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Investigating the Impact of Race and Income on Adverse Childhood Experiences and Family Planning

Mykaila Shannon*

School of Public Health, Brown University, Rhode Island, USA

Abstract

Adverse childhood experiences impact a large portion of the population in the United States [1]. Adverse childhood experiences, or ACEs, are potentially traumatic events that occur in childhood, between birth and 17 years of age [2]. As identified by the Centers for Disease Control and Prevention (CDC)-Kaiser study, there are 10 ACEs split into three groups [3]. The first group is abuse including physical, emotional, and sexual abuse. The second is neglect, both physical and emotional. The last is household dysfunction which includes the mother being treated violently, divorce, incarcerated relative, substance abuse, and mental illness. These experiences are characterized by aspects of the child's environment that can undermine their sense of safety, stability, and bonding. According to the CDC, about 61% of adults surveyed across 25 states reported that they had experienced at least one type of ACE, and nearly 1 in 6 reported they had experienced four or more types of ACEs. Traumatic experiences in childhood have lifelong consequences. Studies show that ACEs have the potential to disrupt early brain development and increase the risk of a range of physical and mental health disorders [4]. Results of a 2017 study, "Unpacking the impact of adverse childhood experiences on adult mental health," indicate an increased likelihood of experiencing drug use, moderate to heavy drinking, suicide attempts, and depressed affect in adulthood with increased experiences of ACEs [5]. ACEs have also been linked to an increase in healthcare utilization and spending. Studies have found that high ACE levels were associated with greater chronic disease burden and greater health care utilization in adulthood [6].

Furthermore, there are potential disparities in the distribution of ACEs. According to the CDC, women and several racial/ethnic minority groups were at greater risk for having experienced 4 or more types of ACEs. Studies have shown that women are significantly more likely than males to report a range of ACEs and mental health, social, and emotional difficulties in adulthood, showing that males and females potentially have distinct patterns of childhood adversities, with females experiencing more complex and varied patterns of childhood adversity [7]. In contrast, some research has found that men and women are just as likely to experience ACEs, but women are more likely to experience some types compared to others. Girls are more likely to experience sexual abuse and to be affected by parental psychiatric problems [8]. However, boys are more likely to report childhood verbal abuse, parental divorce, parental unemployment, and parental death [9]. Some studies even suggest that there is no gender difference between childhood sexual abuse and long-term physical health [10]. It has also been reported that racial minorities are more likely to experience ACEs. Research shows that black and Hispanic children were exposed to more adversities compared with white children, and income disparities in exposure were larger than racial/ethnic disparities, suggesting that the reason for this gap in exposure is societal as well as interpersonal [11]. These findings are synonymous with the majority of the findings found in other research, and, while the data remains controversial, the majority of research finds that racial minorities are more likely to experience ACEs than non-minorities.

Keywords: ACEs • Racial Minorities • Sexual Abuse • Childhood • CDC

Introduction

Research has also emphasized that, while the ACEs have an immediate impact on children who experience them, they also have a tremendous impact on lifelong health and future violence victimization and perpetration, as they have a generational impact on families [12]. The Center for Childhood Counseling notes that intergenerational trauma can be passed down to the child and cause toxic stress, inhibiting brain function and development [13]. They also suggest that parents with known trauma, and even parents who don't think they have experienced any trauma, work through past issues in an effort to break the intergenerational cycle of abuse and provide children with better home environments. In addition to toxic stress and decreased brain function and development, children experience mental health issues before early adulthood in their early and late teens [14]. In fact, one article reported that, in 2017, 13% of U.S. teens ages 12 to 17 said they had experienced at least one major depressive episode in the past year, up from 8% in 2007, and emphasized that young girls are more likely to suffer from depressive episodes. Another study showed that children exposed to ACEs often have parents who were exposed to ACEs, and suggests that efforts to increase community social cohesion may assist families in breaking the cycle of maltreatment across generations [15].

In recent ACE research, it has been found that decisions around family planning are greatly impacted by ACE exposure. Family planning allows people to attain their desired number of children, if any, and to determine the spacing of their pregnancies. It is achieved through use of contraceptive methods and the treatment of infertility [16]. The CDC has noted an increased likelihood of not preventing pregnancy in women who have been exposed to ACEs [17]. Additionally, one study found that ACEs may be linked to adolescent pregnancy and not actively preventing pregnancy, and this varies by socio-economic status, race/ethnicity, and educational attainment [18]. Another study confirms this finding, that preventing pregnancy, and its association with ACEs, is impacted by social status and determinants of health [19]. This thesis study aims to evaluate the association between family planning and ACEs, but

***Address for Correspondence:** Mykaila Shannon, School of Public Health, Brown University, Rhode Island, USA; E-mail: mykaila_shannon@brown.edu*

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also evaluate race/ethnicity and annual income, two key components of social status in the United States, as moderators of that association.

Literature Review

The impact of ACEs on short and long term health

The study of Adverse Childhood Experiences (ACEs) is relatively new. Beginning in 1995, Vincent Felittti and Robert Anda began a study in partnership with the Centers for Disease Control and Prevention (CDC) and the Kaiser Permanente Foundation looking at the relationship of childhood abuse and household dysfunction and many of the leading causes of death in adults, calling it the "Adverse Childhood Experiences (ACEs) Study" [20]. Seven categories of adverse childhood experiences were studied: psychological, physical, or sexual abuse, violence against the mother, living with household members who were substance abusers, mentally ill or suicidal, or ever imprisoned. The number of categories of these adverse childhood experiences was then compared to measures of adult risk behavior, health status, and disease. Participants were given a survey to determine these findings, and medical history, laboratory results, and physical findings were also taken for each participant. The two-year study found that the number of categories of adverse childhood exposures showed a graded relationship to the presence of adult diseases including ischemic heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease. They also found that all seven categories of ACEs were strongly interrelated, and persons with multiple categories of childhood exposure were likely to have multiple health risk factors later in life, showing that these negative experiences at an early age impact individuals for the duration of their lifetime. Anda and Felitti continued to study ACEs and their impact on individuals into the 2000s. A study done in 2006, "The enduring effects of abuse and related adverse experiences in childhood," used the 1998 study to look more specifically at brain function and how this might be impacted by ACEs [21]. The study used the number of ACEs (ACE score) as a measure of cumulative childhood stress and hypothesized a "dose-response" relationship of the ACE score to 18 selected outcomes and to the total number of these outcomes (comorbidity). They found that the graded relationship of the ACE score to 18 different outcomes in multiple domains theoretically parallels the cumulative exposure of the developing brain to the stress response with resulting impairment in multiple brain structures and functions, further solidifying their previous ACE research.

The CDC elaborated on risk factors that can influence ACEs on their website to help researchers better understand the different categories. Individual risk factors outlined include families experiencing caregiving challenges related to children with special needs, children and youths who don't feel close to their parents/caregivers and feel like they can't talk to them about their feelings, youths less than age 15 who start dating early or engaging in sexual activity early, children with few or no friends or with friends who engage in aggressive or delinquent behavior, families with caregivers who were abused or neglected as children, families with young caregivers or single parents, families with low income, families with adults with low levels of education, families who use physical discipline as forms of punishment, families with no sense of boundaries or discipline, families with inconsistent discipline and low levels of parental monitoring and supervision, families that are isolated, and more [22]. The website also lists some community risk factors, such as communities with high rates of violence and crime, high rates of poverty and limited educational and economic opportunities, high unemployment rates, communities with easy access to drugs and alcohol, few community activities for young people, unstable housing and where residents move frequently, food insecurity, and environmental struggles. In contrast, the CDC lists some protective factors at both the individual and community level that encourage safe, nurturing, and resource rich homes and communities. Interpersonal factors include topics such as families who create safe, stable, and nurturing relationships, meaning, children have a consistent family life where they are safe, taken care of, and supported, families with strong social support networks and positive relationships with the people around them, and families where caregivers engage in parental monitoring, supervision, and consistent enforcement of rules. Community factors include topics such as communities where families have access to economic and financial help, communities where families have access to medical care and mental health services, and communities with access to safe, stable housing.

Research shows that ACEs impact children at the time of exposure. A 2018 study stresses that ACE and ACE-related disorders are associated with enduring effects on the structure and function of neural stress-regulatory circuits such as the hippocampus, the amygdala, or the anterior cingulate cortex and promote alterations in stress sensitivity and emotion regulation in later life [23]. In all ACE categories, the child will experience toxic stress, a response that occurs when a child experiences strong, frequent, or prolonged adversity, in the absence of adequate adult support [24]. Because the brain looks to environmental cues for development, this stress can become traumatic and can cause what is initially an adaptive response to the stressor that becomes maladaptive and destructive in childhood as well as adulthood [25]. Signs of toxic stress might not be immediately apparent in children, but this consistent and abundant amount of stress without support can lead to slowed development of the brain in the areas mentioned above, causing stress related disease and cognitive impairment [26].

Research has also shown that ACEs have major health consequences in adulthood in those who experienced them as children. ACE exposure is common and cumulative. According to the CDC, 61% of adults had at least one ACE and 16% had 4 or more types of ACEs [27]. The CDC has also found that many people do not realize that exposure to ACEs is associated with increased risk for health problems across the lifespan. The Behavioral Risk Factor Surveillance System (BRFSS) 2015-2017 in November 2019 found that depression, chronic obstructive pulmonary disease, asthma, kidney disease, stroke, coronary heart disease, cancer, diabetes, and obesity are associated with ACE exposure as children. ACEs can also lead to health risk behaviors, like smoking, drug abuse, and alcoholism in adults, as well as socioeconomic challenges, like unemployment, limited education, and uninsurance. In this study, adverse childhood experiences were significantly associated with poorer health outcomes, health risk behaviors, and socioeconomic challenges. The CDC reports that efforts that prevent adverse childhood experiences could also potentially prevent adult chronic conditions, health risk behaviors, and negative socioeconomic outcomes. They suggest that states can use comprehensive public health approaches derived from the best available evidence to prevent childhood adversity before it begins. By creating healthy communities and focusing on prevention, we can reduce risk for adverse childhood experiences while helping those already affected by these experiences.

Recent studies have found that the impact of ACEs are deeply rooted in the stress response and how it manifests while the child is experiencing the ACE and as they grow into an adult. The stress response, or "fight or flight" response, is the emergency reaction system of the body, including physical and thought responses to one's perception of various situations [28]. One study found that an exposure to an ACE at such a young age is of particular interest. This study suggested that during certain vulnerable developmental phases, the risk for subsequent ACE-related disorders is increased and can lead to an increased likelihood of disorders such as posttraumatic stress disorder, depression, borderline personality disorder, obesity and diabetes [29]. Another study found that adults who have experienced ACEs in their early years can exhibit reduced parenting capacity or maladaptive responses to their children [30]. The physiological changes that have occurred to the adult's stress response system as a result of earlier trauma can result in diminished capacity to respond to additional stressors in a healthy way. Adverse childhood experiences increase the chance of social risk factors, mental health issues, substance abuse, intimate partner violence, and adult adoption of risky adult behaviors. All of these can affect parenting in a negative way and perpetuate a continuing exposure to ACEs across generations by transmission of epigenetic changes to the genome.

It is increasingly important that we pay attention to the impact that parents might have on their children if they have experienced ACEs as a child. This negative stress response at such an early and key developmental stage in the parent can result in toxic stress in their child, causing them to experience ACEs themselves. The toxic stress response can occur when a child experiences strong and frequent adversity without support. This can disrupt

the development of brain architecture and other organ systems, and increase the risk for stress-related disease and cognitive impairment, well into the adult years. If left unaddressed, toxic stress can affect growth, learning, behavior, and immunity. Kids who are exposed to very high doses of adversity have more than double the lifetime risk of heart disease and cancer and a nearly 20-year difference in life expectancy [31]. As the study above showed, this study also found that children who have experienced toxic stress likely have parents that experienced ACEs and are still struggling with the psychological and physical effects of stress. This problem is intergenerational and must be addressed two-fold: to help prevent ACEs from occurring in children and to aid adults who have experienced ACEs.

Groups at a higher risk

ACEs have been shown to impact some groups more than others. Specifically, people of color and women are disproportionately impacted by ACEs, which have a lasting impact on the physical and mental impact of these subpopulations. Since the link between ACEs and life-long negative health impacts was identified in the 1990s, it has become more and more apparent to researchers that there is a disparity in exposure when comparing minorities to non-minorities [32]. Nationally, 61 percent of Black non-Hispanic children and 51 percent of Hispanic children have experienced at least one ACE, compared with 40 percent of white non-Hispanic children and only 23 percent of Asian non-Hispanic children. In every region, the prevalence of ACEs is lowest among Asian non-Hispanic children and, in most regions, is highest among Black non-Hispanic children [33]. In the largest nationally representative study on ACE exposure, they found that participants who identified as Black, Hispanic, or multiracial, those with less than a high school education, those with annual income less than $15,000, those who were unemployed or unable to work, and those identifying as gay/lesbian or bisexual reported significantly higher exposure to adverse childhood experiences than comparison groups [34]. These findings have also shown researchers that the health inequities that come with this significantly more frequent exposure to adverse experiences may be exacerbated across the lifespan of the individuals exposed, and it could impact their future generations.

Research has also shown that ACE exposure is more prevalent in certain areas. In Arizona, Arkansas, Montana, New Mexico, and Ohio, 1 in 7 children had experienced 3 or more ACEs, compared to the national average of 1 in 10 [35]. This could be attributed to the uneven position of services and opportunities in minority neighborhoods. In fact, researchers are beginning to expand the definition of ACEs to include topics like racism, discrimination, minority stress, stigma, and historical trauma. According to the 2016-2018 National Survey of Children's Health (NSCH), 10% of Black, non-Hispanic children (ages 0-18 years) have experienced individual/interpersonal racism. By age, this includes about 2% of infants and 20% of teenagers. However, since this survey is reported by parents on their child's experiences, the true rate is likely much higher. Other studies focusing in detail on perceived self-reported racism and discrimination find rates around 90% for Black children [36]. Many researchers have previously attributed racism and discrimination as root causes of some current ACE, specifically parental incarceration, neighborhood violence, and poverty [37]. However, this does not take into account other types of racism. For example, residential segregation has been proven to lead to higher incidence of obesity, hypertension, engagement in high-risk behaviors, alcohol use and misuse, and poor sleep. This shows that racism and discrimination are in themselves ACEs and should be included in the definition. We will include race/ethnicity in our analysis for this reason, which will be further explained below.

Women are also more likely to experience ACEs, when compared to men. Research has shown that while one in five women experience sexual assault, only one out of 70 men experience sexual assault [38], thus accounting for an overall higher mean of ACE experiences in females. Females experience significantly more ACEs compared to males and a significantly higher prevalence of adverse events in four of the eight categories (sexual, IPV, household substance abuse, and household mental illness) [35]. Another study found that females experience more complex and varied patterns of childhood adversity. Females were significantly more likely than males to report a range of ACEs and mental health, social, and emotional difficulties in adulthood, indicating more complexity and variation in ACE exposures among females [36]. Research has also shown that women who have been exposed to ACEs have a higher risk of developing negative health outcomes when compared to men who were exposed to the same or similar experiences. For example, among women, childhood experiences of physical abuse, sexual abuse, emotional abuse, living with someone who was mentally ill, living with a problem drinker, living with a drug user, and living in a household where adults treated each other violently were associated with higher odds of cancer. Among men, only emotional abuse was associated with higher odds of cancer [37].

More interestingly, researchers have only recently begun evaluating the association between exposure to ACEs and choices in romantic partners, interpersonal relationships, and parenthood in women who have been exposed to ACEs as children. Mothers exposed to ACEs tend to have partners also exposed to ACEs. This exposure was associated with poorer health and unfavourable life conditions within the couples, especially among couples where both members reported exposure to multiple ACEs (38). Additionally, there has also been some research that has shown that women who have experienced one or more ACEs subconsciously contribute to the intergenerational transmission of trauma, and while the mental health histories of both parents/grandparents contribute to the wellbeing of a child, mothers who had negative mental health and/or experienced ACEs as children has specific negative effects on the mental health of their children, perpetuating the cycle of generational trauma [39].

Laws and services surrounding family planning

According to the World Health Organization (WHO), family planning is defined as "the ability of individuals and couples to anticipate and attain their desired number of children and the spacing and timing of their births. It is achieved through use of contraceptive methods and the treatment of involuntary infertility" [40]. Family planning helps couples avoid unintended pregnancies, reduces the spread of sexually transmitted diseases (STDs), and reduces rates of infertility. However, rates of unintended pregnancy in the United States remain high, particularly for certain segments of the population [41]. Unintended pregnancy is most likely among women who are young, unmarried, low-income, and/or members of racial or ethnic minorities [42]. Additionally, there are disparities in STDs, as minority populations, specifically African American and Latinx populations, have significantly higher rates of exposure when compared to white populations in the US [43]. This also means that rates of infertility are significantly higher among these populations, as research has shown [44]. All adverse family planning outcomes, including unintended pregnancy, unintended births, abortions and teen pregnancies, occur more commonly among minority and low socioeconomic status individuals [45].

These disparities in family planning are coupled with disparities in service accessibility across states. This is largely due to federal regulations like the Hyde Amendment. The Hyde Amendment has a disproportionate impact on women seeking abortion given their state of residence. The Hyde Amendment, enacted in 1976 and revised in 1993, bars the use of federal funds to pay for abortion except to save the life of the woman, or if the pregnancy arises from incest or rape [46]. The law was challenged in 2016, but the bill failed to pass in the Senate and resulted in the Hyde Amendment becoming permanent. This law has a significant impact on Medicaid recipients, and has a disproportionate impact on women who are low-income and of color. Approximately 42% of women who have abortions live under the poverty line, and because of historical and institutional racism and oppression, this population is largely women of color [47]. Additionally, over a million women have given birth because they could not afford pregnancy termination procedures since the passing of the Hyde Amendment [48]. There are currently 16 states who use their own state funds to pay for elective abortions and similar services. These states include Alaska, Arizona, California, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, New York, Oregon, Vermont, and Washington [49]. Other states consequently provide less family planning services, or those services are less accessible because of stigma. Only 26 states have federal approval to extend Medicaid eligibility for family planning services to individuals who would otherwise not be eligible [50]. This has made family planning services more accessible in some states

and not others. Therefore, we will evaluate whether living in a state with these policies moderates the association between adverse childhood experiences and family planning outcomes.

Study purpose and hypothesis

The purpose of this study is to examine the association between adverse childhood experiences (ACES) and family planning in women over 18 years old in the United States. We will also examine whether race/ethnicity and income, separately, are moderators of this association. We hypothesize that women who have experienced trauma during their childhood are less likely to engage in behaviors that prevent pregnancy and that race/ethnicity and income have a moderating effect on this association.

Methodology

Description of data

The data used in this study is from the 2019 Behavioral Risk Factor Surveillance System (BRFSS). The (BRFSS) is a collaborative project between all of the United States (US) and participating US territories and the Centers for Disease Control and Prevention (CDC). The questionnaire is administered through telephone surveys designed to collect data on health- related risk behaviors, chronic health conditions, and use of preventive services from the adult population of 18 years or older who live in the US [51].

The 2019 BRFSS sample included 418,368 U.S. non-institutionalized adults. After excluding those who self-identified as men, there were 228, 433 women over the age of 18. In order to minimize bias, those who have had a hysterectomy or sterilization have been excluded from the sample. Within this full sample, there were 1,131 individuals who reported a hysterectomy or sterilization prior to the survey. Hence there were 227,302 participants who did not have a hysterectomy and were not sterile, or chose not to provide a response. Our exposure variable will be exposure to the following ACEs: mental illness, alcoholism, drug addiction, prison, physical abuse, sexual abuse, or emotional abuse. We chose these ACEs because they were all included in the BRFSS questionnaire. Our outcome variable will be the use of any contraception at last sexual encounter. This is operationalized by asking women if they prevented pregnancy in the last sexual encounter they had. After excluding missing information for both the ACE variable and the contraception variable, our analytic sample for this study includes 36,831 individuals over 18 who have not had a hysterectomy or sterilization. The percent of the eligible population that has missing exposure and/or outcome information is 83.80% [52]. The missing information is largely due to people choosing not to answer either the exposure or outcome questions, or both. They have been excluded so that we can examine the association in those who answered both questions. This is presented in Figure 1.

Behavior theory

The ACE Framework and the Attachment Theory postulate that exposure to negative experiences as a child can lead to a number of negative psychosocial, behavioral, and health outcomes [53]. This theory has informed our decision to include ACEs as our exposure variable, and use of family planning as a behavioral outcome. Methods will include use of the 2019 BRFSS to perform a quantitative analysis on the association between ACE's and the efforts by women to prevent pregnancy who are 18 years or older in the United States. Our exposure variable will be adverse childhood experiences, and the outcome variable will be the use of contraception at the last act of sexual intercourse. To operationalize this, we will include everyone who answered yes to any of the adverse childhood experiences questions asked in the BRFSS. These questions include "Did you live with anyone who was depressed, mentally ill, or suicidal?" "Were your parents separated or divorced?" and other questions covering the following ACE topics: alcoholism, drug abuse, criminal history, physical abuse, sexual abuse, and verbal abuse. Operationalization was taken from the California Department of Public Health's "Adverse Childhood Experiences Data Report: Behavioral Risk Factor Surveillance System (BRFSS), 2011-2017," in which they operationalized ACE exposure in this way

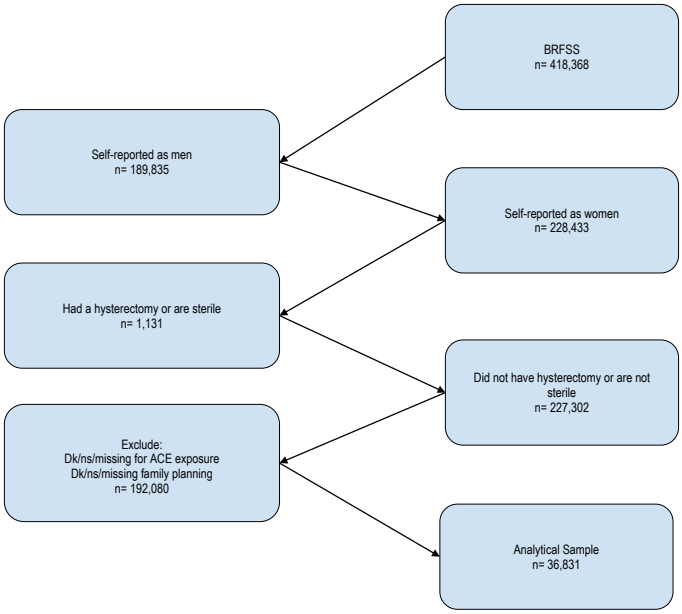

Figure 1. Inclusion and exclusion criteria for analytic sample.

to collect and analyze data on child maltreatment [54]. Our family planning variable will operationalize with the BRFSS question, "The last time you had sex with a man, did you or your partner do anything to keep you from getting pregnant?" We will evaluate the answers to this question to understand the correlation between ACEs and the decision to prevent pregnancy or not.

Additionally, research has shown that minority populations and low-income populations are more likely to experience ACEs, causing a disproportionate development of negative health impacts [55]. According to the Minority Stress theory, minority stress emerges from general environmental circumstances, which include advantages and disadvantages related to factors, such as socioeconomic status and race/ethnicity [56]. This theory postulates that race/ethnicity and low-income, among other areas of disadvantage and discrimination, act as moderators for negative health outcomes, and often result in a lifetime of harassment, maltreatment, discrimination and victimization. In order to understand the racial disparities that exist in the association between ACEs and family planning use, we will evaluate race and annual income as potential moderators to the association between the outcome and exposure.

Because the above theories postulate that exposure to ACEs can lead to negative health outcomes, we will also include physical health and mental health status as covariates, measured as the number of good physical or mental health days a person has had in a 30-day time frame. This is asked in the survey as how many days have you experienced good physical/mental health in the past 30 days. Logistic regression will be used to determine the association between the exposure and the outcome with the above confounding variables included in the model. All statistical analyses will be completed using the data software program, STATA [57].

Adverse childhood experiences

The exposure of interest is self-reported exposure to Adverse Childhood Experiences (ACES). We operationalized ACE exposure as a binary indicator: those who were exposed were coded as "1," and those who were not exposed were coded as "0". Everyone who responded "Yes" to one or more of the discussed experiences was included as having been exposed. Those who replied "No" to all of the discussed experiences were included as having not been exposed.

Family planning

For the purposes of this study, the conceptual definition of family planning is the practice of controlling the number of children in a family and the intervals between their births, particularly by means of artificial contraception or voluntary sterilization [58]. Family planning is operationalized as a binary indicator: if they actively prevented pregnancy they were coded as "1," and if

they did not actively prevent pregnancy, they were coded as "0." Therefore, this indicates whether or not the individual at the time of the interview was actively preventing pregnancy during their last sexual encounter with a male partner. This excludes women who have had a hysterectomy or are sterile.

Potential confounders

This study assesses the following potential confounders: race/ethnicity, annual income, mental health, physical health, and state of residence.

In order to understand the racial disparities that exist in the association between ACEs and family planning, we will also evaluate race/ethnicity and annual income as potential moderators of the association between the outcome and exposure. We define race/ethnicity as an individual's racial and ethnic background. Different races/ethnicities (African American, Latinx, Indigenous, etc.) are more likely to experience ACEs than are White people. We operationalized race/ethnicity as the individuals self-reported race/ethnicity, either Black non-Hispanic, White non-Hispanic, Hispanic, Asian, non-Hispanic, Pacific Islander, Non-Hispanic or other. We define income as the amount of money an individual's household makes annually. We operationalized income as an individual's self-reported household income broken down into the following categories: Less than $15,000, $15,000 to less than $25,000, $25,000 to less than $35,000, $25,000 to less than $35,000, and $50,000 or more [59].

We also chose to include mental and physical health as potential confounders, since the above research cited has found that those who experience ACEs have worse physical and mental health than those who have not been exposed to ACEs and are more likely to develop negative health outcomes. We define poor physical health as being in a state of illness or injury. The survey asked, "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good." We operationalized poor physical health as a binary indicator of illness or injury, either having poor health less than or equal to 14 days, or having good physical health 15 or more days in a 30 day period. We define poor mental health as being in a state of stress or depression, or having problems with emotions. The survey asked "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" We operationalized this as a binary indicator of poor mental health, either having less than or equal to 14 days of poor mental health, or 15 or more days of good mental health in a 30 day period. We chose a 14 day cut-off because depression is defined by the National Institute of Health as feeling persistently sad, anxious, or irritable for two weeks or more [60]. We chose a 14 day cut-off for physical health as well because, similarly to mental health, the CDC defines poor physical health as reporting two weeks or more of physical health in its health related quality of life measure [61].

Lastly, we included state of residence as a potential confounder. As stated previously, available family planning services have an impact on a woman's family planning decisions and health behaviors. Therefore we included state of residence as a confounder to compare those who live in resource rich states to those who don't. We define a state of residence as the state in which the individual lives. We operationalized this as a binary indicator of whether or not the individual lives in a state that exceeds federal standards for family planning or lives in a state that does not exceed federal standards for family planning. This is defined as states either funding all or most abortions compared to those who only fund abortions due to life endangerment, rape, or incest [48].

Statistical analysis

We used STATA version 15.0 for all statistical analysis [62]. To account for complex survey design and to weight the data, we used the BRFSS weighting formula provided by the CDC [63]. Weighting the data allows us to convey nationally representative statistics throughout our analyses of our analytic sample. To describe our sample, we determined unweighted frequencies and weighted percentages for good mental health, demographic and socioeconomic characteristics, and potential confounders. Table 1 shows the distribution of confounders and use of family planning across levels of exposure (ACEs).

Logistic regression was used to examine the association between exposure to ACEs and family planning decisions. Each covariate was

Table 1. Characteristics of women aged 18 years or older by Family Planning BRFSS 2019 (n=36,831).

	Adverse Childhood Experiences	
	Did Experience ACEs	**Did Not Experience ACEs**
	34.6% (n=10,448) Weighted % (n)	65.4% (n=26,383) Weighted % (n)
Family Planning		
Did Not Prevent Pregnancy	33.1% (4,760)	66.9% (12,362)
Prevented Pregnancy	35.9% (5,688)	64.1% (14,021)
Race		
White, Non-Hispanic	37.5% (7,148)	62.5% (16,949)
Black, Non-Hispanic	36.8% (1,502)	63.2% (2,352)
Asian, Non- Hispanic	14% (97)	86% (879)
American Indian/Alaskan Native, Non-Hispanic	37.3% (167)	62.7% (611)
Hispanic	27.6% (1,170)	72.4% (4,441)
Other race, Non-Hispanic	29% (364)	71% (1,151)
Annual Income		
Less than $15,000	34.6% (1,048)	65.4% (2,265)
$15,000 to less than $25,000	36.3% (1,645)	63.7% (3,473)
$25,000 to less than $35,000	41.3% (971)	58.7% (1,960)
$35,000 to less than $50,000	37.9% (1,267)	62.1% (2,814)
$50,000 or more	33.8% (4,289)	66.2% (12,141)
Missing/ Invalid	29.3% (1,228)	70.7% (3,730)
Mental Health		
0-14 Poor Mental Health Days	33.5% (6,601)	66.5% (17,187)
15-30 Poor Mental Health Days	36.7% (3,847)	63.3% (9,196)
Physical Health		
0-14 Poor Physical Health Days	33.8% (7,191)	66.2% (18,620)
15-30 Poor Physical Health Days	36.5% (3,257)	63.5% (7,763)
State of Residence		
Follows Federal Standard	44.4% (9,878)	55.6% (16,100)
Exceeds Federal Standard	4.03% (570)	96.07% (8,793)

assessed individually to determine whether or not it should be included in the final regression model. We examined potential confounders and those that were significantly (p<.05) associated with ACEs (Table 1) and the decision to prevent pregnancy, were included in the final model. These covariates included race/ethnicity, income, and state of residence. Race/ethnicity, income, and state of residence showed the greatest difference in odds and thus were included. Additional regression models were fitted to analyze the moderating effect of race/ethnicity and income on the association between ACE exposure and family planning decisions. We did this by including interactions between race/ethnicity and ACE exposure in one model, and income and ACE exposure in another model. Both models also included main effects of ACEs and the potential moderator.

Results

Overall, 34.6% of individuals included in the study were exposed to ACEs. Out of participants who were exposed to ACEs, 45.6% did not prevent pregnancy, compared to 46.9% who were not exposed.

Table 1 shows the demographic, potential confounders, and outcome variables across levels of the exposure. 65.4% of the sample was white. Among those who were exposed to ACEs, 68.4% of participants self-reported their race/ethnicity as White, compared to 64.2% of participants who were not exposed. Among those who were exposed to ACEs, 68.4% of participants were White, Non-Hispanic, compared to 64.2% in those who were not exposed. Among those who were exposed to ACEs, 14.37% of participants were Black, Non- Hispanic, compared to 8.9% in those who were not exposed. Among those who were exposed to ACEs, 11.2% of participants were Hispanic, compared to 16.8% in those who were not exposed.

Almost half (44.6%) of the sample reported an annual income of at least $50,000. Among those who were exposed to ACEs, 10% of participants made less than $15,000 annually *vs.* 8.59% in those who were not exposed (Table 1). 41.1% of those who were exposed made $50,000 or more, *vs.* 46.0% in those who were not exposed.

We also evaluated poor physical health and poor mental health. For physical health, the majority of participants (68.8%) reported having 2 weeks of poor physical health or less compared to 70.6% who were not exposed. For mental health, in those who were exposed to ACEs, 63.2% of participants had 0-14 poor mental health days compared to 65.2% who were not exposed. Additionally, we evaluated the state of residence. Among those who were exposed to ACEs, 94.5% of participants lived in states that did not exceed the federal standard for family planning services, compared to 61.0% who were not exposed. There are currently 16 states (or 32%) who use their own state funds to pay for elective abortions and similar services. These states include Alaska, Arizona, California, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, New York, Oregon, Vermont, and Washington as of 2021 [49].

There was a significant association between ACE exposure and family planning decisions. The unadjusted regression model shows that those who were not exposed had .881 times the odds of preventing pregnancy when compared to those who were exposed to ACEs (OR: .881 CI 95%: (.817, .950)). The final model adjusted for income, race/ethnicity, and state of residence. After adjusting for these three covariates, those who were not exposed had .870 times the odds of preventing pregnancy compared to those who were exposed (OR: .870, CI 95%:(.802, .945)). A full description is shown in Table 2.

In addition to the adjusted regression model outlined in Table 2, we also fit a model to include race/ethnicity as a moderator of the association between ACE exposure and family planning decisions, as seen in Table 3. The data does not suggest that race/ethnicity is a significant moderator of the association between ACE exposure and pregnancy prevention. Similarly, in Table 4 we fit a model to include annual income as a moderator of the association between ACE exposure and family planning decisions. The data does not suggest that income is a significant moderator of the association between ACE exposure and pregnancy prevention. This means that the data does not show a moderating effect of race/ethnicity or income in the association between ACE exposure and family planning decisions in women over 18 years old.

Table 2. Unadjusted and adjusted odds ratios of women who have used family planning and have not had a hysterectomy, are not sterile, and are 18 years or older.

Characteristics	Unadjusted OR (95%CI)	Adjusted OR for race, income, and state of residence (95% CI)
Adverse Childhood Experience Exposure		
Did Experience ACEs	1 (ref)	1 (ref)
Did Not Experience ACEs	.881 (.817, .950)	.870 (.802, .945)
Race/Ethnicity		
White, Non-Hispanic	1 (ref)	1 (ref)
Black, Non-Hispanic	.731 (.658, .813)	.757 (.679, .845)
Asian, Non- Hispanic	.848 (.682, 1.06)	.859 (.690, 1.07)
American Indian/Alaskan Native, Non-Hispanic	.614 (.470, .802)	.645 (.494, .842)
Hispanic	.686 (.619, .780)	.780 (.693, .878)
Other race, Non-Hispanic	.898 (.733, 1.10)	.938 (.766 1.15)
Annual Income		
Less than $15,000	1 (ref)	1 (ref)
$15,000 to less than $25,000	1.20 (1.03, 1.39)	1.17 (1.00, 1.37)
$25,000 to less than $35,000	1.39 (1.18, 1.65)	1.34 (1.22, 1.60)
$35,000 to less than $50,000	1.54 (1.32, 1.79)	1.40 (1.19, 1.64)
$50,000 or more	1.56 (1.38, 1.77)	1.39 (1.21 1.59)
Missing/ Invalid	.965 (.831, 1.12)	.911 (.709, 1.07)
Mental Health		
0-14 Poor Mental Health Days	1 (ref)	-
15-30 Poor Mental Health Days	1.33 (1.24, 1.43)	
Physical Health		
0-14 Poor Physical Health Days	1 (ref)	-
15-30 Poor Physical Health Days	1.11 (1.02, 1.20)	
States		
Follows Federal Standard	1 (ref)	1 (ref)
Exceeds Federal Standard	1.11 (1.03., 1.21)	1.18 (1.09, 1.29)

Table 3. Coefficients of the interaction between categories of race/ethnicity and ACE exposure in women who have not had a hysterectomy, are not sterile, and are 18 years or older.

The effect of race as a moderator of the association between ACE exposure and family planning decisions	b (SE)	P-value (p<.05)
Race/ethnicity		
White, Non-Hispanic * ACE	1 (ref)	1 (ref)
Black, Non-Hispanic * ACE	.031 (.017)	.260
Asian, Non- Hispanic * ACE	.045 (.054)	.606
American Indian/Alaskan Native, Non-Hispanic * ACE	-.061 (.044)	.393
Hispanic * ACE	.051 (.018)	.121
	.069 (.031)	.217

b=unstandardized regression coefficient (interaction term); SE=Standard Error

Table 4. Coefficients of the interaction between categories of Income and ACE exposure in women who have not had a hysterectomy, are not sterile, and are 18 years or older.

The effect of income as a moderator of the association between ACE exposure and family planning decisions	b (SE)	P-value (p<.05)
Income		
Less than $15,000 * ACE	1 (ref)	1 (ref)
$15,000 to less than $25,000 * ACE	.043 (.024)	.279
$25,000 to less than $35,000 * ACE	.068 (.027)	.131
$35,000 to less than $50,000 * ACE	.021 (.025)	.618
$50,000 or more and ACE	-.040 (.021)	.246
Missing/ Invalid and ACE	.029 (.025)	.487

b=unstandardized regression coefficient (interaction term); SE=Standard Error

Discussion

Our study found that both groups are similar. In other words, exposure to ACEs did not meaningfully affect the decision to use family planning in this study. Based on the Minority Stress Theory, we included race/ethnicity and income as potential confounders to assess whether they impacted the association between ACE exposure and family planning. The moderating effect analysis on income did not show any effect on the association between the exposure and the outcome. Similarly, the moderating effect analysis on race/ethnicity did not show any effect on the association between the exposure and the outcome either.

The study's negative results may be due to the large amount of missing data because while our sample size was relatively large, we did have 83.80% invalid or missing information in our final analytical sample. The reason for this is because 380, 966 participants had a blank value for either the exposure or the outcome questions, meaning they were not asked, or the answer was left blank. Out of the 380,966 participants, 191,144 participants were women. Since those who have had a hysterectomy were already removed, these questions could have been left blank by them purposefully because they were pregnant, or because, as stated in the BRFSS codebook [64]. This could be due to the nature of the survey questions we chose to include in our evaluation. The missing or invalid information was excluded for both the exposure and the outcome. We included all of the BRFSS's questions on ACEs which all included topics that could trigger traumatic memories and feelings surrounding those memories. Some might have chosen not to answer the question in an attempt to avoid triggering these emotions.

While our analyses of race/ethnicity and income were not significant, it is still important to acknowledge the additional barriers of low-income people of color. Those who are low-income have to rely on the state for family planning services and resources. More often than not, those who are low-income are less likely to be able to afford birth control methods, prenatal and postpartum care, and other family planning services. Access is limited if states do not provide the resources. In Alison Giovanelli's 2016 study, nearly two-thirds of the study sample experienced one or more ACEs by age 18. After controlling for demographic factors and early intervention status, individuals reporting ACEs were significantly more likely to exhibit poor outcomes, specifically unplanned pregnancy than those with no ACEs. Those with four or more ACEs had significantly reduced likelihood of high school graduation, increased risk for depression, health compromising behaviors, juvenile arrest and felony charges. They were also less likely to hold skilled jobs and to go further in school even for adversity measured by age 5. The impact for women who experience ACEs does not only negatively affect mental and physical health, but also disproportionately places them in a position of poverty that negatively impacts their ability to appropriately plan or prevent a family. This means that they have a much higher need for adequate services provided by the state However, Paula Nurius's 2012 study tested ACEs within a Social Disadvantage Framework, which postulates that income, as well as other categories of disadvantage, like race/ethnicity, gender identity, and sexual orientation, are moderators of adverse experiences across an individual's lifetime. Results demonstrated the sustained impact of ACEs on mental health many decades later. However, the study also included an analysis of protective factors. These results demonstrate that interventions ameliorating the effects of ACEs and bolstering protective resources such as socioemotional support may be effective toward augmenting mental health even late in life. The article also mentioned that an increase in available family planning services could help mitigate the long-term effects of ACEs, as well as prevent intergenerational trauma. It is important that we continue to bolster protective factors, such as socioemotional support and community building among oppressed categories of people to help mitigate the effects of ACEs.

Again, the moderating effect of race/ethnicity on the association between ACE exposure and family planning decisions was not significant. However, researchers have only recently begun examining the notion that simply being a minority is an adverse childhood experience. A study in the Jordan Institute for Families shows that children who have experienced interpersonal discrimination are likely at higher risk for exposure to institutional/systemic racism. Exposure to racism, and other ACEs, affect our health largely through the body's stress response system. This "toxic stress" destroys critical regulation systems in our bodies and brains and can ruin our health over time. With racism on full display in the media via police killings of black people and the rise of right-wing white supremacist groups into national politics, the stress from the threat of racism is likely very high today for Black children. Not only has there been a rise in violence broadcasting for Black people, but other minority groups, most recently the violent attacks on the Asian community that sparked the Stop Asian Hate Movement. As we continue to analyze the impact that race/ethnicity has on children and adults alike, we need to acknowledge that because of the prejudiced society that we live in, the stress of being a minority is an ACE in itself. There needs to be greater focus on this in future research, as well as an increase in communal services available to people of color to mitigate the prévenance of ACEs in these communities.

What is most interesting about these findings is that states that provide

adequate family planning services may also provide other services that may prevent ACE. It is important when talking about ACEs that we understand that the issue does not remain on the interpersonal level. It is communal and societal, and therefore, the proper services should be made accessible to everyone. As previously stated, the point of family planning services is to decrease STDs, unintended pregnancies, and infertility; however, there are racial disparities in STDs, specifically in African American and Latinx populations, who have significantly higher rates of STDs, unintended pregnancies, and infertility when compared to white populations in the US. Not only are there racial disparities, but research has shown that people who do not have access to these services are more likely to experience these adverse family planning outcomes. It is clear that federal standards for family planning services are not adequate. States that do not have sufficient family planning services and only meet the minimum federal standard should emulateneed to follow states that exceed those standards. Family planning services could not only help reduce adverse family planning outcomes but could also help reduce exposure to ACEs. According to the CDC, ACEs and their effects are reduced when communal services are available. It is important that we continue to build out our family planning resources to reduce the effects above.

We also encountered other limitations that arose during the completion of this study. There is some sampling bias, as white participants and those who make over the national poverty line, which is about 22,000 for a 3-member family, had a higher sampling probability than participants in other race/ethnicity and income categories. There were also limitations in the way that the questions for the exposure and outcome variables were asked. In terms of exposure, we included all ACE questions in our analysis. The ACE questions were asked for the entire survey population. The questions can be interpreted in different ways by each participant. What some might consider physical, emotional, or psychological abuse might not be considered as such in other participants. We contribute the high amount of missing and invalid information to the sensitive nature of the questions and differing definitions of abuse that exist across the analytical sample. Additionally, in terms of the outcome variable, we only included one family planning question, which asked if women prevented pregnancy the last time they had sex with their male partner. Much like the ACE variable, there might be different definitions of what preventing pregnancy means. There could also be some miseducation surrounding pregnancy prevention, as there is an unequal level of access across the United States. Furthermore, the question only captures the use of family planning at the last sexual intercourse event. This only captures a cross-section of the participants' experience and use of family planning at one moment in time.

We encountered some limitations with our potential confounders and moderators. We included annual income, state of residence, and race/ethnicity in our final model. The BRFSS asked participants to state their annual household income. This question can be interpreted in many different ways. When thinking about annual income, some might not limit that value to only include earnings from work. Some people might have included supplemental income, such as help from family members, stocks and bonds, and small side jobs. This could have inflated income levels across groups. Additionally, in order to compare states that had more family planning resources to those states who did not, we categorized states based on whether or not they exceed the federal standard for abortion and other family planning services. Although this distinction is well documented, laws differ across states, and the nature of family planning services is more in line with a spectrum rather than a binary variable. We also encountered some limitations with our race/ethnicity variable. The race/ethnicity variable is limiting and could have caused inflation across groups. The question limited respondents to only one answer and if you identify with more than two options, you might only choose one of your identities or the other option. This would cause inflation across groups and excludes individuals that should be in certain groups.

We also had some limitations with our other confounding variables not included in the final model. We included mental health and physical health in our analysis. Our mental health variable posed the question of whether the individual's mood got in the way of daily activities like cooking, exercising, and cleaning. Some might have counted a day in which an emotion prevented completing a task; however, this is not necessarily characteristic of depressed behavior. There is also no way to tell if the number of poor mental health days was continuous or broken up between good mental health days. Also, asking individuals to remember 30 days back leaves room for recall bias. If they remember a couple days of feeling poorly, they might round that up to a week when in actuality it wasn't that long. There is a chance that the number of poor mental health days has been inflated across groups. Similarly, the physical health question asks whether or not a person's physical health got in the way of daily activities listed above. Good and bad physical health can be defined differently by individuals across the sample, and asking participants to recall information 30 days back can lead to recall bias with this question as well.

Conclusion

Despite our limitations, the study also had strengths. Firstly, the questions in the estionsutesions descriptive nature of the BRFSS survey allowed us to gain insight into not only one type of ACE and family planning methods, but multiple. Therefore, our exposure and outcome variables were able to cover a wide and nuanced range of data. This is fitting, since both ACEs and family planning are both nuanced topics that look different for different people, as we can see from the myriad of current and emerging ACEs and contraceptive methods. Additionally, we were able to evaluate participants based on their state of residence which allowed us to evaluate different frequencies of exposure and outcome across states. It also allowed us to conduct a secondary analysis of state and federal legislature that could contribute to the nature of exposure and outcome. The nature of our data was also reliable, versatile, and generalizable to a larger population. Because of the flexibility of the data, we were able to tailor it to our specific research question.

While the hypothesized effects were not in the expected direction and race/ethnicity and income were not significant moderators, they did shed light on the importance of communal services when addressing ACEs. Only 32% of states currently exceed federal standards for family planning services and provide a pathway to community support. As we continue to address ACEs and family planning in public health it is imperative that we center communal services, especially for low income communities and communities of color. An increase in these services will not only lead to better health outcomes, but also a greater sense of community.

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