

Adverse Childhood Experiences (ACEs) among reproductive age women:
Findings from the 2019 BRFSS

by

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Abstract

Background and Significance

The 1998 Adverse Childhood Experiences ACE Study defines ACEs as ten categories of abuse, neglect, and family stressors before age 18. ACEs contribute to poor health and wellbeing for all genders across the lifespan. Despite rising premature mortality among women, and the impact of childhood adversity on girls and women, scant research examines trends in ACEs among women of reproductive age.

Methods

This study utilizes the 2019 BRFSS Survey and focuses on women and men ages 18-39 in 17 states. The study first analyses gender differences in ACE score and specific ACE exposures. The study then examines age differences in ACE scores between four age cohorts of women of reproductive age (18-24, 25-29, 30-34, 35-39 years). Finally, the study analyses associations between women's ACEs scores and adult physical and mental health, self-reported BMI categories, history of depression, and fair to poor overall health by age cohort.

Results

Findings revealed a higher prevalence of 4+ ACE scores among women as compared to men ages 18-39 years (5.42% difference). A greater proportion of women experienced sexual abuse (16.49% vs. 5.91%), lived with someone experiencing mental illness (22.16% vs. 15.44%), with alcohol abuse (22.31% vs. 18.32%) and drug/prescription medication abuse (13.58% vs. 12.16%), and witnessed domestic violence at home (16.59% vs. 12.84%) compared to men. Younger reproductive age women (18-24 years) experienced a greater prevalence of 4+ ACEs (24.67%) as compared to older reproductive age women (35-39 years) (20.06%; 4.61% difference). In contrast to those without a history of ACEs, women with 4+ ACEs were 1.59 (95% CI, 1.41-1.78) times as likely to develop obesity, 3.46 (95% CI 3.07-3.90) times as likely to have a history of depression, and 1.68 (95% CI 1.45-1.94) times as likely to report fair or poor health.

Discussion

ACEs are associated with significant health problems among reproductive age women. These findings provide a critical foundation for future social epidemiology research focused on this population. Awareness of the prevalence and impact of ACEs must be included in public health planning, policy, and practice to improve the health of reproductive age women.

Public Health Relevance

Childhood adversity and trauma have large effects on adult physical and mental health outcomes (Merrick et al., 2019). Adverse Childhood Experiences (ACEs) is one way to describe and measure abuse, neglect, and household stressors experienced prior to age 18 (Atzl et al., 2019). The ACE Questionnaire assigns one point to each experience of adversity reported. The ACE score is the sum of the points for all experiences reported.

ACEs are common, with previous studies revealing that on average 60% of the United States population report one or more adverse childhood experiences (Atzl et al., 2019). The association of ACEs and key health outcomes across the lifespan is also well documented through national and international studies. Research has shown that greater exposure to ACEs (i.e., higher ACE scores) is associated with higher prevalence of chronic diseases (Felitti et al., 1998; Anda et al., 2006; Sonu et al., 2019) and mental health problems (Dube et al., 2003; Sonu et al., 2019; Merrick et al., 2019). Additionally, smoking, alcohol and substance use are associated with higher ACE scores (Felitti et al., 1998; Dube et al., 2003; Anda et al., 2006). Social outcomes, such as education, employment, and income, have also been linked to ACE scores in a negative dose-dependent relationship; outcomes which further influence overall health status of an individual (Merrick et al., 2019). Although limited research on ACEs among pregnant women is available, some evidence suggests a higher burden of ACEs is associated with poorer mental health during pregnancy (Young-Wolff et al., 2019) and increased risk of complications for both mother and fetus (Racine et al., 2018).

There are growing concerns in the United States about the health and life expectancy of women, particularly of reproductive age. Over the past decade, “working age” adults (ages 25-64 years) experienced a 6.0% increase in age-adjusted all-cause mortality (National Academies of Sciences, 2021). Specifically, among women ages 25-31 years, premature mortality increased from 1999-2014 (Shiels et al., 2017), with 3% increase among white women. While the increasing disparity gaps in mortality rates according to socioeconomic status was first documented among working age non-Hispanic white females, growing research demonstrates a similar and stable gap among Black women as well (National Academies of Sciences, 2021). Furthermore, though decreasing life expectancy (Case & Deaton, 2015) and increasing mortality rates among non-Hispanic white women have gained traction and focus, the mortality rate for Blacks and other historically marginalized populations has consistently been worse (National Academies of Sciences, 2021), with greatest premature mortality rates among American Indian/Alaska Natives followed by Black women (Shiels et al., 2017).

Concurrently, the United States has been experiencing critical epidemics of obesity, substance abuse, and depression (Sachs, 2018). Overall prevalence of obesity among adults has continued to rise, with greater prevalence of severe obesity among women as compared to men (Hales et al., 2020). In addition to physical and physiologic implications for health outcomes, social stigma associated with obesity also has significant ramifications on subjective health status and wellbeing (Sachs, 2018). Described as “deaths of despair”, substance abuse and suicide are significant factors adding to mortality rates among working-age Americans and represented 8% of deaths from 1990-2017 among this population (National Academies of Sciences, 2021). Though rates of depression among women ages 20 and older remained stable from 2007-2016, women have twice the likelihood of having depression compared to men, with a negative relationship between depression prevalence and household income (Brody et al., 2018). Independently concerning, these three epidemics are closely interrelated (Sachs, 2018), and indicate

degrees of underlying psychological distress (National Academies of Sciences, 2021). Mood-altering substances and food are often used as forms of self-medication for pain and trauma, and may explain in part the poor health trends among reproductive age women.

Maternal morbidity and mortality in the United States represent some of the highest rates when compared peer countries (Wang et al., 2020); two times, in fact, the maternal mortality rates for Canada or the United Kingdom (Fuentes-Afflick et al., 2021). Furthermore, low birth weight (LBW) trends have been consistently poor in the United States (Martin et al., 2021). Following a dramatic 20% increase from 1990 to 2006, LBW was on the decline until 2012 (Martin et al., 2021). Representing 8.31% of all births in 2019, LBW has risen once again and represents the highest prevalence since 2006, with the highest rates among non-Hispanic Black women (14.15%) (Martin et al., 2021). Research demonstrates the significant association of higher maternal morbidity and mortality among women of racial and ethnic minorities (Wang et al., 2020), due in large part to the role of structural racism promoting socioeconomic disparities and further intensified by disproportionate access and quality of health care (Declercq & Zephyrin, 2020). The rise of preconception morbidity, i.e., increasing chronic conditions and poor overall health among women prior to conception, also may contribute to maternal mortality rates (Fuentes-Afflick et al., 2021).

Collectively, significant concerns have been raised about the deterioration of women's health, with persistent gaps among racial/ethnic and socioeconomic groups. One possible correlate of these trends is the high prevalence of ACEs among younger, reproductive aged women. This is congruent with life course theory, which proposes that early experiences, both positive and traumatic, have substantial consequences for individuals later in childhood and adulthood (Nurius et al., 2015). Yet, ACEs are a neglected part of the social epidemiology of declining health, as evidenced by the little existing research examining ACEs among women of reproductive age. Furthermore, there are few studies of sex-specific responses to the ACEs survey, and there has also been little attention paid to potential differences in the burden of ACEs among birth cohorts (Sonu et al, 2019; Dube et al., 2003).

Because they are associated with at least five of the ten leading causes of death as well as numerous other physical, mental health and social problems (Center for Disease Control and Prevention, 2019). ACEs are a critical public health concern. Fortunately, they are preventable (Merrick et al., 2019). Further examining the role of early trauma among reproductive age women provides potential insight into the poor health trends currently experienced by this population, and can help inform public health efforts and policies to better support the overall health and wellbeing of this population within the United States.

Study Aims

This study focuses on men and women age 18-39 using recent data from 17 states which collected ACEs survey module data during the 2019 BRFSS National Survey.

The specific aims of this research include:

- 1) To what extent are ACEs sex specific? Do women have a higher prevalence of ACEs overall, and what are the differences in exposures compared to males of same ages?
- 2) Do younger respondents (age 18-24) report higher ACE scores compared to older reproductive age cohorts?

- 3) What is the association between ACE score levels and self-reported obesity, history of depression, and fair to poor health among women of reproductive age?

Methods

2019 BRFSS ACE and Reproductive Aged-Respondents

The Behavioral Risk Factor Surveillance Study (BRFSS) is an annual randomized telephone survey of U.S. adults ages 18 and older regarding specific health behaviors, risk factors and existing health conditions (Centers for Disease Control and Prevention, 2014). State-based, it collects data from all 50 states, the District of Columbia and three U.S. territories (Centers for Disease Control and Prevention, 2014). The survey is comprised of three components: core modules, optional modules, and questions added by individual states (Centers for Disease Control and Prevention, 2021a). While core modules collect data on sociodemographic information and key health behaviors, optional modules further examine specific health issues among state residents (Centers for Disease Control and Prevention, 2021a). The optional ACE module included within the 2019 BRFSS was derived from the CDC-Kaiser Adverse Childhood Experiences study (Centers for Disease Control and Prevention, 2020). Research with de-identified publicly available BRFSS data is IRB exempt.

Our study focused on the 17 states which completed the optional ACEs module as part of the 2019 BRFSS and further narrowed our population to respondents ages 18-39 years. This resulted in a sample of 27,489 women and 25,375 men ages 18-39 years, weighted to represent a national total population of 23,730,895 women and 23,874,684 men ages 18-39 years.

ACE Exposure Categories and Score

The BRFSS ACEs Module included 11 questions examining reported Adverse Childhood Experiences, which are further condensed into 8 total categories including: physical abuse, verbal abuse, sexual abuse, lived with someone experiencing mental illness, lived with someone experiencing substance abuse, lived with someone who was incarcerated, parents' divorce or separation, and witnessed domestic violence at home (Table 1).

The independent variable of the study was the ACE score. Exposure within any of the eight categories contributed one point towards the ACE score. ACE score was then calculated by summing the dichotomized variables for each category. Scores were further grouped as follows: 0, 1, 2-3, and 4+ ACEs.

Classification for each exposure was based on respondents answering "yes", "once" or "more than once" for any of the following items occurring prior to age 18: physical abuse ("How often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way?"), verbal abuse ("How often did a parent or adult in your home ever swear at you, insult you, or put you down?"), lived with someone experiencing mental illness ("Did you live with anyone who was depressed, mentally ill, or suicidal?"), lived with someone experiencing substance abuse ("Did you will 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?"), lived with someone who was incarcerated ("Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?"),

parents' divorce/separation ("Were your parents separated or divorced?"), witnessed domestic violence at home ("How often did your parents or adults in your home every slap, hit, kick, punch or beat each other up?"), and sexual abuse (responses of "once" or "more than once" to any of 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?") (Table 1) (Centers for Disease Control and Prevention, 2021a).

Characterization of Sociodemographic Variables

This study explored respondents' age, race/ethnicity, education, employment, income, marital status, pregnancy status, and number of children in household. Respondents' age was categorized into four cohorts: 18-24 years, 25-29 years, 30-34 years, and 35-39 years. Race/ethnicity was classified as non-Hispanic white, non-Hispanic African American/Black, Hispanic, Asian American, and other/unknown. Reported household income level (\leq \$15,000, \$15-35,000, \$35-50,000, \$50-75,000, and \geq \$75,000) was imputed for approximately 17% of the sample with missing income data. Income level for this population was imputed from a regression analysis based on age, race/ethnicity, sex, education, employment, home ownership, marital status, self-reported overall health, physical and mental health using the STATA impute command. Analyses included respondents' highest level of education (college graduate or higher education, some college, or high school graduate or less), current employment, marital status, and pregnancy status.

Measures of Overall Health and Mental Wellbeing

The three dependent health and mental wellbeing variables included two self-reported mental and overall health questions:

- 1) "(Ever told) (you had) a depressive disorder (including depression, major depression, dysthymia, or minor depression?" with "where responses were dichotomized with "yes" as the affirmative. Respondents with "yes" response were classified as having a history of depression.
- 2) "Would you say that in general your health is excellent, very good, good, fair, poor" where fair or poor responses were dichotomized as the affirmative vs. good, very good and excellent.

The final dependent variable of computed body mass index (BMI) was calculated based on self-reported metrics of height and weight. Responses were dichotomized as obese (\geq 30.0) or not obese ($<$ 29.0).

Measures of Specific Health Conditions and Healthcare Utilization

To support examination of overall health among preconception reproductive women and association with ACE score, additional variables for chronic health conditions and healthcare utilization were included. The chronic health conditions included diabetes and hypertension. Self-reported diabetes was classified by responses to the question "(Ever told) (you had) diabetes?" with responses of "yes" and "yes during pregnancy" dichotomized as the affirmative. Self-reported hypertension was classified by responses to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" with responses of "yes" and "yes during pregnancy" dichotomized as the affirmative.

For healthcare utilization, four variables were included based on the BRFSS questions:

- 1) "About how long has it been since you last visited a doctor for routine checkup?" with responses categorized as "within the past year", "past 1-5 years" and "5+ years or never".
- 2) "Was there a time in the past 12 months when you needed to see a doctor but could not because of cost", with responses dichotomized yes vs. no.
- 3) "Do you have one person you think of as your personal doctor or health care provider?" with "yes only one" or "more than one" responses dichotomized as the affirmative.
- 4) "Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Services?" with responses dichotomized yes vs. no.

Statistical Analyses

Chi square tests were used to determine the significance of differences between ACE score categories and respondents' sociodemographic characteristics and health status outcomes. Multiple logistic regression was used to test the significance of associations between ACE score category and obesity, history of depression, and self-reported fair to poor general health. All data analysis was conducted utilizing STATA Version 16.1 (College Station, TX).

Results

Table 2 and **Figure 1** present the weighted proportion of ACE scores (0, 1, 2-3, 4+) among women as compared to men of reproductive age (18-39 years). Statistically significant differences were observed for ACE scores of 0, 1, and 4+. There was a higher prevalence of men who had ACE scores of 0 (3.17% greater among men) and 1 (1.75% greater among men), but a higher prevalence of women who had ACE scores of 4+ (5.42% greater among women).

Table 3 and **Figure 2** present the weighted proportion of each category of ACEs exposure among women as compared to men of reproductive age (18-39 years). Statistically significant differences were observed across all but two ACE items (physical abuse and lived with someone who was incarcerated). Compared to men, there was a greater proportion of women across all ACE categories. There was a higher prevalence of women who experienced sexual abuse (10.58% difference), domestic violence at home (3.75% difference), lived with someone experiencing mental illness (6.72% difference), alcohol abuse (3.99% difference) and drug/prescription medication abuse (1.42% difference) compared to men.

The association of ACE scores with sociodemographic and health factors among women of reproductive age (18-39 years) is shown in **Table 4**. Of respondents, 19.53% were 18-24 years, 27.21% were 25-29 years, 26.14% were 30-34 years, and 27.11% were 35-39 years. Younger reproductive age women (18-24 years) experienced a greater prevalence of 4+ ACEs (24.67%) as compared to older reproductive age women (35-39 years) (20.06%; 4.61% difference). For all other ACE scores (0, 1, 2-3), there was a slightly greater proportion of older reproductive age women (1.01%, 2.02%, and 1.58% difference for each score, respectively).

Most participants were non-Hispanic white (62.09%). Women college graduates experienced significantly lower prevalence of 4+ ACEs (14.63%) as compared to women with high school diplomas/GED or less (25.93%, $p < 0.05$). A similar trend was present for income, comparing the

proportion of respondents with 4+ ACEs among women with \$75,000+ income (17.16%) to women with \$0-15,000 (31.26, $p < 0.05$).

Examining health outcomes, women reporting “excellent” general health had far lower prevalence of 4+ ACEs (13.56%) as compared to those reporting “poor” general health (40.99%) and “fair” general health (34.97%). When condensed into the dichotomous “fair to poor health” as compared to “good, very good, and excellent”, 15.85% of women had “fair to poor” health; of whom, over one third had 4+ ACEs (36.29%). Over a quarter of women reported a history of depression (27.69%). Of this population, there was a significantly greater prevalence of 4+ ACEs (39.33%) as compared to women without a history of depression (15.75%, $p < 0.05$).

Among women surveyed, most reported seeing at least one provider regularly for general care (76.47%) and have healthcare coverage (85.39%). Women with at least one provider had lower prevalence of 4+ ACEs (21.98%, vs. 23.25% of those without one provider), as did women with healthcare coverage (21.79%, vs. 25.11% for those without coverage). Despite most having healthcare coverage, 18.53% of women reported not being able to access healthcare due to cost. Among this group, there was a significantly greater proportion of 4+ ACEs (34.05%) compared to women not reporting this financial barrier (19.60%). Most women also reported having a check-up within the past year (76.31%). Among this group, there was a lower prevalence of 4+ ACEs (21.07%) when compared to women with a check-up in the past 1-5 years (24.97%) and women with a check-up in the past 5+ years or never (29.76%).

Models 1-3 show the hierarchical logistic regression modeling of the association of ACE score and obesity, history of depression, and fair to poor health. **Figure 3** demonstrates the odds of obesity, history of depression, and fair to poor health by ACE score (1, 2-3, 4+) as compared to those without a history of adverse childhood experiences.

Model 1 shows the statistically significant logistic regression model of obesity and ACE score, sociodemographic characteristics, and additional key outcomes. Compared to those without a history of ACEs, women with 4+ ACEs were 1.59 (95% CI, 1.41-1.78) times as likely to develop obesity. Women with a history of depression were 1.47 (95% CI 1.33-1.62) times as likely to develop obesity, while those with fair or poor health were 1.64 (95% CI 1.45-1.84) times as likely to develop obesity.

Model 2 shows the statistically significant logistic regression model of history of depression and ACEs, sociodemographic characteristics, and additional key outcomes. Compared to those without a history of ACEs, women with 4+ ACEs were 3.46 (95% CI 3.07-3.90) times as likely to have a history of depression. Women with obesity were 1.47 (95% CI 1.33-1.61) times as likely to have a history of depression, while those with fair to poor health were 2.73 (2.42-3.09) times as likely.

Model 3 shows the statistically significant logistic regression model of fair or poor health and ACE score, sociodemographic characteristics, and additional key outcomes. Compared to those without a history of adverse childhood experiences, women with 4+ ACEs are 1.68 (95% CI 1.45-1.94) times as likely to have fair or poor health. Women with obesity are 1.65 (95% CI 1.47-1.86) times as likely to have fair or poor health, while women with a history of depression are 2.65 (95% CI 2.34-3.00) times as likely.

Discussion

ACEs by Sex and Age

The proportion of women of reproductive age (18-39 years) with 4+ ACE scores was significantly greater than proportion of men of same age group (18-39 years). Furthermore, the prevalence of responses for each of the ACE exposure categories was significantly greater among women (ages 18-39) as compared to men of same age group (ages 18-39). Previous studies similarly demonstrate greater prevalence of sexual abuse and witnessing domestic violence at home as compared to men (Afifi et al., 2008). More recently, Fang et al. (2016) found greater prevalence of women vs. men who lived with someone suffering with mental illness or addiction, witnessed domestic violence or experienced sexual abuse. Our findings, however, show more women had 4+ ACEs and had exposure across all categories when compared to men. Furthermore, our findings are specific to reproductive age women, while previous research included adults 18 and above.

This study found a greater proportion of women reporting high ACE scores (4+ ACE score) among younger women (ages 18-24) when compared to older reproductive aged women (35-39), with comparable proportions across all age groups for remaining ACE scores (0, 1, 2-3 ACEs). It is possible there are several factors contributing to these trends. Younger respondents (ages 18-24) may have better memory and recall of earlier childhood as compared to older respondents. Yet, the age gap has been significantly narrowed between youngest and oldest age groups (18-24 vs. 35-39 years), making this potential effect less likely. It may be that younger respondents are more willing to disclose childhood adversity as compared to older women of reproductive age due to generational differences in discussing personal experiences. Finally, it may be that younger women of reproductive age do in fact have greater prevalence of 4+ ACEs as compared to older women of reproductive age. Sonu et al. (2019) similarly found greater prevalence of 4+ ACEs among younger age cohorts, with decreasing prevalence as age increased. However, their work was inclusive of adults of all ages and sexes, with age cohorts of greater range. Comparatively, our findings here focused on narrower age cohorts of women.

ACEs and Overall Health and Mental Wellbeing

This study found a dose-dependent relationship between ACE score and general health status; namely, greater burden of poor to fair health among women of reproductive age with higher ACE scores. It also demonstrates a dose-dependent relationship between ACE score and history of depression. Women of reproductive age with any history of ACE (1, 2-3, 4+ ACEs) were found to have an increased likelihood of developing obesity. Furthermore, this study found that women of reproductive age with obesity had increased likelihood of having a history of depression and experiencing fair or poor health.

These findings further support the well-documented association of ACE scores and poor physical and mental health outcomes (Felitti et al., 1998; Anda et al., 2006; Sonu et al., 2019). Importantly, the results presented here provide evidence that these trends hold true specifically for women of reproductive age in the United States. Moreover, these findings highlight the interrelated nature of these specific outcomes. Obesity, depression, and poor health status are not isolated from each other; rather, dependent upon ACEs as the central factor. Understanding this relationship has critical implications for the role of ACE prevention efforts in improving health outcomes.

ACEs and Healthcare Utilization

This study found a greater rate of high ACE scores (ACE=4+) among women with decreased healthcare utilization (5+ years since last check-up, unable to access to healthcare due to cost, no regular personal provider, and no healthcare coverage) as compared to women with greater healthcare utilization. These findings are distinct from those of previous studies examining ACEs and healthcare utilization, which found an overall association of increased utilization with greater burden of ACEs (Chartier et al., 2010). One possible explanation for this is the variance in specific variables examined. In this study, we examined healthcare coverage, time since last check-up, regular provider, and inability to access care due to cost. Comparatively, other studies have examined frequency of visits in key healthcare settings, such as primary care office, ER, and cumulative visits across any service (Chartier et al., 2010). As such, the variables examined within this study provide an expanded view of the factors (i.e., income, insurance, etc.) influencing an individual's ability to access care, and may allude to both the direct and indirect implications of ACE score on healthcare utilization.

ACEs and the Health of Women of Reproductive Age

Previous research documents well the association of high burden of ACEs and increased risk for chronic conditions (Felitti et al., 1998; Anda et al., 2006; Sonu et al., 2019). Our findings here illustrate higher exposure to childhood adversity among women as compared to men, and among younger women as compared to older women. Furthermore, women with higher ACE scores had greater odds of developing obesity and reporting poor health status and history of depression, with concurrent decreased healthcare utilization. Therefore, because they reported higher ACE scores than older women, younger women appear to be at notably increased risk for chronic diseases and poor mental health outcomes, important for preconception, pregnancy, and peripartum health. Poor preconception health increases pregnancy complications, including premature delivery (Fuentes-Afflick et al., 2021); a significant contributor to both infant mortality and morbidity across the lifespan (Fuentes-Afflick et al., 2021).

Furthermore, our findings here demonstrate higher likelihood of obesity and experiencing depression for women reporting a greater burden of childhood adversity (ACE=4+). These findings support the role of underlying psychologic distress in poor health outcomes and “deaths of despair” and indicate childhood adversity may further contribute (Case & Deaton, 2015) (National Academies of Sciences, 2021) (Sachs, 2018). The high prevalence of women with 4+ ACEs and lowest levels of income (\$0-15,000; 31.26%) and education (high school graduate/GED or less; 26.08%) further indicate the socioeconomic disparities in adversity and likelihood for poor physical and mental health outcomes. These findings stratified by socioeconomic characteristics align with the existing trends among premature mortality for women of working age (National Academies of Sciences, 2021).

Clinical and Public Health Implications

This work has implications for both clinical practice and public health efforts. Given the significant rate of ACE exposures among reproductive age women, using a trauma-informed approach, which recognizes the prevalence of childhood adversity and its impact on health, puts that knowledge into practice and avoids re-traumatization, is critical for prevention and treatment strategies (Substance Abuse and Mental Health Services Administration, 2014). Examining health status and behaviors through a life course perspective will better allow researchers, clinicians, and medical educators to understand factors contributing to health and to design, describe and provide holistic, effective care. Formal integration of training about the science and practice of trauma-informed care within undergraduate and graduate

training for healthcare providers is essential to ensure that clinicians caring for patients can help prevent, mitigate, and treat the effects of adversity and trauma to support healing and health.

In concert with these efforts, it is critical that public health and policy efforts continue to work towards preventing Adverse Childhood Experiences. Pursued through the lens of life course theory, public health efforts are perfectly positioned to address ACEs at all age levels and from multiple perspectives: education, housing, nutrition, health care content and access, to name only a few. Furthermore, public health is well-positioned to continue this research on reproductive aged women. Additional studies on the role of ACEs on seeking contraceptive/STI services and healthcare utilization may further our understanding of the preconception health status and behaviors of reproductive age women. Cross-examination of Pregnancy Risk Assessment Monitoring (PRAMS) and BRFSS data would provide a comprehensive look at the health, behaviors, and attitudes of women during pregnancy and postpartum, and identify existing gaps at the state and national level (Centers for Disease Control and Prevention, 2021b). In addition to ACEs, populations which have been historically oppressed and discriminated against have additional layers of adversity affecting their health and well-being. Prioritizing this work, particularly among diverse sociodemographic populations, across the life course will enable progress towards health equity (Fuentes-Afflick et al., 2021).

Limitations

This study has two key limitations that should be considered. First, recall of experiences by older participants, as compared to younger participants, may introduce a source of bias. However, our exclusion of older middle age and elderly participants (ages 40+) limits both recall and survival bias, increasing the credibility of this work. Second, the majority (63.55%) of women of reproductive age in this study were non-Hispanic white. While this may be reflective of the population in the United States, it may not accurately represent the experience of non-white women. It does not account for experiences of racism, which serve as an additional risk factor interacting with childhood adversity and physical and mental health outcomes (Slopen et al., 2016). As such, this may limit generalizability of findings to populations of non-white women of reproductive age.

Conclusions

Using the 2019 BRFSS, this study is one of few examining the prevalence and impact of ACEs among women of reproductive age. The findings demonstrate the role of ACEs in current physical and mental health outcomes among women of reproductive age, with implications for why premature mortality in the United States is rising, particularly among the same population across all sociodemographic backgrounds. Consideration of this research has vital implications for public health and policy efforts. Though previously neglected in social epidemiology, consideration of ACEs and racial inequalities in adversity for future public health efforts is critical to better support the health and wellbeing of women of reproductive age.

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Appendix

Table 1: 2019 BRFSS ACE Exposure Categories and Corresponding Questions*

ACE Exposure Category	2019 BRFSS ACE Module Question
Physical abuse	“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?”
Verbal abuse	“How often did a parent or adult in your home ever swear at you, insult you, or put you down?”
Sexual abuse	<ol style="list-style-type: none"> 1) “How often did anyone at least 5 years older than you or an adult ever touch you sexually?” 2) “How often did anyone at least 5 years older than you or an adult try to make you touch them sexually?” 3) “How often did anyone at least 5 years older than you or an adult force you to have sex?”
Lived with someone experiencing mental illness	“Did you live with anyone who was depressed, mentally ill, or suicidal?”
Lived with someone experiencing substance abuse	<ol style="list-style-type: none"> 1) “Did you live with anyone who was a problem drinker or alcoholic?” 2) “Did you live with anyone who used illegal street drugs or who abused prescription medications?”
Lived with someone who was incarcerated	“Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?”
Parents’ divorce/separation	“Were your parents separated or divorced?”
Witnessed domestic violence at home	“How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?”

*All questions refer to experiences prior to 18 years of age.

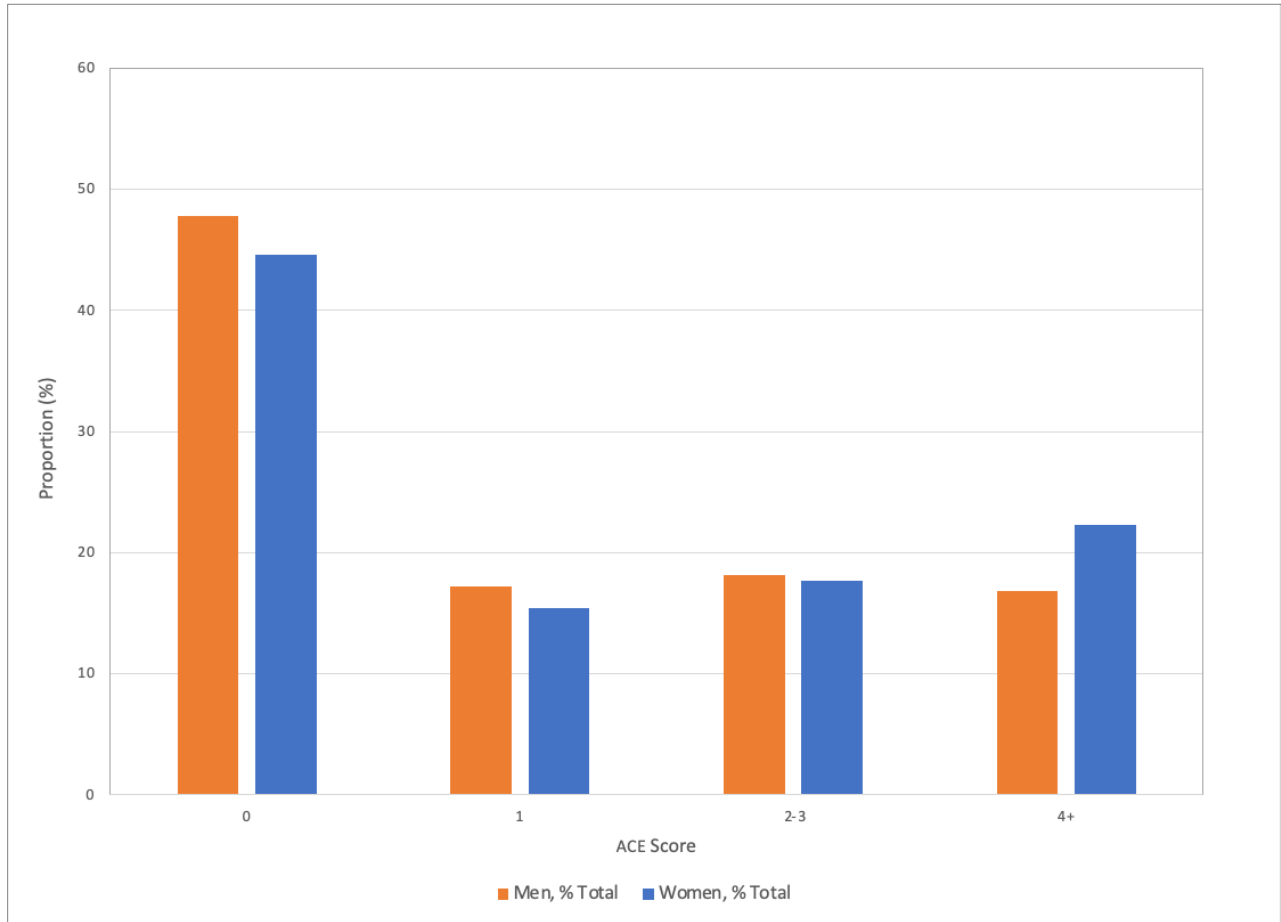
Table 2: ACE Score among women vs. men of reproductive age (18-39 years) among 17 states participating in the 2019 BRFSS*

ACE Scores	Column Percent Total, Men Ages 18-39	Column Percent Total, Women Ages 18-39	Percent Difference
0 ACEs	47.77	44.60	-3.17
1 ACE	17.22	15.47	-1.75
2-3 ACEs	18.15	17.66	-0.49 ^a
4+ ACEs	16.86	22.28	+5.42

* 2019 BRFSS based upon 27,487 responses of women ages 18-39 years, and 25,375 responses of men ages 18-39, in 17 states completing the optional ACEs module, weighted to combined national population of N = 47,605,579.

^a p-value > 0.05. All other values were statistically significant, i.e., p < 0.05.

Figure 1: ACE Score among women vs. men of reproductive age (18-39 years) among 17 states participating in the 2019 BRFSS*¹



* 2019 BRFSS based upon 27,487 responses of women ages 18-39 years, and 25,375 responses of men ages 18-39, in 17 states completing the optional ACEs module, weighted to combined national population of N = 47,605,579.

¹p-value > 0.05 for ACE Score 2-3. All other values were statistically significant, i.e., p < 0.05.

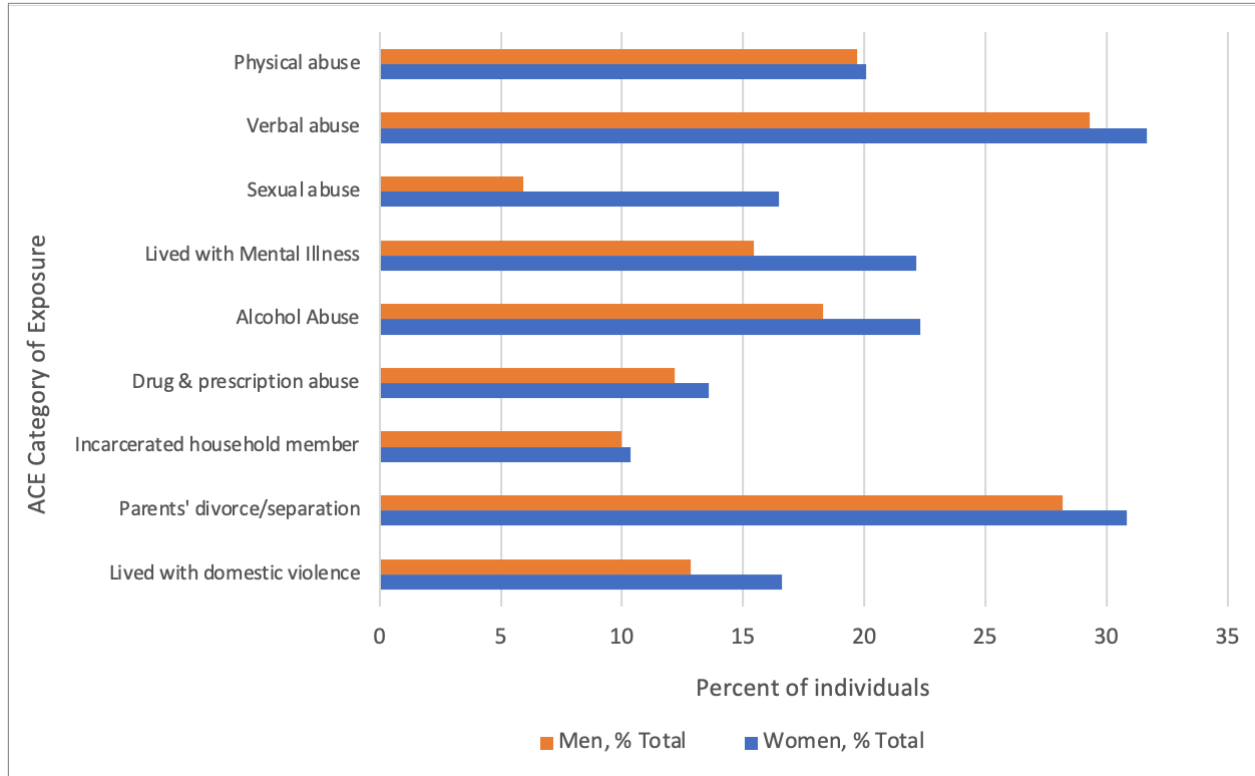
Table 3: Categories of ACEs exposure among women vs. men of reproductive age (18-39 years) among 17 states participating in the 2019 BRFSS*

ACE Category of Exposure	Column Percent Total, Men Ages 18-39	Column Percent Total, Women Ages 18-39	Percent Difference
Physical abuse	19.71	20.10	+0.39 ^a
Verbal abuse	29.31	31.67	+2.36
Sexual abuse	5.91	16.49	+10.58
Lived with mental illness	15.44	22.16	+6.72
Household substance abuse			
Alcohol	18.32	22.31	+3.99
Drugs, prescription medication abuse	12.16	13.58	+1.42
Lived with incarcerated household member	9.97	10.35	+0.38 ^a
Parents' divorce/separation	28.21	30.84	+30.84
Lived with domestic violence	12.84	16.59	+3.75

* 2019 BRFSS based upon 27,487 responses of women ages 18-39 years, and 25,375 responses of men ages 18-39, in 17 states completing the optional ACEs module, weighted to combined national population of N = 47,605,579.

^a p-value > 0.05. All other values were statistically significant, i.e., p < 0.05.

Figure 2: Categories of ACEs exposure among women vs. men of reproductive age (18-39 years) among



17 states participating in the 2019 BRFSS*

* 2019 BRFSS based upon 27,487 responses of women ages 18-39 years, and 25,375 responses of men ages 18-39, in 17 states completing the optional ACEs module, weighted to combined national population of N = 47,605,579.

Table 4: Age, Sociodemographic Characteristics and Key Health Outcomes of Reproductive Age Women (18-39 years), by ACE Score*

	Column Percent Total sample Weighted N=23,730,895	Row Percent 0 ACEs, Weighted N=10,583,986	Row Percent 1 ACE, Weighted N=3,670,734	Row Percent 2-3 ACEs, Weighted N=4,189,838	Row Percent 4+ ACEs, Weighted N=5,286,337
Age					
Age 18-24	19.53	44.04	14.20	17.09	24.67
Age 25-29	27.21	44.98	15.26	16.35	23.40
Age 30-34	26.14	44.16	15.84	18.38	21.62
Age 35-39	27.11	45.05	16.22	18.67	20.06
Race/Ethnicity²					
NH white	63.55	42.51	15.43	18.39	23.67
NH Black	16.79	44.88	17.80	17.24	20.08
Asian	3.05	71.75	11.21	8.79	8.24
Hispanic	13.74	49.76	14.13	16.57	19.54
Other	2.87	35.63	13.61	18.45	32.31
Education²					
High School/GED or Less	35.86	42.75	15.03	16.14	26.08
Some college (1-3 years)	34.39	41.04	15.04	18.87	25.05
College graduate & higher	29.75	50.64	16.58	18.16	14.63
Employment					
Paid employment or self-employed	64.32	43.72	16.49	18.43	21.36
Not employed	35.68	46.20	13.62	16.26	23.92
Income					
\$0-15,000	8.67	38.53	15.18	15.02	31.26
\$15-35,000	20.69	44.07	13.21	16.30	26.41
\$35-50,000	27.04	45.04	15.51	16.57	22.89
\$50-75,000	14.62	45.11	15.29	19.48	20.11
\$75,000 +	28.98	46.13	17.21	19.50	17.16
Marital Status					
Married or Living as married couple	52.61	46.64	15.97	17.73	19.65
Pregnancy Status¹					
Currently pregnant	2.76	45.74	17.88	14.96	21.42
Not pregnant/unsure	97.24	44.57	15.40	17.73	22.30
# Children in Household					
No children	42.24	44.48	15.53	18.19	21.80
1-2 children	41.09	42.20	16.38	18.26	23.17
3+ children	16.67	50.82	13.07	14.81	21.30
General Health Status²					
Poor	3.49	31.58	12.11	15.31	40.99
Fair	12.38	34.75	12.81	17.47	34.97
Good	32.13	43.92	14.77	18.25	23.05

Very good	33.63	44.39	17.01	18.92	19.68
Excellent	18.37	55.22	16.29	14.94	13.56
Ever been told had depressive disorder					
Yes	27.69	29.67	11.32	19.68	39.33
No	72.31	50.32	17.06	16.88	15.75
BMI					
Obese	29.25	34.80	15.83	21.47	27.89
Ever been told had diabetes					
Yes	7.52	36.46	14.78	20.20	28.57
No	92.48	45.26	15.52	17.45	21.76
Ever been told had hypertension					
Yes	19.91	38.94	14.09	19.16	27.82
No	80.09	46.01	15.81	17.28	20.90
Time passed since last check-up²					
Within past year	76.31	45.45	15.92	17.56	21.07
Past 1-5 years	17.77	42.63	13.74	18.67	24.97
5+ years or never	5.92	39.57	14.83	15.84	29.76
Couldn't access healthcare due to cost					
Yes	18.53	36.45	13.22	16.28	34.05
No	81.47	46.45	15.98	17.97	19.60
Personal provider/PCP					
1+ provider regularly see	76.47	44.06	15.99	17.97	21.98
No	23.53	46.36	13.77	16.62	23.25
Healthcare coverage²					
Yes	85.39	44.26	15.68	18.28	21.79
No/unsure	14.61	46.61	14.26	14.02	25.11

* 2019 BRFSS based upon 27,489 responses of women ages 18-39 years in the 17 states completing the optional ACEs module, weighted to national population of N = 23,730,895. For categories missing survey responses, weight population sample is noted as percent difference.

¹ p > 0.05. All other values were statistically significant at p < 0.05.

² Weighted population for this survey response < 1% difference from N=23,730,895.

Hierarchical Logistic Regression Modeling of the association of ACE score and Obesity, History of Depression, and Fair to Poor Health*

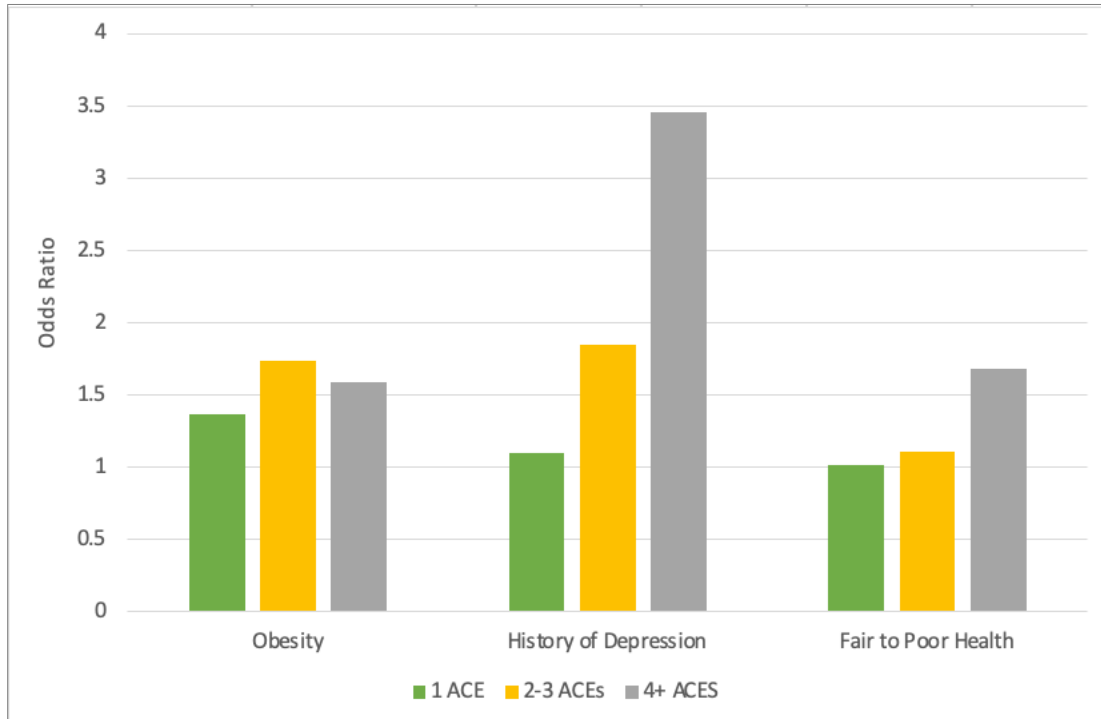
	1. Model of obesity	2. Model of history of depression	3. Model of fair to poor health
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Total ACE score			
0 ACEs	Reference	Reference	Reference
1 ACE	1.37 (1.21-1.55)	1.10 (0.95-1.27) ^a	1.02 (0.85-1.22) ^a
2-3 ACEs	1.74 (1.55-1.95)	1.85 (1.63-2.10)	1.11 (0.94-1.31) ^a
4+ ACEs	1.59 (1.41-1.78)	3.46 (3.07-3.90)	1.68 (1.45-1.94)
Age			
Age 18-24	Reference	Reference	Reference
Age 25-29	1.55 (1.32-1.81)	1.14 (0.97-1.33) ^a	1.89 (1.50-2.37)
Age 30-34	1.93 (1.65-2.27)	0.95 (0.82-1.12) ^a	2.68 (2.13-3.35)
Age 35-39	2.06 (1.75-2.41)	0.92 (0.79-1.08) ^a	4.06 (3.26-5.05)
Race and Ethnicity			
NH white	Reference	Reference	Reference
NH Black	1.90 (1.69-2.14)	0.35 (0.31-0.41)	1.15 (0.99-1.35) ^a
Asian	0.49 (0.25-0.96)	0.54 (0.27-1.06) ^a	1.15 (0.65-2.02) ^a
Hispanic	0.89 (0.75-1.05) ^a	0.46 (0.37-0.55)	1.15 (0.93-1.43) ^a
Other	1.33 (1.09-1.62)	0.68 (0.55-0.85)	1.39 (1.10-1.77)
Education			
Less than GED/HS completion	1.26 (1.11-1.43)	0.98 (0.86-1.13) ^a	1.76 (1.49-2.08)
Some college education (1-3 years)	1.25 (1.21-1.40)	1.09 (0.96-1.23) ^a	1.41 (1.19-1.67)
College graduate & higher	Reference	Reference	Reference
Employment			
Paid employment or self-employed	1.25 (1.12-1.38)	0.72 (0.65-0.81)	0.60 (0.53-0.68)
Not employed	Reference	Reference	Reference
Income			
\$0-15,000	1.32 (1.08-1.60)	1.49 (1.22-1.83)	6.24 (4.89-7.97)
\$15-35,000	1.36 (1.16-1.60)	1.29 (1.08-1.53)	4.72 (3.76-5.92)
\$35-50,000	1.31 (1.15-1.50)	1.22 (1.05-1.43)	2.36 (1.93-2.88)
\$50-75,000	1.22 (1.05-1.40)	1.05 (0.90-1.22) ^a	1.48 (1.17-1.87)
\$75,000 +	Reference	Reference	Reference
Marital Status			
Married or Living as married couple	0.97 (0.87-1.08) ^a	0.68 (0.60-0.76)	1.08 (0.93-1.25) ^a
Not married	Reference	Reference	Reference
# Children in Household			
No children	Reference	Reference	Reference

1-2 children	1.09 (0.99-1.21) ^a	0.93 (0.84-1.03) ^a	0.83 (0.73-0.95)
3+ children	0.97 (0.85-1.11) ^a	0.88 (0.73-1.05) ^a	0.69 (0.57-0.83)
Health Outcomes			
Obese	N/A	1.47 (1.33-1.61)	1.65 (1.47-1.86)
History of depression	1.47 (1.33-1.62)	N/A	2.65 (2.34-3.00)
Fair or poor health	1.64 (1.45-1.84)	2.73 (2.42-3.09)	N/A

* 2019 BRFSS based upon 27,489 responses of women ages 18-39 years in the 17 states completing the optional ACEs module, weighted to national population of N = 23,730,895.

^a p > 0.05. All other comparisons statistically significant, i.e., p < 0.05.

Figure 3: Odds of Key Outcomes by Total ACE Score*¹



* 2019 BRFSS based upon 27,489 responses of women ages 18-39 years in the 17 states completing the optional ACEs module, weighted to national population of N = 23,730,895.

¹ OR calculated with reference to ACE score of 0.

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