



The association between adverse childhood experiences and mental health wellbeing during the adulthood: the cross-sectional study of the 2020 United States Behavioral Risk Factor Surveillance System (BRFSS)

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Background: To understand the frequency of retrospectively self-reported adverse childhood experiences (ACEs) and evaluate whether early ACEs are independently associated with mental health wellbeing during adulthood.

Methods: By using the 2020 Behavioral Risk Factor Surveillance System (BRFSS) publicly available data, we employed chi-square test, Pearson correlation, and linear regression to study the correlation between the late effects of self-reported ACEs on mental health wellbeing during adulthood.

Results: ACEs are not uncommon among the 116,378 participants. Among them, 30.9% of the subjects self-reported parents swearing at them, insulting them, or putting them down during childhood. Around one of four participants reported parents being divorced/separated, past physical abuse, or having lived with a problem drinker/alcoholic. And, 60% of subjects reported at least one ACE. Some of the ACEs such as “has anyone ever forced you to have sex” has a higher level of association with adulthood mental health wellbeing (increased by 167.6%). This was followed by “live with anyone mentally ill” (167.5%), “anyone makes you touch them sexually” (141.5%), “anyone ever touch you sexually” (131.5%), and “live with anyone using illegal drugs” (126.8%). Our linear regression analysis also indicated that the magnitude of the association is different based on individual ACEs. “Living with anyone mentally ill” has the most significant negative effect on poor mental health during the past 30 days (increased poor mental health day by 3.473 days with 95% CI: 3.330–3.617 days), followed by “anyone ever forces you to have sex” (3.463 days with 95% CI: 3.198–3.729 days), “anyone makes you touch them sexually” (2.933 days with 95% CI: 2.732–3.135 days), “anyone ever touches you sexually” (2.688 days with 95% CI: 2.512–2.864 days), and “live with anyone using illegal drugs” (2.439 days with 95% CI: 2.261–2.617 days). Our study also showed that the total combined ACE accounts have a good lineal relationship with adulthood poor self-reported mental health.

Conclusions: Early childhood adverse experiences potentially have significant negative effects on human mental health wellbeing during their adulthood. The magnitude of the association is different based on individual ACEs, and dose-response exists between the total ACEs account and poor mental health wellbeing during adulthood.

Keywords: Adverse childhood experiences (ACEs); mental health; depression

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Introduction

Adverse childhood experiences (ACEs), are potentially traumatic events that occur during childhood (0–17 years). ACEs include experiencing violence, abuse, or neglect, and witnessing violence in the home or community, which directly affect children. ACEs also include aspects of childhood living environments, such as growing up in a household with substance use problems, mental health problems, and instability due to parental separation or household members being in jail or prison, which can indirectly affect children (1,2).

In 2008, a total 51,945 adults from 21 countries participated in the World Mental Health Surveys conducted by World Health Organization (WHO), and the results from this study indicated that ACEs were highly prevalent and accounted for 29.8% of all mental health disorders across those countries (3). ACEs can have lasting negative effects and tremendous lifelong impact on both mental health and physical health across a lifespan (2,4). ACEs, such as household dysfunction and experiencing violence or abuse not only just have a broad immediate and short-term impact on child development, but also have significant long-term effects (5-7). Dr. Chapman *et al.* reported in 2007 that women who reported childhood abuse, but not abuse during adulthood, had significantly elevated scores

for depression, anxiety, somatization, and interpersonal sensitivity compared to women who reported no abuse during their childhood (7). However, different childhood adversities may play different roles or have different level of the effects on the onset of mental health disorders during adulthood (8-12). For example, researchers have found that compared to other ACEs, “living with parental mental illness” had a strong association with significantly increased risk to develop mental health disorders and was not just across all different income categories but also across all age groups (3). Hughes *et al.* conducted a systematic review and meta-analysis in 2016 where they found that individuals with at least four ACEs were strongly associated with anxiety and depression (2). Dr. Chapman *et al.* reported in 2007 that for many adults, the adverse effects of childhood, physical, or sexual abuse are as strong as the effects of current abuse (7). The previous research also demonstrated that the total number of adversities during childhood has a linear relationship with the subsequent first onset mental health disorders across all different income categories (3,12). However, the current understanding on the association between ACEs and mental health conditions is limited due to either small sample size or outdated research reports. More importantly, the correlation between ACEs and self-reported general mental health condition, i.e., mental health wellbeing is lacking. The Behavioral Risk Factor Surveillance System (BRFSS) is an on-going largest continuously conducted health survey system in the world, with more than 400,000 adult interviews each year (13). This research utilized 2020 BRFSS’s publicly available data to study whether there is an independent association between ACEs and self-reported mental health wellbeing during adulthood. We present this article in accordance with the STROBE reporting checklist (available at <https://jphe.amegroups.com/article/view/10.21037/jphe-22-91/rc>).

Highlight box

Key findings

- ACEs potentially have significant negative effects on human mental health and wellbeing when the victims grow up.

What is known and what is new?

- ACEs can have lasting negative effects and tremendous lifelong impact. The previous research demonstrated that the total number of ACEs has a linear relationship with the subsequent first onset mental health disorders.
- This research provides updated evidence with the largest sample size to study the potential long term mental health effects of ACEs. The previous researches may not be able to avoid selection bias since they only selected the cases with diagnosed mental disorders. Our research used self-reported mental health wellbeing as outcome to fill the gap.

What is the implication, and what should change now?

- We should identify ACEs early because early interventions may be effective to improve long term outcomes. For the patients with poor mental health wellbeing, we should identify possible ACEs and refer patients to mental health providers for further evaluation and treatment.

Methods

Sample and measures

The BRFSS collects data on U.S. residents on their demographic information, social-economic status, and chronic health conditions including physical and mental dysfunction, use of preventive services, and health-related risk behaviors (13). In 2020, a total 207,200 people from 28 states participated in the optional self-reported ACEs survey (https://www.cdc.gov/brfss/annual_data/annual_2020.html). However, 90,822 of them were excluded from our

study because they either missed at least one of the ACE questions or provided invalid answers for our analysis (don't know/not sure or refused to answer). The missing data was treated as invalid, as same as refusing to answer the question or answering don't know/not sure. Information from a total of 116,378 respondents was collected and used in this study. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

There was a total of eleven ACEs related questions in the survey. "Did you live with anyone who was depressed, mentally ill, or suicidal? 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? Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility? Were your parents separated or divorced? How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up? Not including spanking (before age 18), how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? How often did a parent or adult in your home ever swear at you, insult you, or put you down? 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?" The answer of "no" or "never" was treated as negative answer and the answer of "once" or "more than once" was treated as positive one. The total accounts of positive answers would be counted as the total ACEs the participants reported during their childhood.

Statistical analysis

We used IBM Statistical Package for the Social Sciences (SPSS) version 22 to analyze the data. We restricted the analytic sample to a total of 116,378 participants with valid responses as described in Sample and Measures section. We employed the chi-square test for bivariate analysis to assess the association of ACEs with background characteristics, and Pearson correlation to examine the correlation between background characteristics in the regression models. Multivariate linear regression analyses after controlling for demographic information, socioeconomic status, comorbidities, medical care access, and health-related risk behaviors were employed to assess the effect of multiple ACEs on mental health wellbeing during adulthood (how

many days the participants reported mentally not good in the past 30 days). Mental health is a state of self-reported well-being in which a participant realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to contribute to his or her community. Assumption of linear regression model, such as linearity, absence of multicollinearity, and normality were studied for the linear regression model. Two-sided test with $P < 0.05$ is considered statistically significant for all these analyses.

Results

Individual ACE frequency

Table 1 presents the frequency of self-reported ACEs among a total of 116,378 valid respondents. ACEs originally from parenting problems are not uncommon. For example, almost one-third of the participants self-reported either being sworn at or physically hurt by their parents. One-fourth of the participants lived in a house with divorced or almost divorced parents and one out of seven of them also reported that their parents beat each other. Various participants also lived with a house member who was an alcoholic (21.3%), had illegal drug abuse (9.1%), were mentally ill (15.7%), or even served time in prison (6.8%). Childhood sexual abuse also was not uncommon among the participants. Among all the participants, 10.4% self-reported being touched sexually, 7.4% self-reported that someone else made the participants touch them, and 4.4% had been forced to have sex.

The frequency of combined ACEs

Table 2 presents the frequency of combined ACEs. Combined ACEs are common during childhood. Only 40.0% of all participants denied any adverse events during their childhood. Nearly 17 percent of adults have experienced four or more ACEs and more than 10% self-reported at least 5 ACEs during their childhood.

The effects of individual ACEs on mental health wellbeing

From *Table 3* "Average days mentally not good in the past 30 days", it was found among subjects with different individual ACE that all ACEs individually associated with prolonged poor mental health wellbeing during adulthood. Among all the ACEs, bitter parent relationship such as

Table 1 Individual ACE frequency among 116,378 participants

Individual ACE	Yes/No	Frequency (%)
Live with anyone mentally ill	18,259/98,119	15.7
Parents divorced/separated	28,966/87,412	24.9
Live with a problem drinker/alcoholics	24,732/91,646	21.3
Live with anyone using illegal drugs	10,618/105,760	9.1
A parent physically hurt you	24,791/91,587	21.3
Live with anyone serving time in prison	7,959/108,419	6.8
Your parents beat each other	17,151/99,227	14.7
A parent swear at you	35,939/80,439	30.9
Anyone ever touches you sexually	12,087/104,291	10.4
Anyone makes you touch them sexually	8,670/107,708	7.4
Anyone ever force you to have sex	5,096/111,282	4.4

ACEs are not uncommon events. Almost one third of the participants reported that their parent swore at them during their childhood and more than 10% reported being sexual abused. ACE, adverse childhood experience.

Table 2 Total events of ACEs

Total ACE accounts	Frequency	Percent (%)	Cumulative percent (%)
0	46,582	40.0	40.0
1	26,477	22.8	62.8
2	14,476	12.4	75.2
3	9,389	8.1	83.3
4	6,509	5.6	88.9
5	4,481	3.9	92.7
6	3,081	2.6	95.4
7	2,197	1.9	97.3
8	1,504	1.3	98.6
9	808	0.7	99.2
10	552	0.5	99.7
11	322	0.3	100.0
Total	116,378	100.0	

ACEs are not uncommon events and many of the participants reported multiple ACEs. 60% of the participants reported at least one ACE and more than 10% of the participants reported at least 5 ACEs. ACE, adverse childhood experience.

divorced/separated parents or physically violent parent relationships (beating each other) during childhood has the least negative effect on participants' general mental

health during adulthood. "Parents divorced/separated" and "parents beat each other" increased poor mental health well-being by 69.1% and 94.7% respectively. The study found that adverse childhood sexual abuse had a very strong association with poor mental health wellbeing during the adulthood. For example, "forced to have sex" increased poor mental health well-being by 167.6%. Our study also indicated that living with anyone mentally ill during childhood has the most significant negative effect on participants' mental health, identical to "being forced to have sex".

In order to control and adjust the demographic information, socioeconomic status, comorbidities, medical care access, and health-related risk behaviors, linear regression analyses were employed to test the effect of multiple ACEs on mental health wellbeing during adulthood. The results of *Table 4* indicated that all ACEs have independent significant negative effects on participants' mental health and wellbeing during adulthood. Certainly, the magnitude of the effect is different based on individual ACE. For example, having divorced/separated parents had the least negative effect among all the ACEs, only increasing the number of days mentally not good by 0.854 days. However, living with anyone mentally ill or being forced to have sex during childhood had the most significant negative effect on mental health wellbeing during adulthood (increasing the number of days mentally not good by almost 3.5 days). Compared to other categories of ACEs, individual childhood sexual assault/trauma had more significant late

Table 3 Average days mentally not good in the past 30 days among subjects with different individual ACEs

Individual ACE	Never		Yes	
	Days	95% CI	Days	95%CI
Live with anyone mentally ill	3.05	3.00–3.09	8.16	8.01–8.30
Parents divorced/separated	3.27	3.22–3.32	5.53	5.42–5.63
Live with a problem drinker/alcoholics	3.25	3.20–3.30	6.13	6.00–6.25
Live with anyone using illegal drugs	3.46	3.41–3.50	7.85	7.65–8.05
A parent physically hurt you	3.24	3.19–3.28	6.61	6.48–6.72
Live with anyone serving time in prison	3.59	3.54–3.63	7.60	7.37–7.83
Your parents beat each other	3.38	3.33–3.42	6.58	6.43–6.72
A parent swear at you	2.84	2.79–2.88	6.14	6.04–6.23
Anyone ever touches you sexually	3.38	3.34–3.43	7.79	7.58–7.97
Anyone makes you touch them sexually	3.47	3.43–3.51	8.38	8.12–8.60
Anyone ever force you to have sex	3.58	3.54–3.63	9.58	9.25–9.92

All ACEs individually associated with prolonged poor mental health wellbeing during adulthood. “Living with anyone mentally ill” and childhood sexual abuse potentially have the most significant negative effect on poor mental health. ACE, adverse childhood experience.

Table 4 Individual ACE and mental condition (days mentally not good) linear regression

Individual ACE	Beta (days)	P value	95% CI
Live with anyone mentally ill	3.473	<0.001	3.330–3.617
Parents divorced/separated	0.854	<0.001	0.728–0.980
Live with a problem drinker/alcoholics	1.674	<0.001	1.544–1.804
Live with anyone using illegal drugs	2.439	<0.001	2.261–2.617
A parent physically hurt you	1.962	<0.001	1.833–2.092
Live with anyone serving time in prison	1.762	<0.001	1.558–1.967
Your parents beat each other	1.944	<0.001	1.795–2.093
A parent swear at you	2.177	<0.001	2.062–2.291
Anyone ever touches you sexually	2.688	<0.001	2.512–2.864
Anyone makes you touch them sexually	2.933	<0.001	2.732–3.135
Anyone ever force you to have sex	3.463	<0.001	3.198–3.729

All ACEs have independent significant negative effects on participants’ mental health and wellbeing during adulthood. Certainly, the magnitude of the effect is different based on individual ACE. ACE, adverse childhood experience.

effects on adulthood mental health wellbeing (increasing the number of days mentally not well by more than 2.6 days).

The effects of combined ACEs on mental health wellbeing

Figure 1 presents the average mentally not good days in the past 30 days among subjects with combined ACE accounts.

The results showed that the total account of ACEs during childhood has the perfect linear relationship with the total number of mentally not good in the past 30 days. Although the participants who reported not having any ACE still reported 2 mentally not good days in the past 30 days, that number jumped to almost 15 days for the participants who reported suffering all the 11 ACEs.

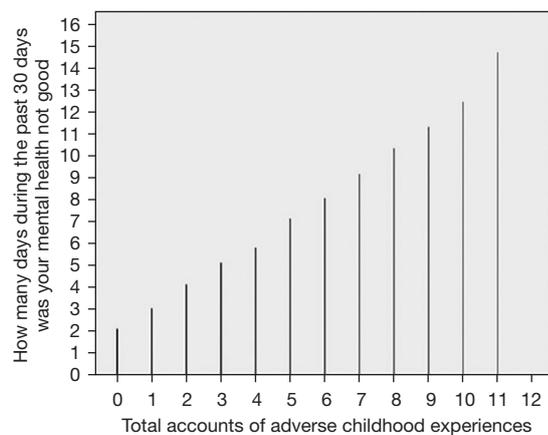


Figure 1 Average days mentally not good in the past 30 days among subjects with combined ACE accounts. The total account of ACEs during childhood has the perfect linear relationship with the total number of mentally not good in the past 30 days. ACE, adverse childhood experience.

Discussion

The accumulating evidence for the negative impact of ACEs on health outcomes in adulthood means that they are now considered a public health concern (2,14). Our research indicated that among all the participants, 60% of them self-reported at least one ACE and early 17 percent have experienced four or more ACEs. According to the National Conference of State Legislatures (published on 2021/08/12), CDC scientists analyzed data from BRFSS in 2019 and the report showed that almost 16 percent of adults have experienced four or more ACEs and 61 percent of them experienced at least one ACE, which is identical to our report (15). According to a 2018 Child Trends brief, researchers reported that 55 percent of children had experienced no ACEs, which is higher than our report (16). However, our report used adult (older than 18 years old) self-reported ACEs during childhood while Child Trends brief utilized ACEs reported by a parent or guardian. Since at least 8 out of 11 ACEs are either related to a child's living environment or parenting, ACEs reported by a parent or guardian may not actually reflect the truth and under-reported ACEs may contribute to the low frequency of ACEs.

Researchers have found that ACEs have been associated with an increased risk for late-onset mental health impairment using adults' retrospective self-reports of ACEs (3,17-19). Rokita *et al.* published a systematic review paper in 2018 and their research indicated a significant association between the adverse effects of childhood maltreatment and

poor parental attachment and social cognition in major psychiatric disorders (18). Dr. Chang *et al.* did a cross-sectional study that was carried out in Macheng city, Hubei province, China, in May 2014 and found that increased ACE scores were associated with increased risks of depression and posttraumatic stress disorder in adulthood (20).

Our research results (linear regression) indicated that although all ACEs have independently significant negative effects on participants' mental health and wellbeing during adulthood, the magnitude of the effect is different based on individual ACE. For example, living with anyone mentally ill or ever forced to have sex during childhood has the most significant negative effect on mental health and wellbeing during adulthood (increasing the days mentally not good by almost 3.5 days). These results are consistent with a previously published report (12). By studying ACEs and mental health in adulthood, Ari Mwachofi and his colleagues found that ACE-affected people experience significantly more days of poor mental health in adulthood than the ACE-unaffected and they also found living with a mentally ill person in childhood is the most consistent predictor of poor mental health in adulthood (21).

Our results also indicated that the total ACE account during childhood has the perfect linear relation with the total number of mentally not good in the past 30 days among all adult participants. A group of researchers from South Carolina conducted research and their results showed that there was a significant dose-response between the total ACE account during childhood and total ACE account during childhood (22). Mwachofi and his colleagues also reported a similar dose-response between ACEs accounts and poor mental health in adulthood (21).

Limitations

Study findings of this project should be interpreted considering several limitations, especially selection bias. Liu and colleagues' research found that prevalence of ACEs during the childhood was substantially higher among homeless adults than among the general population (23). The previous researches also indicated that homeless people were reported to experience more mental health issues than people who are not homeless (24,25). However, the BRFSS is the nation's premiere system of health-related telephone surveys, which may not well represent the homeless population since they may not have home telephone to participate the survey. Respondents may also have denied transgender identity because of concerns about safety, privacy, or transphobia.

Many researchers have used retrospective reports to assess the long-term consequences of early ACEs (8-12). However, recall bias also cannot be ignored since current individual characteristics and experiences may bias the recall of these reports (26,27). More importantly, participants' mental health wellbeing may have important effects on the reporting of traumatic childhood experiences. Associations between ACEs and adulthood mental health outcomes measured by retrospective reporting may be not the same as cause and effect analysis (27,28). Studies that use retrospective reporting to estimate the associations between childhood adversity and adulthood mental health outcome may be biased (27). The prospective studies, especially with large sample size, are needed to confirm the effect of ACEs on mental health during adulthood.

Despite these limitations, this study represents a rare and unique opportunity to study mental health outcomes among the individuals who had ACEs during their childhood by using the largest continuously conducted health survey system in the world. Our findings showed that ACEs have been associated with increased risk for late onset of mental health impairments. Although the total ACE account during the childhood showed good linear relationship with mental health wellbeing during the adulthood, the individual ACEs may play different role in this association. For those children with identified adverse experiences, early interventions, such as cognitive-behavioral therapy, psychological therapies, parent training, and broader support interventions, may be effective to improve long term outcomes (29).

Conclusions

Early childhood adverse experiences are not uncommon, and they potentially have significant negative effects on mental health wellbeing during adulthood. The magnitude of the association is different based on individual ACEs, and dose-response exists between the total ACEs account and poor mental health wellbeing during adulthood.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://jphe.amegroups.com/article/view/10.21037/jphe-22-91/rc>

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