



**Childhood Substance Abuse
Exposure and Prescription Opioid
Misuse in Adulthood: 2019 Indiana
Behavioral Risk Factor Surveillance
System Survey**



**Indiana
Department
of
Health**



CHILDHOOD SUBSTANCE ABUSE EXPOSURE AND PRESCRIPTION OPIOID MISUSE IN ADULTHOOD: 2019 INDIANA BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM SURVEY

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ABSTRACT

Indiana is in the midst of an opioid epidemic, with a significant portion of the burden associated with prescription opioids. This study examined the relationship between the adverse childhood experience (ACE) of household member substance abuse and prescription opioid misuse in adulthood using data from the 2019 Indiana Behavioral Risk Factor Surveillance System survey. A multivariate logistic regression model was conducted to examine the relationship between childhood substance abuse exposure and prescription opioid misuse in adulthood while controlling for sex, age, race, education, and other ACE exposures. An additional set of multivariate logistic regression models was also conducted to examine the relationships between childhood substance abuse exposure and various health behaviors and outcomes in adulthood, including smoking, binge drinking, risky sexual behaviors, health-related quality of life, depressive disorder, asthma, and chronic obstructive pulmonary disease (COPD), while adjusting for the same covariates as the first model. Prevalence estimates indicated that childhood substance abuse exposure significantly differed across age, income, education, and homeownership. After adjusting for demographic factors and exposure to other ACEs, those who were exposed to household member substance abuse in childhood had 1.69 times greater odds of misusing prescription pain medications in adulthood than those who were not exposed to household member substance abuse. In addition, exposure to household member substance abuse in childhood was significantly associated with five out of seven of the various health outcomes after adjusting for demographic factors and exposure to other ACEs.

INTRODUCTION

In 2014, substance use disorder was estimated to affect approximately 21.5 million individuals aged 12 years or older in the United States (SAMHSA, 2014). Substance use disorder (SUD) is defined as a recurrent use of alcohol and/or other drugs that cause clinically significant impairments including health problems, disability, and early death (SAMHSA, 2014). The most frequently characterized substances of SUD include alcohol, nicotine products, marijuana, opioids, cocaine, and methamphetamine (SAMHSA, 2014). A national survey on drug use and health examined a 10-year trend of Indiana prevalence estimates on commonly abused substances and found that among Indiana residents, alcohol was the most used substance, followed by tobacco, marijuana, and opioids (Balio et al., 2017). The rise of opioid usage in Indiana has negatively impacted life expectancy and become the primary attributing substance in overdose deaths (Haskins, 2019). While substance use trends vary within the United States, data from the National Center for Health Statistics found that between 2000 and 2013, age-adjusted rates for opioid-related deaths increased significantly across all ages, races, ethnicity groups, and regions of the country. The Midwest region suffered the greatest impact, with opioid-related deaths increasing 11-fold by 2013 (Hedegaard et al., 2015). In 2015, overdose deaths in Indiana consisted of approximately 1,245 casualties, more than doubling the rate since 2005 (Indiana Department of Health, 2017). By 2017, Indiana reached its peak overdose deaths, with more than 1,800 fatalities (Indiana Department of Health, 2017).

The devastating effects of SUD have become more apparent as a critical public health issue. Over the past few decades, subject matter experts have explored upstream factors and identified social and environmental factors such as early life experiences associated with harmful effects on lifelong health and life expectancy. Previous population health analyses demonstrated that SUD is associated with adverse childhood experiences and mental illness (Choi et al., 2017; Cavanaugh et al., 2015). Adverse childhood experiences (ACEs) are defined as traumatic experiences and events, such as childhood abuse, household neglect and violence, that occur in individuals between the ages of 0 and 17 years. Researchers have found strong associations between cumulative ACE exposures and subsequent substance abuse in adulthood (Austin & Shanahan, 2018; Merrick et al., 2020; Stein et al., 2017).

While the effects of multiple ACEs have been observed in many research studies, indicating such experiences may predict prescription opioid misuse in adulthood, there is limited study literature that has examined the relationship between the ACE of household member substance abuse exposure specifically with prescription opioid misuse in adulthood, while controlling for the effects of the other ACE exposures. Thus, the purpose of the study is to investigate the relationship between household member substance abuse exposure in childhood and later prescription medication misuse in adulthood while adjusting for demographic factors and other ACE exposures. In addition, as findings from recent studies on ACEs have demonstrated their association with negative health outcomes (e.g., chronic diseases and health risk behaviors including excessive smoking and drinking), poor quality of life, and premature death (Jia & Lubetkin, 2020; Campbell et al., 2016; Crouch et al., 2017), the secondary purpose of this study is to examine the relationships between household member substance abuse exposure in childhood and various health outcomes in adulthood.

METHODS

DATA SOURCE

This study utilized data from the 2019 Indiana Behavioral Risk Factor Surveillance System (BRFSS), an annually conducted telephone survey that collects information about Indiana residents' health-related behaviors, chronic health conditions, and access and use of health care and preventative services. In 2018, Indiana began including the 11 ACE questions developed by the Centers for Disease Control and Prevention (CDC) that were adapted from the original CDC-Kaiser ACE Study.

ACE CATEGORIZATION

Table 1 displays the 11 ACE questions that were added to the Indiana BRFSS. The 11 ACE questions were categorized into three types of abuse and five types of household dysfunction, for a total of eight ACE categories: emotional abuse, physical abuse, sexual abuse, household member mental illness, household member substance abuse, household member incarceration, parental divorce/separation, and household domestic violence. For each ACE category containing a response of "yes", "no", or "don't know/refused", respondents indicating "yes" were classified as exposed and respondents indicating "no" were classified as not exposed. For any ACE category containing a response of "never", "once", or "more than once", respondents indicating "never" were classified as not exposed and respondents indicating "once" or "more than once" were classified as exposed, with the exception of emotional abuse exposure. While some previous studies have defined emotional abuse exposure by responses indicating "once" or "more than once", this study defined emotional abuse exposure only as responses indicating "more than once" (Stabler, M., & Perveen, G., 2017).

Table 1: BRFSS ACE Questions and Categories

ACE Category	BRFSS Question
Child Abuse	
Emotional abuse (More than once)	"How often did a parent or adult in your home ever swear to you, insult you, or put you down?"*
Physical abuse (Once or more than once)	"How often did a parent or adult in your home ever hit, beat, or physically hurt you in any way?"
Sexual abuse (Once or more than once to any of the following questions)	"How often did anyone at least 5 years older than you, or an adult, ever touch you sexually?" "How often did anyone at least 5 years older than you, or an adult, try to make you touch them sexually?" "How often did anyone at least 5 years older than you, or an adult, force you to have sex?"
Household Dysfunction	
Parental separation/divorced (Yes)	"Were your parents separated or divorced?"

Incarcerated household member (Yes)	"Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?"
Substance abuse in the household (Yes to either of the following questions)	"Did you live with anyone who was a problem drinker or alcoholic?" "Did you live with anyone who used illegal street drugs or who abused prescription medications?"
Domestic violence in the household (Once or more than once)	"How often did your parents or adults in your home ever slap, hit, kick, punch, or beat each other up?"
Mental illness in the household (Yes)	"Did you live with anyone who was depressed, mentally ill, or suicidal?"

MAIN PREDICTOR

The main predictor assessed in this study was exposure to household member substance abuse during childhood. Respondents indicating “yes” to either of the following two questions, “Did you live with anyone who was a problem drinker or alcoholic?” or “Did you live with anyone who used illegal street drugs or who abused prescription medications?”, were classified as exposed to household member substance abuse. Those who responded with “don’t know” or refused to answer either of the two questions were excluded from this study.

MAIN OUTCOME

The 2019 Indiana BRFSS survey incorporated six questions regarding prescription and non-prescription painkiller use in adulthood, including self-reported non-prescription opioid misuse and feelings of dependence on prescription painkillers. Respondents who reported “yes” to using prescription pain medication that was not prescribed to them by healthcare providers were defined as prescription pain medication misusers. Respondents who reported “do not know or refused” to using prescription pain medication that was not prescribed to them by healthcare providers were excluded from analyses.

SECONDARY OUTCOMES

A number of health risk indicators were assessed in the 2019 Indiana BRFSS survey, such as smoking; binge drinking habits; engagement in risky sexual behaviors; and self-reported general, physical, and mental health status indicators. Smoking was defined as individuals who reported that they currently smoke. Binge drinking was defined as males having five or more drinks on one occasion or females having four or more drinks on one occasion. Engagement in risky sexual behaviors was defined as individuals who reported having exchanged money or drugs for sex, injected any non-prescription drugs, or received treatment for a sexually transmitted infection within the past year. Lastly, in accordance with the CDC and its collaborative efforts to develop a BRFSS tool that measures quality of

life (CDC, 2000; Chanlongbutra et al., 2018), a health-related quality of life (HRQL) indicator was constructed using the following four general, physical, and mental health status questions:

1. Would you say that, in general, your health is excellent, very good, good, fair, or poor?
2. Now thinking about your physical health, which includes physical illness and injury, how many days during the past 30 days was your physical health not good?
3. Now thinking about your mental health, which includes stress, depression, and problems with emotions, how many days during the past 30 days was your mental health not good?
4. During the past 30 days, approximately how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

To construct the HRQL indicator, each of the four questions was dichotomized and assigned a point value based on the dichotomization for summation into a single HRQL score. For the first question, individuals who responded with "fair" or "poor" were assigned a point value of 1, indicating poor general health. Questions 2 through 4 were dichotomized into a binary "unhealthy days" indicator; individuals who responded to questions 2 through 4 with a number of days equal to or greater than 14 were assigned a point value of 1 for the respective question, indicating frequent mental or physical distress (CDC, 2004). All four questions' point values were summed into a final HRQL score, ranging from 0 to 4, with a higher score indicating poorer health. Lastly, the HRQL score was dichotomized, with a score ranging from 0 to 2 classified as "Good health-related quality of life" and a score of 3-4 classified as "Poor health-related quality of life" (Dumas et al., 2020; Chen et al., 2014).

Several health conditions were also evaluated in this report, including depressive disorder, chronic obstructive pulmonary disease (COPD), and asthma. Depressive disorder was defined as individuals who reported having ever been diagnosed with depression, major depression, dysthymia, or minor depression. COPD was defined as individuals who reported having ever been diagnosed with COPD, emphysema, or chronic bronchitis. Asthma was defined as individuals who reported currently being diagnosed with asthma.

COVARIATES

This study's analyses adjusted for a number of covariates, including demographic factors (i.e., sex, age, race, and education) and exposure to other ACEs. Sex was dichotomized into male or female. Age was categorized into the following six groups: 18-24, 25-34, 35-44, 45-54, 55-64, and 65+. Race was categorized into the following four groups: White Non-Hispanic, Black Non-Hispanic, Multiracial/Other Race, Non-Hispanic, and Hispanic. Education was categorized into the four following groups: did not graduate high school, graduated high school, attended college or technical school, and graduated college or technical school.

As previous research has demonstrated that ACEs are highly interrelated (Wade et al., 2017), it is likely that respondents who were exposed to household substance abuse during childhood also experienced one or more other ACEs; therefore, a composite "ACE score" was calculated to sum up each of the other measured seven ACEs (i.e., excluding the household member substance abuse ACE) to be used for

adjustment in analyses. This cumulative, adjusted ACE score was then categorized into three distinct groups: "0 ACEs" for those who reported only experiencing household substance abuse, "1-2 ACEs" for those who reported one or two additional ACE exposures, and "3+ ACEs" for those who reported three or more additional ACE exposures.

STATISTICAL ANALYSIS

All analyses for this study were conducted by using SAS version 9.4. Only weighted percentages and analyses are presented; the methods for developing BRFSS weighting and stratification variables have been described in detail elsewhere (CDC, 2019). All missing data were excluded from analyses.

Prevalence estimates of household substance abuse exposure by demographic factors, including sex, age, race, income, education, and home ownership, were calculated. Prevalence estimates were also calculated for household substance abuse exposure by the categorized, adjusted ACE score and other individual ACE exposures. These associations were considered statistically significant if Wald chi-square tests produced p-values less than .05.

In assessing the primary outcome, a multivariate logistic regression model was conducted to examine the relationship between household substance abuse exposure and prescription pain medication misuse, while adjusting for demographic factors and other ACE exposures. An additional set of multivariate logistic regression models was conducted to assess the relationships between household substance abuse exposure and various health risks and outcomes, including smoking, binge drinking, risky sexual behaviors, depressive disorder, asthma, COPD, and HRQL, all while controlling for the same covariates as the first model.

RESULTS

All analyses were performed using the weighting and stratification variables from the 2019 Indiana BRFSS dataset. The sample contained 6,881 responses that were included for analysis, excluding a total of 1,511 missing results.

PREVALENCE OF HOUSEHOLD MEMBER SUBSTANCE ABUSE EXPOSURE BY DEMOGRAPHIC CHARACTERISTICS AND ACES STATISTICAL ANALYSIS

Table 2 demonstrates the prevalence of household member substance abuse exposure by demographic factors, cumulative adjusted ACE score categorization, and the individual ACE categories. The prevalence of exposure to household substance abuse was higher amongst younger age groups, individuals with less than \$15,000 annual household income, individuals who did not graduate high school, and individuals who do not own a home compared to their respective counterparts; however, exposure to household substance abuse did not significantly differ among sex or race.

Approximately 65% of respondents who had an ACE score of three or more reported household member substance abuse, while approximately 25% of respondents who had an ACE score of one or two reported household substance abuse. Only 8% of respondents who reported experiencing no other

ACEs were exposed to household substance abuse. The three ACEs that were most associated with household substance abuse exposure were household incarceration, domestic violence, and sexual abuse; 78% of respondents who reported household incarceration, 68% of respondents who reported domestic violence, and 64% of respondents who reported sexual abuse also reported household substance abuse.

Table 2: Prevalence of Household Substance Abuse Exposure by Demographic Factors and Other ACEs							
	Sample Size	Household Substance Abuse Exposure		No Exposure		p-value	
	Total (N=6,881)	%	95% CI	%	95% CI		
Sex							
Male	3,071	28.2182	23.44-27.49	71.7818	72.20-76.55	0.053	
Female	3,810	25.4707	26.30-30.13	74.5293	69.86-73.70		
Age							
18-24	339	31.2918	25.89-36.68	68.7082	63.31-74.10	<.0001	
25-34	587	32.1363	27.90-36.37	67.8637	63.62-72.10		
35-44	713	32.2786	28.35-36.20	67.7214	63.80-72.64		
45-54	1,046	26.6464	23.62-29.67	73.3536	70.33-76.38		
55-64	1,454	26.2914	23.67-28.90	73.7086	71.09-76.32		
65+	2,742	17.2267	15.50-18.95	82.7733	81.04-84.50		
Race							
Black#	433	28.1793	22.40-33.95	71.8207	66.04-77.60	0.07	
Hispanic	280	24.2221	18.17-30.27	75.7779	69.73-81.82		
Multi/Other Race#	272	24.8890	18.23-31.54	75.1110	68.45-81.77		
White#	5,788	27.1909	25.67-28.70	72.8091	71.29-74.33		
Income							
<\$15,000	477	33.8634	28.32-39.40	66.1366	60.59-71.68	<.0001	
\$15,000-\$25,000	953	27.5377	23.78-31.29	72.4623	68.71-76.21		
\$25,000-\$35,000	616	32.2198	27.13-37.30	67.7802	62.70-72.86		
\$35,000-\$50,000	819	28.8407	24.63-33.05	71.1593	66.95-75.37		
\$50,000+	2,693	26.2928	24.16-28.43	73.7072	71.57-75.84		
Education							
Did not graduate HS	470	31.8192	26.54-37.10	68.1808	62.90-73.46	0.049	
Graduated HS	2,154	27.1416	24.69-29.59	72.8584	70.40-75.31		
Attended College\$	1,791	29.9182	27.30-35.53	70.0818	67.46-72.70		
Graduated College	2,435	20.4912	18.51-22.47	79.5088	77.53-81.49		
Homeownership							
Rent Home	1,348	35.0573	31.76-38.335	64.9427	61.65-68.23	<.0001	
Own Home	5,193	24.3548	22.78-225.92	75.6452	74.08-77.21		
Other Arrangements	273	31.6595	24.75-38.57	68.3405	61.43-75.25		

Cumulative Adjusted ACE Score						
0 ACEs	3,257	8.0315	6.81-9.24	91.9685	90.76-93.18	
1-2 ACEs	2,413	25.0876	22.87-27.30	74.9124	72.70-77.13	
3+ ACEs	1,120	65.6369	62.20-69.07	34.3631	30.93-37.80	<.0001
Household Mental Illness						
No Exposure	5,821	19.2522	17.92-20.58	80.7478	79.42-82.08	
Exposure	1,060	58.0436	54.43-61.65	41.9564	17.92-20.58	<.0001
Household Incarceration						
No Exposure	6,455	21.4591	20.15-22.77	78.5409	77.23-79.85	
Exposure	426	78.1617	73.49-82.84	21.8383	17.16-26.51	<.0001
Parental Separation/Divorce						
No Exposure	5,182	17.9844	16.61-19.36	82.0156	80.64-83.39	
Exposure	1,608	46.1252	43.11-49.14	53.8748	50.86-56.89	<.0001
Household Domestic Violence						
No Exposure	5,836	18.0573	16.75-19.37	81.9427	80.36-83.26	
Exposure	1,045	67.6963	64.22-71.17	32.3037	28.83-35.78	<.0001
Physical Abuse						
No Exposure	5,295	19.5399	18.09-20.99	80.4601	79.01-81.90	
Exposure	1,586	48.8783	45.74-52.01	51.1217	47.99-54.26	<.0001
Emotional Abuse (More Than Once)						
No Exposure	5,098	15.7860	14.44-17.13	84.2140	82.87-85.56	
Exposure	1,783	53.0302	50.12-55.94	46.9698	44.06-49.88	<.0001
Sexual Abuse						
No Exposure	6,628	24.9573	23.57-26.34	75.0427	73.66-76.43	
Exposure	253	64.6224	57.36-71.89	35.3776	28.11-42.64	<.0001

* Percentages may not add up to 100% due to missing responses. Responses which were listed as "Don't Know/Not Sure" or "Refused" were classified as missing values in the analysis.
† Frequencies were weighted using the LLCPWT variable from the BRFSS.
95% confidence limits for each stratified frequency are presented in brackets.
‡ Calculated Wald Chi-Square p-value
§ Non-Hispanic
§ Includes technical school

ASSOCIATION BETWEEN HOUSEHOLD MEMBER SUBSTANCE ABUSE EXPOSURE AND PRESCRIPTION PAIN MEDICATION MISUSE

Table 3 demonstrates the results from the multivariate logistic regression model that examined the relationship between household member substance abuse in childhood and prescription pain medication misuse in adulthood. After adjusting for demographic characteristics and cumulative adjusted ACE score, the model demonstrated that childhood household substance abuse exposure was

statistically significantly associated with prescription pain medication misuse in adulthood (aOR 1.69 [95% CI 1.00, 2.85]).

ASSOCIATION BETWEEN HOUSEHOLD MEMBER SUBSTANCE ABUSE EXPOSURE AND SECONDARY OUTCOMES

Table 3 also demonstrates the results from the subsequent multivariate logistic regression models that examined the relationships between household member substance abuse and various health behaviors and conditions, including current smoking, binge drinking, risky sexual behaviors, HRQL, depressive disorder, asthma, and COPD. After adjusting for demographic characteristics and cumulative adjusted ACE score, the models demonstrated that childhood household substance abuse exposure was statistically significantly associated with current smoking (aOR 1.56 [95% CI 1.25, 1.94]), binge drinking (aOR 1.34 [95% CI 1.06, 1.69]), risky sexual behavior (aOR 1.72 [95% CI 1.19, 2.51]), depressive disorder (aOR 1.72 [95% CI 1.41, 2.10]), and COPD (aOR 1.37 [95% CI 1.06, 1.77]). There were no statistically significant associations found between household substance abuse exposure and asthma or HRQL when controlling for demographic factors and other ACEs.

Table 3: Adjusted Odds Ratios for Prescription Pain Medication Misuse and Poor Health Outcomes by Substance Abuse Exposure		
	Household Substance Abuse Exposure	
	aOR	95% CI
Primary Outcome		
Prescription Pain Medication Misuse	1.69	1.00-2.85
Secondary Outcomes		
Current Smoking	2.07	1.24-3.47
Binge Drinking	1.19	0.68-2.11
Risky Sexual Behaviors	3.63	1.90-6.92
HRQL	1.86	1.02-3.40
Depressive Disorder	1.69	1.03-2.78
Asthma	1.45	0.68-3.12
COPD	1.06	0.47-2.36
Abbreviations: aOR - Adjusted Odds Ratio; HRQL- Health-Related Quality of Life; COPD - Chronic Obstructive Pulmonary Disease		
Bold aOR signifies statistical significance at the .05 level.		
Odds Ratios were adjusted for sex, age, race, education, and cumulative adjusted ACE Score, with no exposure to household substance abuse as the referent.		

DISCUSSION

This study uniquely demonstrated the impacts of a specific adverse childhood trauma, household member substance abuse, and its association with prescription opioid misuse in adulthood. Results

from this study indicate that household substance abuse exposure differed significantly by age groups, income, education, homeownership, and other ACE exposures. This study also revealed statistically significant associations between substance abuse exposure with a number of health outcomes, including prescription pain medication misuse, while controlling for demographic factors and other ACE exposures.

Although household member substance abuse is a less common adverse childhood experience, it is important for researchers to address the interrelationships between multiple adverse childhood exposures, especially within high-risk populations (Wade et al, 2017). Given the likelihood of adults reporting more than one ACE exposure during childhood, this study's approach of developing a cumulative, adjusted ACE score to use for adjustment in analyses was consistent with methods used in a similar study that also assessed the effects of one single ACE (Gjelsvik et al., 2014). After adjusting for demographic factors and exposure to other ACEs, Indiana adults who were exposed to household substance abuse in childhood had 1.69 times greater odds of misusing prescription pain medications in adulthood, compared to those who were not exposed to household substance abuse (aOR 1.69 [95% CI 1.00, 2.85]); however, given the lack of precision of this estimate, as demonstrated by the wide 95 percent confidence interval, the strength of this association ranges from minimal to strong. Future research should explore this relationship further to obtain more precise estimates.

This study has several limitations. First, given the cross-sectional nature of its study design, the observed relationships cannot be interpreted as causal. Secondly, using self-report data is inherently susceptible to various biases; for example, there is a strong potential for recall bias, as adult respondents are asked to recall information on exposures that occurred during childhood. Respondents may have also over-reported socially acceptable factors or under-reported stigmatized factors (e.g., prescription pain medication misuse). Thirdly, it could not be assessed whether the relationships were dependent upon the type of household member who abused substances (i.e., parent, sibling, etc.), the duration of exposure to the substance abuse, or the type of substance that was abused. Lastly, as the prescription pain medication use state-added questions only addressed those who misuse prescription pain medications that were not prescribed to them, Indiana's BRFSS program is encouraged to explore additional questions that also address prescription opioid misuse for medication that was actually prescribed to them by healthcare providers; this would ultimately maximize the potential sample size, thus giving researchers greater statistical power to detect true relationships.

Indiana is experiencing a devastating opioid epidemic. Given the continued increase in prescription opioid misuse and opioid-related deaths in Indiana, this study supports the need for addressing adverse childhood events in early life that can influence future rates of substance misuse. The findings demonstrate the effects of household substance abuse exposure as a critical public health concern amongst Indiana's adult population and highlight the need for additional efforts to prevent ACEs and/or mitigate their negative impacts. Trauma-informed intervention methods that prevent or mitigate the harmful effects of ACEs, such as household substance abuse, have the potential to reduce the rate of prescription opioid misuse.

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