established a general graded association between categorical ACEs and most outcomes. We used $p < 0.05$ to determine a statistically significant interaction between ACEs by sex and ACEs by race and ethnicity. As an exception, we used $p < 0.10$ for interaction terms comparing the American Indian versus White participants, given the small sample size of participants who identified as American Indian and attendant reductions in power. We used linear regression for continuous outcomes (depression), logistic regression for binary outcomes (suicidal ideation, binge drinking, and current smoker), and Poisson regression for count outcomes (number of sexual partners).

Statistical analysis for Wave 5 outcomes were conducted with the full analytical sample ($N = 9,690$); however,

statistical analysis for Wave 3 outcomes excluded participants who self-identified as LGB (i.e., bisexual, 100% or mostly gay) in Wave 3 ($N = 350$). The reason for restricting the analysis to participants who self-identified as heterosexual in Wave 3 ($N = 9,274$) related to the wording of the item assessing number of sexual partners with whom participants had “vaginal intercourse” in that wave. We recognize this wording could have resulted in underestimation of the number of sexual partners for LBG participants in Wave 3. To obtain correct standard errors in the regression models with Wave 3 outcomes, we used the “subpop” command in Stata as recommended by Chen and Chantala (2014). For that, we used a dummy variable representing the subgroup of participants who self-identified as heterosexual (1) versus else (0). In Wave 5, participants were asked about male and female sexual partners separately. Thus, for Wave 5 outcomes, we retained the full sample and included sexual orientation as control. All analyses were conducted in Stata/SE 15.1. The present study was considered exempt from the first author’s university institutional review board.

Results

Sample demographics are shown in Table 1. In this analytical sample, a greater proportion of women had obtained a college degree by mean age 38 compared to men (41.2% versus 33.5%). White participants had the lowest proportion of parents without a high school diploma (9.3%), whereas Latinx participants had the greatest proportion of parents without a high school diploma (43.6%).

Also shown in Table 1, compared to men, a greater proportion of women experienced emotional abuse (19.2% versus 14.1%), and sexual abuse (27.1% versus 12.0%). However, a greater proportion of men witnessed violence compared to women (12.3% versus 8.7%). As for polyvictimization, a greater proportion of women experienced four or more ACEs than men (5.3% versus 3.1%). Also shown in Table 1, a greater proportion of participants who self-identified as Black (22.0%) or American Indian (35.3%) experienced sexual abuse than White (18.6%) participants. Latinx (20.8%), Black (20.1%), and American Indian (22.7%) participants were almost four times more likely to have witnessed violence than White (5.9%) participants. With respect to polyvictimization, 12.7% of American Indian participants experienced four or more ACEs, compared with 3.4% of White participants.

As shown in Table 2, at mean age 21, women had higher mean depression scale scores compared to men ($M = 1.95$ versus 1.49). Men reported more sexual partners ($M = 1.71$ versus 1.33) and had a greater proportion of people who reported any binge drinking (61.8% versus 44.3%) and smoking (36.1% versus 32.2%) at that age. Similar trends

Table 1 Sample Demographic Characteristics and Adverse Childhood Experiences (ACEs) Weighted Percentages and Means by Sex, Race, and Ethnicity, and corresponding bivariate associations

	Men N = 4,118	Women N = 5,572	OR or ^a Coef.	Latinx N = 1,403	OR or ^a Coef.	Black N = 1,916	OR or ^a Coef.	Asian N = 665	OR or ^a Coef.	AI N = 170	OR or ^a Coef.	White N = 5,456
Sample demographics												
Parents with less than HS, %	14.2	16.1	1.21*	43.6	.14***	20.8	.46***	18.5	.46**	23.2	.31***	9.3
Family better off prior 16, mean	2.99	3.00	^a .01	2.94	^a -.04	3.10	.13**	2.94	^a -.04	2.71	^a .05	2.99
HS diploma (W3), %	82.2	84.4	1.17*	74.6	.51***	80.0	.67**	90.9	2.42**	73.1	.47*	85.3
College degree (W5), %	33.5	41.2	1.42***	27.6	.56***	29.8	.60***	52.7	1.76*	22.2	.38*	40.8
Married/cohabitating (W3), %	23.4	31.2	1.48***	32.0	1.16	19.8	.60***	21.0	.61*	36.7	.99	28.7
Married/cohabitating (W5), %	70.1	71.0	1.05	68.4	.71**	50.2	.33***	72.9	.86	67.8	.27***	75.6
Sexual orientation (W5), %	4.3	4.8	1.12	4.9	1.08	4.5	.98	2.6	.56	7.3	1.62	4.6
ACEs by type and polyvictimization, weighted %												
Emotional abuse	14.1	19.2	1.45***	16.4	.97	13.4	.76	21.3	1.33	24.8	1.63*	16.4
Physical abuse	13.6	12.2	.88	15.8	1.43**	11.8	1.01	21.1	2.03**	21.7	2.10**	11.6
Sexual abuse	12.0	27.1	2.79***	20.3	1.12	22.0	1.23*	13.8	.70	35.3	2.40***	18.6
Family member with suicide history	3.0	5.3	1.80***	4.9	1.23	3.7	.91	3.2	.77	9.1	2.36**	4.1
Substance abuse in household	14.1	12.7	.89	13.6	1.00	14.8	1.12	4.9	.33*	15.1	1.14	13.5
Parental incarceration	9.8	11.3	1.18	13.1	1.52*	16.5	1.99*	4.4	.50*	13.3	1.54	9.0
Parental death or absence	9.2	11.7	1.30*	11.1	1.50*	23.9	3.86***	8.3	1.07	10.3	2.75**	7.5
Witnessed violence	12.3	8.7	.68***	20.8	3.66***	20.1	3.43***	10.7	1.07	22.7	4.54***	5.9
ACEs												
0	47.4	41.6	1	37.8	1	31.9	1	45.9	1	29.7	1	49.0
1	29.8	29.4	1.09	30.2	1.41*	33.1	1.81***	30.6	1.04	27.3	1.31	28.9
2	14.2	15.6	1.21	17.7	1.81***	19.7	2.41***	16.4	1.00	19.7	1.67	12.8
3	5.6	8.4	1.80***	8.8	1.54	9.4	2.10***	4.5	.70	10.6	1.02	6.0
≥ 4	3.1	5.3	2.06***	5.5	1.85*	5.9	2.76***	2.6	.28*	12.7	3.09	3.4

Results account for cluster, strata, and sample weight variables. For sex associations with sample demographic characteristics and ACEs, male is the reference group; for race and ethnicity associations, White is the reference group

OR Odds ratio, AI American Indian

* p < .05, ** p < .01, *** p < .001

^aCoefficient,

^bIncidence rate ratio

Table 2 Outcomes Weighted Percentages and Means by Sex, Race, and Ethnicity Wave 3 (2001–2002) and Wave 5 (2016–2018), and corresponding bivariate associations

	Men N = 3,969	Women N = 5,305	OR, ^a Coef. or ^b IRR	Latinx N = 1,319	OR, ^a Coef. or ^b IRR	Black N = 1,828	OR, ^a Coef. or ^b IRR	Asian N = 643	OR, ^a Coef. or ^b IRR	AI N = 161	OR, ^a Coef. or ^b IRR	White N = 5,248
Wave 3 (mean age 21)												
Depression, mean	1.49	1.95	^a .46***	1.97	^a .33**	2.00	^a .34**	1.95	^a .36 ^c	1.93	^a .27	1.63
Suicide ideation, %	6.4%	6.7%	1.06	7.0%	.98	3.8%	.45***	5.5%	.69	10.5%	2.37***	7.0%
Sexual partners, mean	1.71	1.33	^b .78***	1.50	^b 1.00	1.87 (.08)	^b 1.27***	1.12	^b .64***	1.50	^b 1.06	1.47
Binge drinking	61.8%	44.3%	^b .49***	47.5%	^b .61***	23.1%	^b .19***	38.3%	^b .34***	55.9%	^b .58 ^c	60.0%
Current smoker	36.1%	32.2%	^b .84*	24.5%	^b .52***	21.3%	^b .42***	21.9%	^b .42***	45.3%	^b .70	38.5%
	Men N = 4,118	Women N = 5,572	OR, ^a β, or ^b IRR	Latinx N = 1,403	OR, ^a β, or ^b IRR	Black N = 1,916	OR, ^a β, or ^b IRR	Asian N = 665	OR, ^a β, or ^b IRR	NA/AI N = 170	OR, ^a β, or ^b IRR	White N = 5,456
Wave 5 (mean age 38)												
Depression, mean	2.25	2.39	^a .14	2.23	^a .01	2.48	^a .15	1.99	^a -.36**	3.22	^a .22	2.28
Suicide ideation, %	7.6%	6.4%	.83	6.3%	.85	6.1%	.78	5.4%	.74	13.1%	.97	7.3%
Sexual partners, mean	1.74	1.29	^b .74***	1.84	^b 1.31*	1.88	^b 1.31***	1.28	^b .85*	1.53	^b .97	1.39
Binge drinking, %	52.1%	40.0%	^b .61***	47.3%	.93	33.2%	^b .49***	35.6%	^b .55***	50.2%	1.05	49.2%
Current smoker, %	30.8%	24.3%	^b .72***	19.7%	^b .59***	27.0%	.90	18.8%	^b .51***	43.6%	1.03	29.0%

Results account for cluster, strata, and sample weight variables. For sex associations with sample demographic characteristics and ACEs, male is the reference group; for race and ethnicity associations, White is the reference group

OR Odds ratio, IRR Incidence Rate Ratio, AI American Indian

^aCoefficient, ^bIncidence rate ratio, ^cp < .10

*p < .05; **p < .01; ***p < .001

Table 3 Bivariate Regression Models Estimating the Association between ACEs and Outcomes in Wave 3 (2001–2002) and Wave 5 (2016–2018)

	Depression	Suicidal ideation	Sexual partners	Binge drinking	Current smoker
	β (95% CI)	OR (95% CI)	IRR (95% CI)	OR (95% CI)	OR (95% CI)
Wave 3 (mean age 21)^a					
ACEs score (ref: none)					
1	.30 (.145, .45)***	1.76 (1.26, 2.46)***	1.19 (1.08, 1.31)***	.93 (.80, 1.07)	1.28 (1.09, 1.51)**
2	.71 (.52, .91)***	2.61 (1.83, 3.73)***	1.21 (1.08, 1.35)**	.90 (.75, 1.08)	1.40 (1.14, 1.72)**
3	.89 (.59, 1.19)***	4.15 (2.08, 6.15)***	1.50 (1.23, 1.83)***	.77 (.61, .96)**	1.87 (1.47, 2.38)***
≥ 4	1.29 (.92, 1.66)***	3.61 (2.17, 5.99)***	1.39 (1.16, 1.68)***	.78 (.58, 1.06)	2.77 (2.03, 3.79)***
Wave 5 (mean age 38)^b					
ACEs score (ref: none)					
1	.43 (.26, .60)***	2.00 (1.50, 2.66)***	1.05 (.96, 1.16)	1.01 (.86, 1.19)	1.40 (1.14, 1.74)**
2	.78 (.54, 1.02)***	2.46 (1.79, 3.37)***	1.31 (1.07, 1.60)**	.90 (.74, 1.08)	1.69 (1.32, 1.17)***
3	1.06 (.74, 1.38)***	3.33 (2.27, 4.88)***	1.35 (.97, 1.88)	.93 (.72, 1.20)	2.27 (1.76, 2.93)***
≥ 4	1.49 (1.07, 1.91)***	4.62 (2.86, 7.45)***	1.25 (.91, 1.72)	1.06 (.77, 1.46)	3.22 (2.24, 4.62)***

^aResults account for Wave 3 cluster, strata, and sample weight variables

^bResults account for Wave 5 cluster, strata, and sample weight variables

OR odds ratio, IRR Incidence Rate Ratio

* $p < .05$; ** $p < .01$; *** $p < .001$

of sex differences in sexual partners, binge drinking, and smoking were also observed at mean age 38.

Table 3 shows results from bivariate regression models estimating the associations between ACEs and proximal outcomes at mean age 21 and distal outcomes at mean age 38. Findings show a statistically significant graded association between ACEs and all outcomes at mean age 21, except for binge drinking. At mean age 38, a statistically significant

graded association between ACEs and outcomes was still observed for depression, suicidal ideation, and being a current smoker.

Tables 4 and 5 show results from multivariate models with interactions between ACEs and sex and ACEs and race and ethnicity, respectively. Statistically significant interactions of ACEs by sex were identified in a multivariate model with depression as an outcome assessed at

Table 4 Multivariate Regression Models Estimating the Differential Association by Sex between ACEs and Outcomes in Wave 3 (2001–2002) and Wave 5 (2016–2018)

	Depression	Suicidal ideation	Sexual partners	Binge drinking	Current smoker
	β (95% CI)	AOR (95% CI)	IRR (95% CI)	AOR (95% CI)	AOR (95% CI)
Wave 3 (mean age 21)^a					
ACEs score (continuous)					
	.04 (−.14, .22)	1.45 (1.25, 1.67)***	1.14 (1.07, 1.22)***	1.08 (.97, 1.19)	1.22 (1.11, 1.34)***
Sex (ref: men)					
	.29 (.15, .44)***	.79 (.57, 1.14)	.82 (.74, .91)**	.51 (.44, .59)***	.78 (.65, .93)*
ACES X Sex (ref: men)					
	.15 (.04, .26)**	1.18 (.97, 1.39)	.96 (.89, 1.03)	.97 (.86, 1.09)	1.06 (.94, 1.20)
Wave 5 (mean age 38)^b					
ACEs score (continuous)					
	.24 (.14, .34)***	1.40 (1.20, 1.64)***	1.10 (1.01, 1.20)*	.97 (.87, 1.07)***	1.26 (1.14, 1.39)***
Sex (ref: men)					
	.02 (−.13, .16)	.75 (.54, 1.04)	.77 (.69, .85)***	.54 (.46, .63)	.68 (.56, .83)***
ACES X Sex (ref: men)					
	.11 (−.02, .24)	1.02 (.84, 1.24)	.95 (.86, .85)	1.11 (.98, 1.25)	1.05 (.94, 1.18)

^aResults account for Wave 3 cluster, strata, and sample weight variables. Models control for race, parental educational attainment (W1), age (W3), high school degree (W3), married or cohabitating (W3), and family better off (W5)

^bResults account for Wave 5 cluster, strata, and sample weight variables. Models control for race, parental educational attainment (W1), age (W5), college degree (W5), married or cohabitating (W5), and family better off (W5), sexual orientation (W5)

AOR Adjusted Odds Ratio, IRR Incidence Rate Ratio (adjusted)

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 5 Multivariate Regression Models Estimating the Differential Association by Race and Ethnicity between ACEs and Outcomes in Wave 3 (2001–2002) and Wave 5 (2016–2018)

	Depression	Suicidal ideation	Sexual partners	Binge drinking	Current smoker
	β (95% CI)	AOR (95% CI)	IRR (95% CI)	AOR (95% CI)	AOR (95% CI)
Wave 3 (mean age 21)^a					
ACEs score (continuous)	.26 (.19, .33)***	1.56 (1.39, 1.74)***	1.10 (1.06, 1.15)***	1.09 (1.01, 1.17)*	1.25 (1.16, 1.34)
Race and Ethnicity (ref: White)					
Latinx	.04 (–.23, .30)	.78 (.41, 1.48)	.89 (.76, 1.04)	.76 (.60, .96)*	.43 (.31, .59)***
Black	.07 (–.13, .27)	.47 (.26, .86)**	1.22 (1.06, 1.39)*	.18 (.14, .25)***	.31 (.22, .43)***
Asian	.45 (–.07, .97) ^c	.65 (.27, 1.54)	.69 (.49, .97)*	.34 (.23, .51)***	.42 (.22, .78)**
American Indian	.05 (–.56, .67)	1.17 (.36, 3.78)	.94 (.73, 1.21)	.75 (.45, 1.27)	.89 (.48, 1.66)
ACEs X Latinx (ref: White)	.11 (–.05, .27)	1.16 (.89, 1.53)	1.06 (.92, 1.22)	0.92 (.80, 1.05)	.96 (.82, 1.13)
ACEs X Black (ref: White)	.06 (–.06, .18)	0.98 (.72, 1.31)	.99 (.92, 1.06)	1.02 (.86, 1.20)	1.10 (.92, 1.31)
ACEs X Asian (ref: White)	–.16 (–.44, .13)	1.10 (.67, 1.89)	1.08 (.81, 1.45)	1.06 (.77, 1.46)	1.09 (.77, 1.56)
ACEs X AI (ref: White)	.05 (–.34, .45)	1.05 (.63, 1.75)	1.00 (.91, 1.01)	1.12 (.78, 1.61)	1.10 (.82, 1.47)
Wave 5 (mean age 38)^b					
ACEs score (continuous)	.31 (.22, .40)***	1.43 (1.27, 1.62)***	1.04 (.97, 1.11)	1.02 (0.95, 1.11)	1.32 (1.21, 1.43)***
Race and Ethnicity (ref: White)					
Latinx	–.17 (–.50, .16)	.59 (.34, 1.04)	.98 (.77, 1.25)	.97 (.72, 1.29)	.38 (.27, .54)***
Black	–.16 (–.41, .10)	.77 (.67, 1.17)	1.20 (1.02, 1.39)*	.50 (.38, .66)***	.71 (.54, .93)*
Asian	–.13 (–.39, .14)	1.01 (.53, 1.90)	.90 (.74, 1.11)	.54 (.31, .94)*	.72 (.42, 1.23)
American Indian	.30 (–.36, .99)	.89 (.31, 2.66)	.80 (.54, 1.17)	.81 (.45, 1.44)	1.39 (.63, 3.03)
ACEs X Latinx (ref: White)	–.02 (–.21, .18)	1.10 (.85, 1.42)	1.19 (.95, 1.47)	1.03 (.89, 1.20)	1.06 (.87, 1.30)
ACEs X Black (ref: White)	–.03 (–.19, .12)	.83 (.67, 1.05)	1.00 (.91, 1.11)	1.03 (.89, 1.19)	.91 (.78, 1.07)
ACEs X Asian (ref: White)	–.14 (–.45, .16)	.76 (.56, 1.07)	1.02 (.88, 1.18)	1.00 (.69, 1.46)	.87 (.63, 1.17)
ACEs X AI (ref: White)	.18 (–.22, .56)	1.14 (.72, 1.85)	1.14 (1.01, 1.28)*	1.18 (.90, 1.54)	.93 (.62, 1.41)

^a Results are weighted and adjusted for Wave 3 cluster and strata. Models control for gender, parental educational attainment (W1), age (W3), high school degree (W3), married or cohabitating (W3), and family better off (W5)

^b Results are weighted and adjusted for Wave 5 cluster and strata. Models control for sex, parental educational attainment (W1), age (W5), college degree (W5), married or cohabitating (W5), and family better off (W5); sexual orientation (W5)

AOR Adjusted Odds Ratio, IRR Incidence Rate Ratio (adjusted), AI American Indian

^c $p < .10$

* $p < .05$; ** $p < .01$; *** $p < .001$

mean age 21, Wave 3 ($p = 0.007$; Table 4). As the number of ACEs increase, depressive symptoms at mean age 21 increase at a higher rate for women than men. At mean age 38, a statistically significant interaction between race and ACEs was identified specifically for American Indian versus White participants for the number of sexual partners outcome, Wave 5 ($p = 0.044$; Table 5). As the number of ACEs increase, the number of sexual partners at mean age 38 increase at a higher rate for American Indian participants compared to White participants.

Discussion

This study explored sex, racial, and ethnic differences in short- and long-term associations between ACEs, depression, and risk behaviors. Consistent with findings from

previous research (Campbell et al., 2016), we identified a significantly higher number of ACEs reported by women compared with men. We also identified differences in the proportion of ACEs types and cumulative number by race and ethnicity. Specifically, our findings showed that individuals who identified their ethnicity as Latinx and race as Black and American Indian are more likely to experience four or more ACEs as compared to participants who identified their race as White. Not all studies find racial and ethnic differences in the cumulative number of ACEs (Centers for Disease Control & Prevention, 2010; Koenen et al., 2010). However, in studies with broader measures of ACEs that incorporate life stressors more commonly experienced by Black and Latinx children such as witnessing neighborhood violence (Cronholm et al., 2015; Slopen et al., 2016), participants who identified their race as Black and ethnicity as Latinx are consistently found to

have experienced greater levels of victimization and polyvictimization (Cronholm et al., 2015; Slopen et al., 2016).

Of note, 12% of the American Indian participants experienced 4 or more ACEs, compared with 3.4% of White participants. Indeed, American Indian participants were represented in greater proportion across several ACE types. In particular, over one-third of American Indian participants experienced child sexual abuse, compared with less than one-fourth of White participants. Individuals from Asian backgrounds also experienced higher rates of physical abuse relative to White participants. These trends of ACEs types and cumulative number by race and ethnicity can inform gender-responsive and culturally informed intervention priorities. Targeted interventions can address historical exclusions and high prevalence of social risk factors in racial and ethnic minority communities that may better respond to the increased burden of ACEs. Trends of ACEs types and cumulative number by race and ethnicity – particularly including individuals from American Indian and Asian descent are essential given research on these groups from population-based studies is limited (Pro et al., 2020).

Consistent with findings from previous research (Felitti et al., 1998; Hughes et al., 2017), we observed an association between cumulative number of ACEs and most short- and long-term outcomes assessed at mean age 21 and mean age 38. However, we did not observe statistically significant graded associations for binge drinking at either time point, or for past year number of sexual partners by mean age 38. The lack of association between ACEs and past-year binge drinking in this sample might be explained by the high proportion of participants who reported at least one episode of binge drinking in the past year—approximately half of the sample, suggesting this behavior was normative for this age group. As for number of sexual partners in the past year, the lack of a statistically significant association with cumulative ACEs in the participants' late 30 s might be explained by the demographic changes associated with family formation and more stable relationships in mid-adulthood. Instead of number of sexual partners, future research with middle aged and older adults might benefit from including other indicators of risky sexual behavior (e.g., unprotected sex).

We hypothesized sex interactions in the associations between cumulative number of ACEs and both short and long-term outcomes assessed at mean age 21 and mean age 38. Our hypothesis was confirmed for depression at mean age 21. Results showed that an increased number of ACEs was associated with higher depressive symptoms in women than men in their transition to adulthood. The greater proportion of women compared to men who have experienced child sexual abuse might partially explain this finding. Studies have shown that child sexual abuse is a particularly strong predictor of depression in adulthood (Poole et al., 2017),

even after controlling for other childhood traumas (Ege et al., 2015). Findings highlight the importance of addressing depressive symptomatology among young women who experience sexual abuse and polyvictimization.

We also hypothesized that the association between cumulative number of ACEs, depression, and risky behavior with worse outcomes would be concentrated among racial and ethnic minority participants compared with White participants. Our hypothesis was only confirmed for one outcome: number of sexual partners at mean age 38 comparing American Indian versus White participants. The greater proportion of American Indian participants who reported child sexual abuse, as compared to White participants, may partially explain this finding. This association is most likely relevant because child sexual abuse is also strongly associated with multiple risky sexual behaviors (Abajobir et al., 2017). The lack of an interaction effect at mean age 21 might be partially explained by the fact that a greater proportion of American Indian participants reported marriage or cohabitation compared to White participants. By mean age 38, however, a greater proportion of White participants were married or cohabitating as compared to American Indian participants. Children traumatized by ACEs may engage in sexual activity as one coping mechanism to alleviate emotional distress (Hall et al., 2014). Further, given the racial disparities in exposure to sexual violence and abuse (e.g., Luken et al., 2021), studies that investigate the role of implicit bias and disproportionate burden of social stressors (e.g., structural racism) in the association between ACEs and trajectories of risky sexual behavior among individuals who identify as American Indian, Black, and Latinx ethnicity are warranted.

Recall bias is a common limitation when analyzing ACEs. Traumatic events experienced in childhood are likely underreported by participants in surveys (Della Femina et al., 1990); therefore, the associations between ACEs, depression, and risk behaviors might be underestimated. Relative to many studies, the sample of American Indian participants in the Add Health dataset is large, and our findings provide preliminary evidence of a disproportionate burden of ACEs among American Indian individuals. However, the sample size among this subgroup may have been too small to adequately power analyses. In addition, we used sex as a binary indicator (i.e., men/women). Add Health collects data on sexual orientation, but not on other gender identities—which precluded the examination of a more nuanced analysis of gender and ACEs in the interaction models. To more fully incorporate an anti-racist approach, use of an intersectionality is critical moving forward in this work. Examination of socioeconomic status and disability in addition to race, ethnicity, sex, gender, and sexual orientation is encouraged.

Implications and Future Directions

Our findings contribute to the body of research on health disparities by examining impacts of ACEs by sex, race, and ethnicity, demonstrating that short-term impacts of a cumulative number of ACEs on depressive symptomatology are more concentrated among women, and that the impacts on risky sexual behavior are stronger among American Indian individuals in their late 30 s. ACEs appear to be largely unrecognized as potential mechanisms for observed disparities in health outcomes. Despite concerted efforts to reduce health disparities (Centers for Disease Control & Prevention, 2017; Department of Health & Human Services, 2011), racial and ethnic minority groups continue to experience higher rates of mental health outcomes and risk behaviors compared with their White counterparts (Banta et al., 2014; Centers for Disease Control & Prevention, 2018; Cornelius et al., 2020). Some of the well-investigated contributing factors behind health disparities include socioeconomic status (Dressler et al., 2005; Hogben & Leichter, 2008) and geographic location (Giovenco et al., 2019; Lutfi et al., 2015). Yet, the disproportionate burden of adverse health outcomes experienced by Black, American Indian, and Latinx groups in particular persists after accounting for such factors. Therefore, the inclusion of ACEs in the examination of contributing mechanisms for health disparities is warranted.

While our findings further understanding of the impact of ACEs gender, racial, and ethnic differences in short term and long-term associations between ACEs, mental health, and risk behaviors, we recognize that our analyses did not capture the variability that exists within population groups. Within-group follow-up analyses are recommended for a more nuanced examination of the impact of polyvictimization on mental health outcomes and risky behaviors within sex, racial, and ethnic groups. Within-group analyses can help characterize the range of adverse to positive outcomes experienced by individuals in predominantly racial and ethnic minority communities and to identify protective factors that help individuals thrive, despite experiences of childhood adversity. Additional future research could build upon our findings using larger sample sizes of historically underrepresented and oppressed racial and ethnic groups in the U.S. to allow for intersectional analyses of sex, race, and ethnicity. Findings from studies examining within-group variations and intersectional identities may have important implications for the development of gender-responsive and culturally informed preventive interventions to hinder exposure to ACEs in the first place and mitigate its adverse impacts over the life course.

Conclusion

Our study provides unique insights into the cumulative impact of ACEs, with longitudinal data from large samples assessed at important time points over the life course, from emerging adulthood through adulthood. Results expand on findings from cross-sectional studies by including proximal outcomes at mean age 21 and distal outcomes at mean age 38. Examination of associations at two time points is relevant, as social demographics that impact risk behaviors (e.g., marital status, education) change over adulthood. Our findings highlight that childhood polyvictimization may not impact all population groups homogeneously and may contribute to health disparities among specific groups (i.e., women and individuals of American Indian descent).

Our findings support the need for policies and public investment to offset historical exclusion of (and structural racism impacting) Latinx, Black, and American Indian communities that may contribute to an increased exposure to ACEs among Latinx, Black, and American Indian children. The reduction of disproportionate exposure to ACEs can foster the attainment of health equity across gender groups, as well as across racial and ethnic groups. According to the Centers for Disease Control and Prevention (2021), health equity is “achieved when every person has the opportunity to ‘attain his or her full health potential’ and no one is ‘disadvantaged from achieving this potential because of social position or other socially determined circumstances’”. As such, the promotion of social and environmental conditions for *all* children to thrive in a protected, safe environment, can facilitate opportunities for *all* individuals to achieve their full potential over adulthood. Given observed racial disparities in our work and other research, targeted efforts might be needed for select communities to ensure equitable conditions and outcomes.

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Availability of Data and Material Access to Add Health restricted-use data were obtained through the University of North Carolina at Chapel Hill.

Code Availability Upon request.

Declarations

Ethics Approval This article consisted of analysis of de-identified data and it does not contain any studies with human participants performed by any of the authors.

Consent to Participate N/A

Consent for Publication Yes.

Conflicts of Interest The authors declare no conflict of interest.

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