

# Adverse Childhood Experiences and Health-Related Quality of Life in Adulthood in American Indians and Alaska Natives

Andrei Stefanescu, PhD, MS, and Amy Hilliker, BA

*Abstract: Adverse childhood experiences (ACEs) can result in trauma that persists into adulthood. The goal of this study was to estimate the associations of ACEs with health-related quality of life (HRQOL) metrics in American Indian and Alaska Native (AI/AN) adults in the United States using data from the 2015-2019 Behavioral Risk Factor Surveillance System. Adults (n = 1,389) were asked about current health and ACEs during childhood. ACE score was defined as the total number of ACEs reported. HRQOL outcomes included fair or poor general health, poor general health, poor physical health, poor mental health, and poor physical or mental health. Weighted logistic regression was used to measure the association between ACE score and HRQOL outcomes. A unit increase in ACE score was associated with 14% greater odds of fair or poor general health (OR = 1.14, 95% CI: 1.06, 1.23) and nearly 30% greater odds of poor mental health in the last 30 days (OR = 1.29, 95% CI: 1.20, 1.40). ACEs pose a threat to quality of life in AI/AN adults. These results highlight the need for ACEs prevention in AI/AN communities. Future studies should identify factors associated with resilience to best inform prevention and treatment strategies.*

## INTRODUCTION

Adverse childhood experiences (ACEs) are events occurring from birth to age 17 that can result in long-term trauma that persists into adulthood (Centers for Disease Control and Prevention [CDC], 2021). Examples of ACEs include physical, emotional, and sexual abuse; living in a household with substance use problems; parental separation; and parental incarceration (CDC, 2021). ACEs are associated with numerous chronic illnesses and adverse health outcomes in adulthood, including cancer, heart disease, type 2 diabetes, chronic obstructive pulmonary disease, heavy drinking, depression, and poor oral health (Akinkugbe et al., 2019; Amemiya et al., 2019;

Deschênes et al., 2021; Hu et al., 2021; Merrick et al., 2019). Several studies have also identified a strong association between the number of ACEs experienced in childhood and health-related quality of life in adulthood (Chanlongbutra et al., 2018; Corso et al., 2008; Gjelsvik et al., 2014; Jelley et al., 2020; Martín-Higarza et al., 2020; Masheb et al., 2021).

American Indians and Alaska Natives (AI/ANs) are disproportionately impacted by ACEs. A recent analysis of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) found that AI/AN respondents reported the highest number of ACEs on average and had the highest rates of parental substance abuse, household violence, physical abuse, and sexual abuse of all race/ethnicity groups examined (Richards et al., 2021). These findings are consistent with other analyses of large, population-based data sets, which have found significantly higher ACE scores in AI/AN respondents compared to non-Hispanic Black, non-Hispanic White, and Hispanic respondents (Giano et al., 2021; Kenney et al., 2016). Two regional studies conducted in South Dakota also found that, compared to White residents, AI/AN residents had significantly higher ACE scores (Moon et al., 2016; Warne et al., 2017).

To date, three studies have examined associations between ACE score and health outcomes in AI/AN populations. A study looking at AI/AN adults with type 2 diabetes in five AI/AN communities in the Upper Midwest found significant negative associations between ACE score and mental and physical health (Brockie et al., 2018). Two studies of AI/AN residents of South Dakota found that higher ACE scores were associated with depression, anxiety, alcohol misuse, smoking, and post-traumatic stress disorder in adulthood (Moon et al., 2016; Warne et al., 2017). According to the literature, these associations have not been investigated in other AI/AN populations. The primary goal of this study was to estimate the associations of ACEs with health-related quality of life metrics and chronic illness in adulthood in a diverse, multi-state sample of AI/AN participants living in the United States.

## **METHODS**

### **Study Design**

The Behavioral Risk Factor Surveillance System (BRFSS) is a cross-sectional telephone survey of adults 18 and older conducted annually in all 50 U.S. states, the District of Columbia (DC), and three U.S. territories. BRFSS data collection focuses on health behavior, chronic illnesses, and prevention. Since 2009, BRFSS has included an optional ACEs module including

11 questions about childhood experiences including physical, sexual, and emotional abuse; domestic violence; living with someone with drug addiction, alcohol addiction, or mental illness; parental separation; and incarceration of a household member (CDC, 2020).

For this study, we analyzed BRFSS data that were collected between January 2015 and December 2019 from the 17 states that reported ACEs data to the CDC. Survey respondents were included if they self-identified as AI/AN and provided valid answers to the ACEs module questions. After applying these criteria, the final sample size was  $n = 1,389$ . BRFSS data were collected as part of routine public health surveillance, so this project was exempt from Institutional Review Board approval.

### Variables

Each ACEs question was converted to a binary variable. If a respondent answered that they experienced that ACE, the value was set to 1. Otherwise, the value was set to 0. ACE score was calculated as the sum of all individual ACE variables and ranged from 0 to 11. Because data at higher ACE scores was sparse, ACE scores between 6 and 11 were collapsed into one category. This ACE score variable (6 or more ACEs) was used as the primary predictor.

The primary health-related quality of life (HRQOL) outcomes were self-reported fair or poor general health and self-reported poor general health. For the first outcome, the fair and poor categories were combined to create an outcome measure representing less than good general health. Secondary outcomes included poor physical health (15+ days of previous 30 days experiencing physical illness or injury; yes/no), poor mental health (15+ days of previous 30 days experiencing stress, depression, or other emotional problems; yes/no), and poor physical or mental health (15+ days of previous 30 days that physical or mental health restricted the respondent from usual activities such as self-care, work, and recreation; yes/no).

Covariates included biological sex (male/female), state of residence, age (categorized into 5-year windows), and annual household income (<10K, 10-<15K, 15K-<20K, 20K-<25K, 25K-<35K, 35K-<50K, 50K-<75K, and  $\geq 75K$ ). Income and age were analyzed as continuous variables.

### Statistical Analysis

A summary of the study sample is presented in Table 1. Categorical variables are summarized using frequencies and weighted percentages, and continuous variables are summarized using medians and interquartile ranges. Weighted logistic regression is used to

calculate odds ratios (OR) and 95% confidence intervals (CI) for associations between continuous ACE score and HRQOL outcomes. Results are reported after adjusting for sex, state of residence, age, and income. Statistical significance was defined a priori for these analyses as  $\alpha = 0.05$ . Data management and analyses were completed using SAS 9.4.

## RESULTS

A summary of participant characteristics is presented in Table 1. After weighting, a majority of the sample was male, most respondents were in the 40-64 age range, and the respondent household income distribution was flat. Approximately 17% of the sample was composed of respondents from New Mexico, a state with a large proportion of American Indian residents. However, several states with large AI/AN populations, including Arizona, California, and Oklahoma, were not represented in the sample. Respondents reported a median of 1.8 total ACEs. Univariate summaries of the outcome variables are presented in Table 2. About a third of the sample (33.6%) reported fair or poor general health, with 11.7% reporting poor general health.

Adjusted associations between ACE score and HRQOL outcomes can be seen in Table 3. ACE score was significantly associated with all five HRQOL outcomes that we investigated. A unit increase in ACE score was associated with 14% greater odds of self-reported fair or poor general health ( $OR = 1.14$ , 95% CI: 1.06, 1.23) and 11% greater odds of self-reported poor physical health ( $OR = 1.11$ , 95% CI: 1.03, 1.20). The strongest association we identified was between ACE score and self-reported poor mental health in the last 30 days. A unit increase in ACE score was associated with nearly 30% greater odds of reporting poor mental health in the last 30 days ( $OR = 1.29$ , 95% CI: 1.20, 1.40).

**Table 1**  
**Participant characteristics (n = 1,389)**

<b>Variable</b>	<b>n</b>	<b>Weighted %</b>
<b>Sex</b>		
Male	659	55.6%
Female	730	44.3%
<b>Annual Household Income</b>		
< \$10,000	144	12.9%
\$10,000-<\$15,000	128	8.5%
\$15,000-<\$20,000	168	10.5%

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## ADVERSE CHILDHOOD EXPERIENCES AND QUALITY OF LIFE 5

**Table 1 continued**  
**Participant characteristics (n = 1,389)**

Variable	<i>n</i>	Weighted %
<b>Annual Household Income (cont.)</b>		
\$20,000-<\$25,000	151	13.6%
\$25,000-<\$35,000	138	11.5%
\$35,000-<\$50,000	139	12.8%
\$50,000-<\$75,000	127	11.3%
≥ \$75,000	192	19.0%
<b>State of Residence</b>		
Alabama	83	6.8%
Delaware	23	0.7%
Florida	125	4.7%
Indiana	50	6.6%
Iowa	26	1.9%
Michigan	71	10.9%
Mississippi	39	4.0%
Missouri	63	8.3%
New Mexico	438	17.4%
North Dakota	174	3.6%
Pennsylvania	21	7.6%
Rhode Island	35	1.3%
South Carolina	50	6.5%
Tennessee	60	6.7%
Virginia	42	6.4%
West Virginia	28	1.8%
Wisconsin	61	5.0%
<b>Age Group (years)</b>		
18-24	67	8.1%
25-29	74	7.5%
30-34	73	7.3%
35-39	88	9.6%
40-44	98	10.6%
45-49	117	10.4%
50-54	130	9.5%
55-59	151	9.4%
60-64	186	10.0%
65-69	140	5.9%
70-74	114	5.1%
75-79	59	3.1%
80+	73	3.6%
<b>ACE Score</b> (median, [Q1, Q3])	1.8	[0.1, 4.4]

**Table 2**  
Participant outcomes (*n* = 1,389)

Variable	<i>n</i>	Weighted %
<b>Fair or Poor General Health</b>		
Yes	468	33.6%
No	914	66.4%
<b>Poor General Health</b>		
Yes	173	11.7%
No	1209	88.3%
<b>Physical Health Poor 15+ of Last 30 Days</b>		
Yes	307	21.3%
No	1029	78.7%
<b>Mental Health Poor 15+ of Last 30 Days</b>		
Yes	245	20.3%
No	1106	79.7%
<b>Physical or Mental Health Poor 15+ of Last 30 Days</b>		
Yes	222	15.9%
No	1125	84.1%

**Table 3**  
Adjusted associations between ACE score and health-related quality of life\*

Outcome	Odds Ratio per Unit Increase in ACE Score	95% Confidence Interval	p Value
<b>Fair or Poor General Health</b>	1.14	1.06, 1.23	<0.001
<b>Poor General Health</b>	1.10	1.01, 1.21	0.035
<b>Poor Physical Health</b>	1.11	1.03, 1.20	0.008
<b>Poor Mental Health</b>	1.29	1.20, 1.40	<0.001
<b>Poor Physical or Mental Health</b>	1.26	1.17, 1.37	<0.001

\*Models are adjusted for age, biological sex, income, and state of residence

## DISCUSSION

Adverse effects of ACEs historically reported in the general population are now being confirmed in the AI/AN community. In a recent publication, Elm et al. (2020) found that high ACE scores are associated with increased risk of depression and generalized anxiety disorder in American Indian adults with type 2 diabetes. In AI/AN children, Kenney et al. (2016) found that high ACE scores are associated with numerous adverse psychosocial outcomes, including

depression, anxiety, attention deficit hyperactivity disorder, low grades, and behavioral problems, possibly forming a bridge to poor mental health outcomes in adulthood. The current study confirms and builds on these results, demonstrating a negative overall association of ACEs with poor mental health in adulthood. This study is also the first to provide AI/AN-specific evidence of association between ACEs and poor physical health in adulthood in a large, multi-state data set. These results emphasize the seriousness of ACEs as a public health problem in the AI/AN population.

Preventing ACEs in AI/AN communities is critical. High ACE scores place affected individuals at risk for re-victimization later in life. In a national sample, AI/AN women with higher ACE scores were more likely to report physical intimate partner violence as adults (Pro et al., 2020). The long-term effects of ACEs can also be transgenerational, and ACE scores can have adverse effects on parenting outcomes. Childhood physical abuse was negatively associated with both parental dissatisfaction and parental role impairment in a large sample of AI/AN parents (Libby et al., 2008). Wurster et al. (2020) found that ACEs in AI/AN parents are negatively associated with their children's social-emotional functioning by way of parental emotional distress. The authors also identified a potential intervention point – high parental emotional availability diminished this relationship (Wurster et al., 2020).

Several other factors may mitigate the association between ACEs and adverse outcomes in adulthood. Bellis et al. (2017) showed that having always-available trusted adult support during childhood diminishes the harmful effects of ACEs. Strengthening tribal community bonds can also reduce harm associated with ACEs in adulthood. A recent study found that sense of belonging to the tribal community moderated the relationship between ACEs and inflammatory markers in a sample of 90 members of a Blackfeet community (John-Henderson et al., 2020). In a sample of Indigenous residents living with type 2 diabetes, social support also moderated the relationship between ACEs and physical health (Brockie et al., 2018).

This study has several key strengths. Using national BRFSS data provided a large sample size that allowed for precise estimation of measures of association. The population-based design of BRFSS provided for more accurate estimates than studies based on convenience samples or that used more restricted sampling frames. States with primarily rural and primarily urban AI/AN populations were included in the sample, providing greater diversity and representation of different built environments. The breadth of data collected through BRFSS also allowed us to adjust for major confounders that could have threatened the validity of a smaller study.

The BRFSS methodology also has certain limitations. BRFSS is a telephone-based survey, so many individuals living on rural reservation lands, where telephone access may be limited, are not covered in the survey's sampling frame. Additionally, several key states with large AI/AN populations, including Arizona, Oklahoma, Alaska, and California were not represented in the sample at all. These issues limit the generalizability of the study's findings, and follow-up investigations should aim to fill these knowledge gaps. Self-report of the variables used for this analysis is also a limitation. Imprecision in self-reported race/ethnicity may have impacted the respondents who were included in the study, and self-report of childhood ACEs introduces the threat of recall bias. While the models were adjusted for known major confounders, there is still a possibility of residual confounding from unmeasured confounders.

Despite these limitations, this study provides valuable insight into the scope of ACEs as a threat to AI/AN health and quality of life across the life course. Investigators should make efforts to conduct regional follow-up studies to assess these relationships with a more geographic focus. The relationships between ACE score and adult outcomes are likely to differ by region, as AI/AN residents of different regions of the United States experience different socioeconomic, natural, and built environments. For example, Libby et al. (2008) found that substance use fully mediated the relationship between childhood physical abuse and parental outcomes in Northern Plains tribes. However, these relationships were only partially mediated in Southwestern tribes, indicating that other factors influence these relationships in this region (Libby et al., 2008). The Indigenous population of the United States is exceptionally diverse and includes more than 550 federally recognized tribes in addition to state-recognized tribes and other Indigenous communities. There can be vast differences in culture, language, dietary patterns, and lifestyles among different tribes, especially across long distances. Another avenue for future investigation is operationalizing and assessing the impact of these cultural factors on the relationship between ACEs and health outcomes in adulthood.

Addressing ACEs as a public health problem will require a multipronged approach focusing on both prevention and mitigation. Developing strategies to reduce household destabilization in AI/AN children should be a major priority. Collaborative and family-centered approaches tailored to AI/AN communities may prevent out-of-home placement for at-risk AI/AN children, improve parent-child relationships, and prevent family separation (Lucero & Bussey, 2012). Expanding awareness of factors that mitigate the relationship between ACEs and poor outcomes in adulthood can also help inform interventions to build individual- and community-



level resilience, reduce the future health burden on AI/AN children, and improve quality of life in adults impacted by ACEs. In both children and adults, decolonized approaches to clinical counseling and integration of traditional therapeutic practices in health and wellness services may offer additional benefit to those impacted by ACEs (Gone et al., 2020; Gone, 2021). An effective example of such an approach is the Urban American Indian Traditional Spirituality Program in Detroit. This program introduced urban American Indian community members to traditional Indigenous spiritual practices aimed at improving health and well-being (Gone et al., 2020).

This study contributes to a growing body of literature on the harmful health consequences of ACEs in the AI/AN population. Given the high prevalence of ACEs in AI/ANs, it is imperative to both prevent ACEs and provide appropriate care to individuals who have been impacted by ACEs. Therapeutic and preventative strategies tailored to specific community and individual needs can reduce the health burden of ACEs on AI/AN communities and improve quality of life for AI/AN individuals. These strategies should be designed and implemented in collaboration with tribal community leaders to avoid paternalistic, oppressive, colonizing, or counterproductive interventions.

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### CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

**AUTHOR INFORMATION**

Andrei Stefanescu, PhD, MS, is an Epidemiologist and Data Analytics Team Lead at the Los Angeles County Department of Public Health in Los Angeles, CA. Amy Hilliker, BA, is an M.S. student in clinical counseling at Bellevue University, College of Arts and Sciences in Bellevue, NE.