

# Adverse Childhood Experiences Affect Health Risk Behaviors and Chronic Health of Iowans

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**Abstract** Adverse childhood experiences (ACEs), include childhood abuse and household dysfunction, and are associated with a variety of behavioral risk factors and chronic illnesses in adulthood. This study replicates the original ACEs study (Felitti et al. *American Journal of Preventive Medicine*, 14(4), 245–258. doi:10.1016/s0749-3797(98)00017-8, 1998) with a representative sample of adults in Iowa. Data come from the Behavioral Risk Factor Surveillance System (BRFSS) survey of 2012 when ACE assessments were first introduced in Iowa by the Centers for Disease Control and Prevention (2012). The majority of adults in Iowa (58%) have experienced at least one ACE, and depending on the type of ACE, co-occurrence of ACEs ranged from 76% to 97%. Health risk behaviors in adulthood, such as drinking, smoking, and obesity were significantly related to the number of ACEs experienced. ACEs were also associated with depression. Chronic health outcomes including heart disease, stroke, and COPD were also significantly predicted by the number of ACEs. This replication study demonstrates that the need for intervention and prevention programs in Iowa are similar to the needs found in other states in the U.S. for addressing the consequences of ACEs.

**Keywords** Adverse childhood events · Child abuse · Chronic health · Health risk behaviors · Trauma

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Between 1995 and 1997, as part of the Adverse Childhood Experiences study, more than 17,000 adult members of the Kaiser Permanente Health Plan completed a survey, retrospectively measuring childhood stress and maltreatment to calculate members' total adverse childhood experiences (ACE) score (Felitti et al. 1998). The original survey focused on ten types of trauma, including abuse (physical, sexual, psychological), neglect (emotional, physical), and household dysfunction (substance abuse, divorce, mental illness, battered mother, and criminal behavior). Participants were also evaluated through physical and mental examinations and ongoing tracking of health to determine associations between early experiences and later behavior and health outcomes.

The original ACEs study found that nearly two-thirds of participants reported at least one ACE and more than one-fifth reported three or more ACEs (Felitti et al. 1998). Additionally, childhood trauma was linked to multiple negative health and social behaviors and outcomes such as alcoholism, illicit drug use, intimate partner violence, smoking, sexually transmitted diseases, adolescent pregnancy, depression, poor health-related quality of life, liver disease, ischemic heart disease, and chronic obstructive pulmonary disease. Researchers found that as the number of ACEs increased, so did levels of risk for major chronic illnesses (e.g. COPD, heart disease, diabetes, stroke). Extensive research has described the negative impact of toxic stress on healthy development via prolonged activation of the stress response system (Teicher et al. 2002). Early experiences with trauma and stress have been linked to changes in the brain, HPA axis, and autonomic nervous system, suggesting that ACEs are related to a devastating and lasting insult on development.

The profound association between childhood trauma and later negative outcomes incited multiple state agencies to address how adverse childhood experiences (ACEs) impact the health and well-being of their residents. A statewide report on

ACEs in Wisconsin, a compilation of ACEs data across an aggregation of states (WI, AR, LA, NM, TN, WA), and work internationally have inspired a closer look at more defined populations. In 2012, the Central Iowa ACEs 360 Steering Committee provided funding to add questions to the Iowa Behavioral Risk Factor Surveillance System (IBRFSS) (Iowa Department of Public Health 2012) in hopes of assessing ACEs in Iowa (Gudmunson et al. 2013). As such, 6361 randomly selected Iowans were administered the confidential survey to determine the prevalence of ACEs and subsequent implications on health and well-being. Iowa communities as well as government and private agencies can now use data from the ACEs study to better focus efforts aimed at reducing and preventing child maltreatment and family dysfunction, and to educate and prepare trauma-focused service providers to diagnose and treat related health behaviors and outcomes associated with ACEs.

Iowa's aging population has been characterized as primarily Caucasian, rural, and slow-growing. According to most recent U.S. Census data, Iowa's total population increased by 4.1% from 2000 to 2010, compared with average national growth of 9.7%. Meanwhile, the proportion of the Iowa population aged 65 and older continues to rank in the top ten nationally, suggesting a scenario in which a growing population of older adults must be supported by a somewhat stagnant number of employed residents (Mackun and Wilson 2011). Additionally, rural families have fewer resources and less access to mental health professionals than their urban counterparts, a problem compounded by the increasingly aging population in need of such services (Goldsmith et al. 1997). The health of Iowans living in rural communities can be traced to stressors that are somewhat unique to the state, such as occurred in the agricultural economic downturn of the 1980s, dubbed the "Farm Crisis." Research on the impacts of economic pressure showed increased risk for health and behavioral problems in families living in a state financially dependent upon agriculture. Findings related to this work have contributed to the development of the Family Stress Model that suggests that economic hardship may create an environment in which parents are more likely to engage in unhealthy behaviors (e.g., substance use and antisocial behavior) and be plagued by emotional distress which may contribute to household dysfunction and unhealthy parenting practices found to be inconsistent with child well-being (Conger et al. 1995; Conger et al. 2002). But, to date, there have been no Iowa studies investigating how ACEs may have impacted adult health for many who grew up in the midst of the Farm Crisis.

The purpose of the current study is to determine the prevalence of ACEs among Iowans as well as to better understand the relationships between ACEs and health risk behaviors and disease. Guided by principles of a human development theoretical framework, findings from this study will help to explain the impact that early trauma has on development,

behavior, and health across the lifespan. Findings will be used to increase awareness of the impact of ACEs and to inform a coordinated response from communities, state organizations, and health care entities.

## Methods

### Sample

This study seeks to replicate, to the extent that data would permit, the original ACEs Study, which has been described in detail elsewhere (Anda et al. 1999; Dube et al. 2003). In 2012, in an effort to examine the prevalence and implications of ACEs within the Iowa population, a coalition of health care providers, health advocacy foundations, and other concerned citizen organizations (see [www.iowaaces360.org](http://www.iowaaces360.org)) provided funding to include ACE questions in a periodic state health survey known as Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS uses survey questions developed and standardized by the Centers for Disease Control and Prevention (CDC). The CDC and Iowa state agencies collaborated to administer the survey to Iowa residents, age 18 and older, via landline and cell phone telephone interviews.

The sampling protocol resulted in a randomly selected stratified sample with oversampling to ensure that minority populations would be included in adequate numbers to make comparisons. Statistical weights were incorporated in the data analysis to enable valid population estimates from the data. The core BRFSS interview questions requested demographic information and inquired about health awareness and attitudes as well as health conditions and health-related behaviors. In 2012, under the agreement that states may add optional questions to the BRFSS, the ACEs questionnaire was included in the survey. It was the first time that ACEs questions were included in the BRFSS in Iowa.

### Measures

**Adverse Childhood Experiences (ACEs)** Participants' childhood adversity was assessed across two general categories—experiences of childhood abuse (i.e., emotional, physical, sexual) and experiences of household dysfunction (i.e. substance abuse, member imprisonment, mental illness, adult violence, parental separation or divorce) before age 18 (Felitti et al. 1998). For childhood abuse, *emotional abuse* was measured by a single question, "How often did a parent or adult in your home ever swear at you, insult you, or put you down?" Another question, "How often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking." was used to measure *Physical abuse*. Finally, *sexual abuse* was measured by three 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?" All items were originally coded from 1 (*Never*), 2 (*Once*), 3 (*More than once*). For categories that had multiple items, they were recoded to 0 (*Never*) and 1 (*At least once*) for any incidence of abuse.

For exposures to household dysfunction during childhood, *substance abuse* was measured by two items, "Did you live with anyone who was a problem drinker or alcoholic?", and "Did you live with anyone who used illegal street drugs or who abused prescription medications?". *Member imprisonment* was measured by "Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?" *Mental illness* was measured by a one-item, "Did you live with anyone who was depressed, mentally ill, or suicidal?" Lastly, for *parental separation*, participants responded to the question, "Were your parents separated or divorced?" *Adult violence* was measured by "How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?" All items were originally coded as 1 (*Yes*) and 2 (*No*). They were recoded into 0 (*No*) and 1 (*Yes*).

**Demographics** For demographic information, participants were asked to report their age in years. Their ages were then recoded to the following age groups: Ages 18–24, Ages 25–34, Ages 45–54, Ages 55–64, and Ages 65 or older. Second, participants were also asked to indicate their gender, and it was coded to 0 (*men*) and 1 (*women*). Race and ethnicity was coded using a set of dummy variables, 0 (*no*) and 1 (*yes*) into categories *White*, *Black*, *Hispanic*, *Other*, and *Multi-racial*. Finally, education was measured by asking participants to report the highest grade or year of school he or she completed, with codes, 1 (*never attended school or only kindergarten*), 2 (*Grades 1 through 8*), 3 (*Grades 9 through 11*), 4 (*Grade 12 or GED, HS graduate*), 5 (*College 1 year to 3 years, attended college*), and 6 (*College 4 years or more, graduated college*). For the present study, groups 1 to 3 were collapsed to one group (No HS diploma).

### Health Risk Behaviors and Chronic Health Problems

Participants were asked whether or not he or she been smoked at least 100 cigarettes in his or her entire life, in which 0 (*no*) and 1 (*yes*). If yes, they were also asked about current smoking habits which was coded 0 (*not smoking*) and 1 (*currently smoking*). To assess whether or not a participant was a heavy drinker, participants were first asked to indicate how many days per week or per month did he or she have at least one drink of any alcoholic beverages such as beer, wine, a malt beverage or liquor during the past 30 days. Participants could either respond in days per week or days in past 30 days. Based on this item, total number of alcoholic beverages consumed

per day was computed, or 0 (*did not drink*). Lastly, adult men having more than two drinks per day and adult women having more than one drink per day was consider heavy drinkers, where 0 (*no*) and 1 (*yes*). To determine whether or not a participant is obese or overweight, participants were asked to self-report their weight and height. Then, Body Mass Index (BMI) was calculated using participant's weight and height. BMI categories were computed based on BMI, from 0 ( $BMI < 30$ ) to 1 ( $BMI > 30$ ). Lastly, based on their BMI categories, adults who have a BMI great than 30 were considered as obese for the present analyses. For depression, participants were asked how often did he or she feel so depressed that nothing could cheer himself or herself up during the past 30 days. The item was recoded so that the referenced group is 0 (*no depression*) versus everyone else 1 (*depressed*) indicating some level of depression.

For physical activity, participants were asked whether or not he or she participated in any physical activities or exercise other than his or her regular job, such as running, calisthenics, golf, gardening, or walking for exercise during the past month. Participants were also asked if he or she ever had heart disease, any cancer, stroke, chronic bronchitis, emphysema, or COPD, and diabetes. All items were coded as 0 (*no*) and 1 (*yes*).

**Analysis Plan** Because this was the first time that the CDC had contracted with officials in Iowa's state government, the plan for analyses was based on the original ACEs study (Felitti et al. 1998). Thus, this study could be viewed as a partial replication of Felitti and colleagues' original study. There are, of course, some important differences. The CDC has made minor alterations in the measurement of specific ACEs, the geographic location of the sample is different, and there is a large timespan between studies. Nevertheless, to the extent possible, researchers sought to equate the forms of analysis used in each of these studies. Both studies included demographic information about the samples including the prevalence of ACEs in the adult populations. In the analyses, a cross-tabulation approach was first used to estimate the percentages of co-occurrence between specific ACEs. Second, logistic regressions were ran using the numbers of ACEs as a grouping variable to assess incremental changes in the risks of ten different health risk behaviors, depression, or other major health problems. Finally, percentages representing the relationship between the number of total ACEs and the percent having a total number of behavioral risk factors were calculated. All analyses were completed using SPSS software.

## Results

Table 1 displays the prevalence of ACE and the probability that respondents who were exposed to one ACE category also experienced additional ACE categories (generally referred to

**Table 1** Prevalence and co-occurrence of adverse childhood experiences

Category of Childhood Exposure	Sample Size	Prevalence (%)	Percent Exposed to Another Category													
			Emotional Abuse	Physical Abuse	Sexual Abuse	Substance Abuse	Member Imprisoned	Mental Illness	Adult Violence	Parental Separation	Any One Additional Category	Any Two Additional Categories				
Childhood Abuse:																
Emotional	1970	35	-	38	18	46	14	33	33	35	76	56				
Physical	901	16	84	-	28	58	22	43	54	44	95	82				
Sexual	631	10	66	46	-	56	22	45	38	42	87	71				
Household Dysfunction:																
Substance abuse	1475	26	61	35	21	-	22	39	39	42	84	66				
Member imprisoned	276	7	74	51	31	83	-	54	51	65	97	87				
Mental illness	967	17	68	39	26	59	21	-	37	44	87	71				
Adult violence	872	16	75	55	24	66	23	42	-	51	96	83				
Parental separation	1046	22	57	33	19	51	21	36	37	-	80	62				
		<i>Median</i>	68	39	24	58	22	42	38	44	87	71				
		<i>Range</i>	57–84	33–55	18–31	46–83	14–23	33–54	33–54	35–65	76–97	56–87				

Total unweighted sample size was 6361

as a “pile up” of ACEs). Overall, more people (58%) in Iowa experienced an ACE than did not. The highest category of abuse experienced was emotional abuse (35%), followed by physical (16%) and sexual abuse (10%). In regards to household dysfunction, which was experienced by 26% of respondents, having lived with a problem drinker (23%) was the most prevalent category followed by separation or divorce of parents (22%). The Respondent probability of exposure to any one additional category ranged from 76% - 97% (median: 87%), with those reporting physical abuse having the highest chance (68%) of also experiencing another trauma category

followed by substance abuse (58%) and parental separation or divorce (44%). The likelihood of experiencing two or more “pile-ups” of ACEs, ranged from 56% - 87% (median: 71%). Emotional abuse was the most likely candidate to be considered a “stand alone” ACE, meaning that if a respondent was to have experienced only one ACE then it was most likely emotional abuse. However, analyses suggest that ACEs do not happen in isolation, as 76% of those respondents who were exposed to emotional abuse also reported exposure to one additional ACE category.

The prevalence of categories by demographic characteristics is shown in Table 2. Iowa respondents demonstrate an inverted age pyramid such that older persons reported fewer single exposures as well as a lower prevalence of “pile up” ACEs than younger persons. There were no significant differences by gender. Respondents identifying as “White” fared better than “Black”, “Hispanic”, and “Multi-racial” persons in single and “pile up” ACEs, while those identifying as “Other” reported the lowest prevalence of exposure in all categories. Education generally was associated with a lower prevalence of ACEs, however not finishing college seemed to pose an additional risk.

Table 3 presents the number of health problems and health behaviors and the odds ratio that the participants experienced. The results show that persons with increased “pile up” of ACEs showed generally higher prevalence and risk (adjusted odds ratio) of reporting a health risk behavior as compared to those with fewer exposures. Comparison of those with no exposures to those with exposures in 4 or more ACEs categories suggests that there may be a consistent pattern in regards to some health risk behaviors. For example, a respondent experiencing 4 or

more ACEs was 3.5 times more likely than a person with no exposures to be a current smoker (CI = 2.7–4.5). Additionally, obesity and reports of depression during the last month showed an increased odds ratio of 1.5 (CI = 1.2–1.9) and 3.2 (CI = 2.6–4.0), respectively when compared to respondents reporting no ACEs exposures. The range of odds ratios for the presence of disease conditions when persons exposed to 4 or more categories of ACEs were compared to those with no exposures spanned from 1.3 (CI = 1.0–1.8) for cancer to 3.8 (CI = 2.6–5.4) for respiratory diseases such as

**Table 2** Demographic characteristics of the 2012 Iowa ACEs study

Characteristics	Sample size ( <i>n</i> )	Adult Population Estimate ( <i>n</i> )	Percent of Population	Percent reporting at least one ACE
Age group (years)				
18–24	314	278,817	13	62
25–34	578	318,811	15	65
35–44	777	317,633	15	67
45–54	1086	374,655	18	59
55–64	1362	351,209	17	55
≥ 65	2244	425,375	21	44
Gender				
Men	2541	984,733	48	59
Women	3820	1,081,768	52	57
Race				
White	5916	1,859,183	91	57
Black	77	35,543	2	80
Hispanic	198	85,636	4	67
Other	84	45,599	2	54
Multi-racial	47	28,191	1	81
Education				
No HS diploma	411	198,578	10	65
HS graduate	2143	667,420	32	58
Attended College	1857	719,467	35	60
Graduated College	1942	481,035	23	53
All participants	6361	2,066,501	100	58

chronic bronchitis, emphysema, or COPD. The odds ratios of heart disease, stroke, and diabetes were 2.8 (CI = 1.9–4.1), 2.8 (CI = 1.8–4.6), and 2.1 (CI = 1.5–2.8) respectively. Data suggests that a threshold of risk is present for stroke and diabetes. Respondent risk for these conditions, in particular, seemed to increase when 4 or more ACEs were reported as compared to those reporting fewer exposures.

A positive association was found between increased “pile up” of ACEs and the number of health risk behaviors specifically linked to the leading causes of death e.g. heart disease, cancer, stroke, respiratory diseases (chronic bronchitis, emphysema, or COPD), and diabetes. For example, among persons with no ACE exposures, 41% were found to have no health risk behaviors related to the leading causes of death, whereas only 20% of those reporting 4 or more categories of ACEs reported no health risk behaviors (see Table 4).

## Discussion

In regard to prevalence of ACEs as well as findings that link ACEs to adult outcomes, Iowa data is similar to those of other states as well as to the original Kaiser study conducted in San Diego, California (Anda et al. 1999). In general, 57.9% of respondents in the Iowa sample experienced an ACE.

Emotional abuse (35.2%) had the highest prevalence among the three categories of abuse. This is problematic considering research has shown that childhood emotional abuse presents an increased risk for lifetime depressive disorders (Chapman et al. 2004; Gibb et al. 2007; Wright 2007). Of household dysfunction by categories, substance abuse had the highest prevalence, followed by mental illness, adult violence, and imprisonment of a family member. The high prevalence of substance abuse found in this Iowa sample was similar to that reported by Felitti et al. (1998) in the original ACEs study and is consistent with findings from the Family Transitions Project (FTP) that also features an Iowa sample (Rueter et al. 2007). Previous investigations using the FTP sample reported alcohol disorders as the most prevalent of all disorders assessed (Rueter et al. 2007). Furthermore, a two-fourfold increase in risk of heavy drinking, self-reported alcoholism, and marrying an alcoholic have been reported in persons reporting a “pile up” ACEs as compared to those without exposure (Dube et al. 2002).

Most individuals reporting a “pile up” of ACEs from multiple categories had experienced emotional abuse (see Table 2). Previous research on youth has shown that co-occurrence of psychological maltreatment with physical or sexual abuse has been associated with greater magnitude or frequency of risk behaviors and functional impairment when



**Table 3** Odds ratios for the number of adverse childhood experiences and health risk behaviors, depression, and major health problems

Number of Categories	Health Risk Behaviors & Depression	Prevalence (%)	Odds Ratio*	95% CI	Health Problems	Prevalence (%)	Odds Ratio*	95% CI
0	Current smoker	11.0	1.0	Referent	Heart Disease	6.2	1.0	Referent
1		15.6	1.4	1.1–1.8		7.1	1.4	1.1–1.8
2		18.7	1.8	1.3–2.4		7.0	1.5	1.1–2.1
3		24.8	2.6	1.9–3.6		10.3	3.0	2.0–4.5
4+		33.7	3.5	2.7–4.5		7.5	2.8	1.9–4.1
0	Heavy drinker	4.6	1.0	Referent	Any Cancer	12.5	1.0	Referent
1		7.1	1.5	1.1–2.2		12.0	1.1	0.9–1.4
2		6.5	1.3	0.9–2.0		11.0	1.2	0.9–1.5
3		8.0	1.8	1.1–2.9		12.0	1.4	1.0–2.0
4+		7.3	1.6	1.0–2.4		9.5	1.3	1.0–1.8
0	Obesity (BMI $\geq$ 30)	26.6	1.0	Referent	Stroke	2.8	1.0	Referent
1		29.6	1.2	1.0–1.4		2.9	1.2	0.8–1.8
2		30.3	1.2	1.0–1.5		2.5	1.2	0.7–2.0
3		31.8	1.3	1.0–1.7		3.1	1.7	0.9–3.3
4+		33.4	1.5	1.2–1.9		3.6	2.8	1.8–4.6
0	No physical activity	23.4	1.0	Referent	Chronic bronchitis, emphysema, or COPD	4.8	1.0	Referent
1		22.8	1.0	0.8–1.2		5.2	1.2	0.9–1.7
2		20.4	0.9	0.7–1.1		6.4	1.6	1.1–2.3
3		20.3	0.9	0.7–1.2		7.5	2.0	1.2–3.1
4+		23.8	1.1	0.9–1.4		12.0	3.8	2.6–5.4
0	Depressed in past 30 days (referent = none)	19.4	1.0	Referent	Diabetes	9.3	1.0	Referent
1		26.7	1.5	1.2–1.8		9.9	1.2	0.9–1.5
2		31.8	1.9	1.5–2.4		9.2	1.2	0.9–1.6
3		39.4	2.6	2.0–3.4		8.5	1.2	0.8–1.7
4+		46.8	3.2	2.6–4.0		11.9	2.1	1.5–2.8

\*Odds ratios control for age, gender, race, and level of education. CI = confidence interval

compared to physical or sexual abuse without emotional trauma (Spinazzola et al. 2014). Spinazzola et al. (2014) also found that psychological maltreatment was found to be an equivalent or significantly greater predictor of negative outcomes compared to the co-occurrence of physical and sexual abuse. Interventions and prevention programs need to address psychological maltreatment or emotional abuse as capable of

independently inflicting lifelong trauma as well as of exacerbating the effects of physical and sexual abuse when co-occurring.

The number of ACEs was positively related to the number of health risk behaviors assessed in this study. As ACEs increased in the Iowa population, risks of smoking also increased which supports previously published findings that report individuals with an ACE score of five or more as more

**Table 4** Relationship between the number of ACEs and number of health risk behaviors

Number of categories	Sample size	Percent with number of health risk behaviors				
		0	1	2	3	4+
0	2940	41	38	17	4	1
1	1446	36	35	21	7	1
2	760	34	37	19	9	2
3	463	28	37	23	10	3
4+	752	20	36	27	13	4
Total	6361	35	37	20	7	2

Risk factors include: current smoker, heavy drinker, obesity, no physical activity, and depression

likely to be a current smoker or have a history of smoking (Ford et al. 2011). Depression was also linked to a graded increase in exposure to childhood trauma, which aligns with work by Chapman et al. (2004) that described an increased risk of depressive disorders in individuals experiencing childhood trauma. Consistent with previous research (Anda et al. 2002; Chapman et al. 2004; Briggs and Price 2009) and, specifically, in the Iowa-based Family Transitions Project (Kim et al. 2003; Wickrama et al. 2008), results from the present study indicate that exposure to ACEs was associated with greater likelihood of depression in adulthood.

The prevalence of both adult and childhood obesity stands at critically high levels in Iowa where the current obesity rates are 30.9% and 13.6%, respectively (Iowa Department of Public Health 2012; Ogden et al. 2012). In the present study, the risk of obesity was more likely in association with greater exposure to ACEs. This finding is consistent with previous research that examined relationships between self-reported abuse in childhood, body weight, and obesity in adults (Felitti et al. 1998; Fuemmeler et al. 2009; Burke et al. 2011). Moreover, Fuemmeler et al. (2009) found an increased risk of overweight and obesity for men with history of childhood sexual abuse but not for women. This study also reported an association between trauma and other forms of disordered eating. Women with a history of physical abuse were more likely to report skipping meals in effort to lose weight as well as other problematic eating habits (Fuemmeler et al. 2009). No significant trend was found between ACE exposures and reporting “no” physical activity, a health risk behavior which has been commonly linked to obesity.

Limitations to these findings exist. First, data was collected via retrospective, self-reported surveys asking adult participants about exceedingly private information from childhood. This data collection procedure may potentially present an issue related to underestimation of report, as some memories may be traumatic and therefore repressed or less likely to be reported (Femina et al. 1990; Williams 1995). Additionally, while the Iowa sample accurately reflected the lack of racial diversity and markedly older population in the state, the demographics of this sample may prevent the findings from being transferable to other populations. Age is especially important factor to consider as retrospective research requires respondents to recall memories from childhood, and the older age groups may have crossed an age-based memory threshold or have a cohort effect such that they may interpret some experiences differently than younger generations. Historical changes in perspective or shifting of cultural norms, such as attitudes or stigma surrounding talking about mental illness as well as the potential that older respondents may be less likely than younger to seek healthcare may have resulted in reduced report of disease due to lack of diagnoses. Alternately, differences may be explained by the protocol used in the current study, as BRFSS sampling excludes homeless persons, and

persons in institutions, prisons, or hospitals, which may have resulted in an underestimation of ACEs for the Iowa population. As more states utilize BRFSS protocol to collect ACEs data, confidence in interpreting the prevalence of ACEs and relationship of ACEs to health behaviors and outcomes should improve.

## Implications and Future Research

The results of the present study have important implications for design of mental and physical health prevention and intervention activities delivered in health care settings and beyond. First, medical and mental health professionals may better serve their adult patient population by recognizing the impact that adverse childhood experiences and the associated toxic stress may have on their adult patients’ health and well-being over the lifecourse. Efforts targeted at reducing depression should consider recognition of adverse childhood experiences as a possible risk factor. Additionally, proactive mental health screening delivered outside the clinic as well as revising treatment so that it is trauma-informed may be warranted. With increased insight about the sequela of trauma, practitioners may be better able to connect their patients to appropriate medical, social and community services. Interventions and prevention programs need to address psychological maltreatment or emotional abuse as capable of independently inflicting lifelong trauma as well as of exacerbating the effects of physical and sexual abuse when co-occurring. With increased insight about the sequela of trauma, practitioners may be better able to connect their patients to appropriate medical, social and community services.

Second, the present study may inform future research, medical school curricula, and continuing education directed at medical and mental health professionals in an effort to increase understanding about the relationships between different categories of ACEs as well as the cumulative impact of co-occurring abuses and their effects on health risk behaviors and outcomes. Future research might examine how childhood trauma may be related to known obesity-risk behaviors, and how the magnitude of the effect may differ based on gender. Future research might also examine how ACEs may lead to other maladjusted eating-related behaviors and outcomes beyond the ones examined in the present study.

Finally, results from the present study can inform policy. Policymakers can use this study to quantify need in order to allocate and coordinate funding and resources for services. Those designing and delivering health and human services may benefit by improving coordination of care among agencies in response to the high prevalence of individuals experiencing “pile up” of ACEs reported in this study. The pervasiveness of substance abuse reported in this study, when combined with those from the FTP sample, suggest that

unhealthy substance and alcohol use may be influenced by stressors emanating from multiple environments and demonstrate the need for greater attention to the factors related to alcohol use and its sequelae, specifically in rural environments like Iowa. Targeting unhealthy substance use may require more comprehensive consideration of who, how and where funding and efforts could be distributed. In conclusion, the impact of coordinated, comprehensive prevention and intervention activities may inform future policymaking, as trauma-informed care and services have the potential to better meet needs, eliminate redundancy in resource allocation, and reduce reliance on public services.

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