ASSOCIATION OF ADVERSE CHILDHOOD EXPERIENCES AND BEHAVIORAL HEALTH AMONG CHILDREN AND ADOLESCENTS IN THE UNITED STATES

by

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DEDICATIONS

To my mother, Bhagabati Regmi, whose selfless love, hard work, and sacrifices have been the driving force behind my success.

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PREFACE

Three manuscripts were prepared as a part of this dissertation and will be submitted for peer review and publication to “Child Abuse & Neglect”, “Journal of Child & Adolescent Trauma”, and the “Journal of Interpersonal Violence”. Each of these manuscripts are presented in Chapters II, III, and IV, respectively.
ABSTRACT

Adverse childhood experiences (ACEs) have enduring implications for various behavioral and mental health issues, necessitating a thorough examination of factors that mitigate their adverse effects. The present research draws upon the Healthy Outcomes from Positive Experiences (HOPE) framework and the socioecological model to investigate the moderating role of different types of resilience, including child resilience, family resilience, safe neighborhoods, and supportive neighborhoods, on the associations between ACEs, substance use disorder (SUD), and depression. This study also explores the relationships between ACEs and mental health care needs and service utilization among children and adolescents in the United States. We conducted cross-sectional studies utilizing combined data from the National Survey for Children's Health (NSCH), covering four years (2016-2019) for the first paper (N = 54,434) and the second paper (N = 94,369) and two years (2018-2019) for the third paper (N = 43,213). Data analyses were performed using a hierarchically well formulated model of logistic regression analysis. Propensity score matching was used for the first paper, in which we found that family resilience moderates the association between ACEs and SUD (B = -0.07, SE = 0.02, p < .01), whereas all resilience (i.e., child, family, safe neighborhood and supportive neighborhood) decreases the log odds of SUD except supportive neighborhood while holding ACEs=0 and all other variables constant. In the case of depression, both child resilience (B = -0.03, SE = 0.01, p < .001) and family resilience (B = -0.02, SE = 0.01, p < .05) moderate the association between ACEs and depression, while all resilience reduces the log odds of depression while holding ACEs = 0 and all other variables constant. ACEs show a dose-response association with SUD among adolescents, depression among children and adolescents, and mental health care needs among children and adolescents. Furthermore, ACEs have a strong positive association with mental health care utilization in the past year among children and adolescents. These findings offer
valuable guidance for clinicians, public health professionals, and policymakers, providing insights to help effectively address the impact of ACEs.
# Table of Contents

List of Tables ...................................................................................................................................... ix
List of Figures ....................................................................................................................................... x

## Chapter I Introduction

Statement of the Problem .................................................................................................................. 1
Summary of Literature Review .......................................................................................................... 3
Theoretical Background ...................................................................................................................... 11
Trends and Gap in the Literature ....................................................................................................... 16
Purpose of the Study .......................................................................................................................... 20
Specific Aims ..................................................................................................................................... 21
Significance of the Study .................................................................................................................... 23
Organization of the Study ................................................................................................................... 24

## Chapter II

Adverse Childhood Experiences, Substance Use Disorder, and Moderating Effect of Resilience: Findings from the National Survey of Children’s Health

Introduction ...................................................................................................................................... 25
Methods .......................................................................................................................................... 29
Results ............................................................................................................................................. 34
Discussion ....................................................................................................................................... 41
Conclusion ....................................................................................................................................... 45

## Chapter III

Role of Child Resilience, Family Resilience, Safe Neighborhood, and Supportive Neighborhood on Depression among Children and Adolescents with Adverse Childhood Experiences

Introduction ....................................................................................................................................... 46
Methods .......................................................................................................................................... 50
Results ............................................................................................................................................. 55
Discussion ....................................................................................................................................... 63
Conclusion ....................................................................................................................................... 68

## Chapter IV

...................................................................................................................................................... 70
List of Tables

Table 1. Sociodemographic variables based on SUD diagnosis in the study sample .......................... 34
Table 2. Description of continuous variables in the study ................................................................. 36
Table 3. Prevalence of ACEs according to SUD among US adolescents aged 12-17 ...................... 37
Table 4. Relationship of ACEs with SUD.......................................................................................... 37
Table 5. Moderation effect of different types of resilience and ACEs predicting SUD .................. 39
Table 6. Sociodemographic variables according to the prevalence of depression among US adolescents aged 12-17 years. ........................................................................................................ 55
Table 7. Prevalence of ACEs and according to depression among US adolescents aged 12-17 .... 57
Table 8. Descriptive table of continuous variables ......................................................................... 58
Table 9. Relationship of ACEs with depression ................................................................................ 59
Table 10. Moderation effect of child resilience and ACEs on depression ....................................... 61
Table 11. Sociodemographic variables according to the mental health care needs among US children and adolescents aged 6-17 years. ...................................................................................................... 79
Table 12. Association between ACEs and mental health care needs among children and adolescents .... 82
Table 13. Association between ACEs and receiving mental health care in last 12 months among children and adolescents with mental health care needs ........................................................................ 84
List of Figures

Figure 1. The pair of ACEs Tree.................................................................................................................. 13
Figure 2. Study variables according to the Hope Framework................................................................. 16
Figure 3. Conceptual mapping ................................................................................................................ 21
Figure 4. Moderating effect of family resilience and ACE score on SUD ............................................ 40
Figure 5. Moderation effect of different resilience according to HOPE framework of ACEs to the outcome of depression ............................................................................................... 50
Figure 6. Moderation effect of child resilience on depression ............................................................... 62
Figure 7. Moderation effect of family resilience on depression ............................................................ 63
Chapter I
Introduction

Statement of the Problem

Adverse childhood experiences (ACEs) are associated with long-lasting adverse effects including substance use disorder (Bomysoad & Francis, 2020; Bryant et al., 2020; Dube et al., 2003; Leza et al., 2021), depression (Bomysoad & Francis, 2020; Felitti et al., 1998; Karatekin, 2018), and increased healthcare utilization (Hargreaves et al., 2019; Koball et al., 2021; Okeson et al., 2022). ACEs can also contribute to negative educational and social outcomes and put children at a heightened risk of negative health outcomes and limited life prospects, including educational opportunities and employment, especially among those who have experienced multiple ACEs (Bae, 2020; CDC, 2023; Duke, 2020; Toth & Cicchetti, 2013). Policymakers, public health practitioners, public health educators, and counselors are raising awareness of how ACEs influence diverse outcomes (Navalta et al., 2018; Zyromski et al., 2020). As ACEs have cascading impacts on major public health challenges (i.e., substance use and depression), there is an increased need to prevent ACEs and their negative impacts. The development of greater resilience is one of the most promising emergent avenues to mitigate the effects of ACEs. However, without a better knowledge base about ACEs and their impacts, as well as a thorough understanding of resilience and the factors that foster resilience, we cannot make evidence-based suggestions about interventions for ACEs (Masten & Barnes, 2018).

Research on ACEs and their association with behavioral and mental health has predominantly centered on adult populations (Hargreaves et al., 2019; Leza et al., 2021), underscoring the need for further investigation among children and adolescents (Scully et al., 2020). While there are recent studies investigating factors that protect against the
detrimental consequences of ACEs on negative health outcomes (Crandall et al., 2019; Daines et al., 2021; Elmore et al., 2020; Hanson et al., 2022; Kuhar & Kocjan, 2021; Yu et al., 2022), there is a limited understanding of protective factors (e.g., role of family, neighborhood) against the influence of ACEs on substance use and depression among children and adolescents. Although some research has delved into resilience factors against ACEs, there are still significant research gaps about factors that protect against the impacts of ACEs on substance use disorder (SUD) and depression, which are two primary emerging concerns among US adolescents.

Existing research has predominantly concentrated on either looking at the association between ACEs and negative health and behavioral outcomes or investigating the individual level of resilience (e.g., self-esteem) on the negative health outcomes (Kim et al., 2022; Norris & Norris, 2021; Tranter et al., 2021). However, these studies have not explored potential distinctions in the roles of different levels of resilience as a moderator, prompting questions about whether different types of resilience moderate the association between ACEs and negative health outcomes. Moreover, only a limited number of studies have conducted comprehensive assessments that includes a child’s internal resilience, family resilience, and community resilience in their analyses (Kuhar & Kocjan, 2021; Yu et al., 2022), despite their crucial significance in altering SUD and depression outcomes among children and adolescents. It’s also important to note that previous studies have not represented the US population or adolescent populations.
Summary of Literature Review

Adverse Childhood Experiences – Definition and Scope

ACEs are defined as traumatic experiences that happen during the first 18 years of life, and it is well-documented that their impacts can be detrimental to one’s physical health, mental health, and overall well-being (Centers for Disease Control and Prevention [CDC] 2022). Individual ACEs are broadly classified into three categories: abuse, neglect, and household dysfunction. The 10 domains that comprise the total ACEs are: 1) physical abuse; 2) sexual abuse; 3) emotional abuse; 4) physical neglect; 5) emotional neglect; 6) incarceration of a family member; 7) household mental illness; 8) household substance abuse; 9) parental divorce; and 10) witnessing intimate partner violence (Felitti et al., 1998). ACE literature originated with the CDC-Kaiser Permanente ACE landmark study in 1998 (Felitti et al., 1998), which outlined these 10 domains (Felitti et al., 1998). Prior to Felitti et al.’s (1998) study, researchers tested the hypothesis of the association of childhood adversity and negative physical and mental health outcomes, but these works of literature used different terms like “childhood trauma,” “early life adversity,” and “toxic stress” (Bertolli et al., 1995; Felitti et al., 1998; Garbarino, 1993; Green, 1988; Pollak et al., 1998; Sherfinski et al., 2019). Felitti et al., (1998) was the first study of its kind to use the term “adverse childhood experiences” and categorize these experiences into 10 distinct domains (Felitti et al., 1998). These domains are frequently employed as the foundation for many ACE measurement techniques in both research and practice (Crouch et al., 2019; Krinner et al., 2021; Sherfinski et al., 2019). As research on ACEs advances, the definitions of ACEs are becoming inclusive, encompassing broad categories such as peer victimization, exposure to community violence, physical limitations, and racism (Finkelhor et al., 2013). The term “adverse childhood experiences” was included in the Medical Subject heading (MeSH)
term in the year 2019, under which it includes 27 different related terms like “childhood trauma”, “early life stress”, and traumatic experiences (National Center for Biotechnology Information [NCBI], 2022).

Felitti et al. (1998) found that ACEs are very common among people in the US. About half (50.5%) of the people in the study reported at least one ACE. According to the National Survey of Children’s Health (NSCH), approximately 48.6% children had experienced at least one type of ACE and 6.5% children had experienced four or more ACEs (Mansuri et al., 2020). The most frequently encountered ACE exposures among children were economic challenges (22.5%), the divorce or separation of parents or guardians (21.9%), living with parents who has mental illness, suicidal thoughts, or depression (7.1%), and living with parents who has substance abuse or alcohol problem (8.1%) (Crouch et al., 2019). Retroactively reported ACEs are also common among adults; of the 214,157 adults from 23 states included in Behavioral Risk Factor Surveillance System (BRFSS), 61.6% had at least one ACE, and 24.6% reported 3 or more ACEs (Merrick et al., 2018).

In the literature, ACEs are primarily operationalized in three ways. The first way is to focus on one individual adversity (e.g., sexual abuse, physical abuse) (Baytunca et al., 2017; Houry, 2017; Stephens et al., 2022). However, assessing only one adversity may overestimate the effect of that individual adversity and overshadow the cluster effect of other adversities (Green et al., 2010). Another way of operationalizing ACEs is to show adversities as dichotomous indicators (Bethell et al., 2017; Karatekin, 2018). For example, ACEs are measured if a person has faced any of the listed adverse experiences, such as physical abuse, or not. Finally, the most popular way in the literature is to count each type of adversity, and report them as a summative score (Krinner et al., 2021), which appears to be a more comprehensive approach
to account for overall adverse childhood exposure (Bethell et al., 2017). This summative approach enabled studies to measure the gradient effect of ACEs. With this method, studies have revealed a dose-response association between ACEs and unfavorable health consequences (Friedman, 2016; Treme & Quick, 2022). Therefore, we adopted the summative approach to ACEs in this study (Bethell et al., 2017; Heerman et al., 2021; Xu et al., 2022). The presence of multiple ACEs has been shown to have a cumulative effect on the health of a child; for example, the addition of one individual ACE increased the likelihood of substance use by 40.0% (Dube et al., 2003). In addition, there is evidence of the graded relationship between the number of ACEs and health outcomes across all ages (Bomysoad & Francis, 2020; Chapman et al., 2004; Dube et al., 2003).

ACEs are directly and indirectly linked with the leading causes of deaths among US adolescents (SmithBattle et al., 2022; Thompson & Kingree, 2022). Individuals with one or more ACEs have more than twice the risk of developing cardiovascular disease (CVD; Godoy et al., 2021) and around 1.4 times the risk of suicidal ideation (Thompson et al., 2019). ACEs are also associated with diabetes (Huang et al., 2015; Hughes et al., 2017), respiratory diseases (Anda, Brown, Dube, et al., 2003; Cunningham et al., 2014), and lung cancer (Brown et al., 2010). Additionally, ACEs are associated with behavioral problems (Petruccelli et al., 2019), mental health problems (Karatekin, 2018), and poor health outcomes later in life (Loxton et al., 2021). A non-causal link between ACEs and leading causes of death includes increased healthcare utilization (Testa et al., 2022), less utilization of routine healthcare checkups (Koball et al., 2021), and excessive use of emergency services (Okeson et al., 2022).

Studies have demonstrated significant positive associations between ACEs and various school-related challenges among children and adolescents, including school dropout (Bae, 2020),
chronic school absenteeism (Stempel et al., 2017), and lower grade and academic performance (Duke, 2020). Additionally, ACEs have social and economic ramifications, as individuals with ACEs tend to earn less and experience a lower quality of life compared to those without ACEs (CDC, 2023). Due to their overall negative impact on health and well-being (Gilgoff et al., 2020), ACEs have been described as one of the most significant threats to normative child development and adaptation (Toth & Cicchetti, 2013).

**Adverse Effects of ACEs**

ACEs are an area of interest in public health for two specific reasons. Firstly, ACEs are very common with more than 50% of people having experienced at least one ACE (Blodgett & Lanigan, 2018; Felitti et al., 1998). Secondly, ACEs are linked with several negative outcomes including chronic diseases (SmithBattle et al., 2022; Thompson & Kingree, 2022), behavioral health (Rogers et al., 2022), mental health problems (De Venter et al., 2013; Karatekin, 2018), and health care utilization (Koball et al., 2021). Based on the scope of this study, the adverse effects of ACEs are broadly divided into three categories.

**ACEs and substance use.** Several studies have highlighted the association between ACEs and substance use (Bomysoad & Francis, 2020; Bryant et al., 2020; Campbell et al., 2016; Dube et al., 2003; Gomez et al., 2018; Kim et al., 2021; Leza et al., 2021). However, many of these studies have focused on adult population (Bryant et al., 2020; Campbell et al., 2016; Dube et al., 2003; Kim et al., 2021; Leza et al., 2021) and very few studies focused on adolescent populations (Bomysoad & Francis, 2020; Gomez et al., 2018). Most of the studies show a dose-response relationship between ACEs and substance use. For instance, ACE scores of four or more are associated with an increased risk of substance use compared to people with lower ACE scores (Campbell et al., 2016). Studies have also found an association with different derivatives of
substance use. ACEs are associated with drug use dependency (Bryant et al., 2020; Oei et al., 2021), severity of drug dependency (Leza et al., 2021), and increased number of relapses while in substance use treatment (Hughes et al., 2017).

**ACEs and mental health problems.** Mental health problems are common among children and adolescents exposed to ACEs, as they often develop in response to traumatic experiences (Vibhakar et al., 2019). Several studies have highlighted the positive association between ACEs and mental health problems (Bomysoad & Francis, 2020; De Venter et al., 2013; Karatekin, 2018; Lee & Chen, 2017; Lowthian et al., 2021). Like studies around substance use, mental health studies show a dose-response relationship between ACEs and mental health problems. For instance, children exposed to four or more ACEs are four and half times more likely to suffer from depression and twelve times more likely to commit suicide (Felitti et al., 1998). Similarly, adults with four or more ACEs are at 30 times higher odds of attempting suicide compared to people without ACEs (Hughes et al., 2017). Most of the studies that explored the association between ACEs and mental health problems, have focused on the outcome of depression among adults (Hughes et al., 2017; Karatekin, 2018; Lee et al., 2020). Studies show an increased risk of depression with either a greater number of ACEs or with a particular set of ACEs (Lee et al., 2020). For instance, ACE scores of four or more among adolescents are associated with increased risk of many mental health conditions (i.e., depression, anxiety, behavioral problems, ADHD, and substance use disorders; Bomysoad & Francis, 2020) compared to adolescents with fewer ACEs. In comparison to all ACEs, some individual ACEs such as, parental mental illness, and sexual abuse are strongly associated with the diagnosis of depression among children and adolescents (Fitzgerald & Kawar, 2022; Lee et al., 2020). Notably, some high-risk ACEs (i.e., parental separation, witnessing domestic or neighborhood violence, and witnessing drug use) have even
more increased risk of depression than other individual ACEs among children and adolescents (Lee et al., 2020).

**ACEs and health care utilization.** Given the significant impact of ACEs on the burden of diseases, it is not surprising that ACEs also affect healthcare utilization (Bonomi et al., 2008; Kalmakis & Chandler, 2015). ACEs increase the need for health care and could be associated with healthcare utilization in different ways, including simply increased utilization and also increased need for care (whether it is being utilized or not). Studies have linked ACEs with increased healthcare utilization among children (Hargreaves et al., 2019; Kamiya et al., 2016; Okeson et al., 2022). One study showed that each ACE, compared to no ACES, is associated with a higher level of unmet specialist care (e.g., Psychiatrist), and the addition of each ACE independently increased the odds of the need to visit specialist care (Bloom et al., 2019). Most of the studies in healthcare utilization have looked into the association of healthcare utilization with individual ACEs. For instance, children who have experienced sexual assault have more visits to mental health services (New & Berliner, 2000) and were more likely to use emergency services (Okeson et al., 2022). Furthermore, some ACEs (e.g., sexual assault) are associated with the increased need for mental health treatment (Price et al., 2014). ACEs may result in increased healthcare utilization thereby affecting health care expenditure because of the greater cost associated with treatment (Chartier et al., 2010).

ACEs are also associated with some of the negative behaviors and conditions related to healthcare utilization. For instance, children with ACEs are more likely to miss appointments with healthcare providers (Koball et al., 2021), and people with ACEs have been found to have lower odds of being currently insured and receiving a physician checkup in the past year (Alcalá et al., 2018).
ACEs are also linked to several other problems (e.g., school-based victimization, educational attainment, and juvenile crimes) that can be indirectly linked with behavioral and mental health problems and healthcare utilization among children and adolescents. For instance, Forster et al. (2020) found a significant graded association between cumulative ACEs and the likelihood of school-based victimization, including physical bullying for boys, being threatened with a weapon, theft or property destruction, and perpetration, including bullying and bringing a weapon to campus (Forster et al., 2020). Additionally, higher ACE scores were linked to a higher chance of involvement with the juvenile justice system (Graf et al., 2021). Furthermore, ACEs are also linked to poverty and lower levels of education (Stewart-Tufescu et al., 2022; Walsh et al., 2019) which are strongly linked with behavioral problems and healthcare utilization.

**ACEs and Resilience**

We can gain a comprehensive understanding of children’s experiences by considering both adverse and positive events, such as positive social relationships and factors that promote resilience (Lopez et al., 2021). Resilience can act as a buffer against the impact of traumatic events, reducing the potential for long-lasting emotional health issues in adulthood (Forkey et al., 2021) and laying a strong foundation for the physical, emotional, and mental well-being in children (Kuo et al., 2012). Additionally, resilience has a protective influence against various negative outcomes, including mental health problems (Goldenson et al., 2021). If we can strengthen resilience, it may reduce negative outcomes of ACEs (Forkey et al., 2021).

Resilience among children may include traits and factors such as self-esteem, positive relationships, active engagement in family and social activities, academic aspirations, and a sense of motivation (Orkibi et al., 2018). These factors can strengthen resilience after ACEs (Kwong & Hayes, 2017). At the individual level, self-esteem plays a negative mediating role in
the relationship between ACEs and depressive symptoms (Kim et al., 2022). Thus, enhancing children’s self-esteem can contribute to bolstering their emotional resilience. The maintenance and strengthening of emotional resilience in children with ACEs can have positive effects on their psychological well-being (Tranter et al., 2021). Furthermore, personal behaviors such as engaging in physical activities provide a protection against various adverse life events, including ACEs, and promote resilience (Norris & Norris, 2021). ACEs are significantly associated with child resilience in a dose-dependent manner. As the number of ACEs increases, the likelihood of resilience decreases (Heard-Garris et al., 2018). Specifically, studies have found that children who have 4 or more ACEs tend to have lower resilience compared to those with fewer ACEs (Goldenson et al., 2021). The association of ACEs and resilience persisted after adjusting for child, family, and community variables (e.g., neighborhood safety; Heard-Garris et al., 2018).

Family resilience plays an important role in mediating the ACEs-related association (Heard-Garris et al., 2018). One study found that children were more resilient if their families ate meals together, attended religious activities together, and shared ideas (Heard-Garris et al., 2018). Adolescents living apart from their parents have been found to have a higher prevalence of substance use (i.e., marijuana; Regmi et al., 2019), while adolescents who lived with their parents and placed a greater value on the family had protection from alcohol use later in their lives (Ewing et al., 2015). These findings suggest that addressing ACEs within a family-centric approach can strengthen the resilience of children (Morris et al., 2021).

In addition to child resilience and family resilience, the physical environment, social environments, and neighborhood safety and support have also been shown to be associated with substance dependence (Kadushin et al., 1998). Positive factors like living in a resourceful neighborhood may interfere with the pathway from ACEs to substance use. Specifically,
neighborhood safety was significantly related to a higher probability of resilience, compared to children and adolescents without access to neighborhood facilities (Heard-Garris et al., 2018). Within the context of school, having supportive peer relationships and caring adults, including mentors and teachers, have been shown to contribute to children's resilience (Holmes et al., 2018). In addition, Forster et al. (2017) found that positive and affectionate student-teacher relationships are negatively associated with substance use among children with ACEs.

**Theoretical Background**

The cumulative inequality theory (Ferraro & Shippee, 2009) and life course epidemiology (Ben-Shlomo & Kuh, 2002) make an argument that early childhood exposures to trauma can have both direct and indirect effects on adult health. The direct impacts of ACEs can be measured through biomarkers and the effects on the endocrine system (Friedman, 2016). Some studies suggest that adverse event exposures before the age of 18 may leave a biological mark on health (Friedman, 2016; Slopen et al., 2010). These stress biomarkers are measurable predictors of various biological processes that predict diseases and inflammation (Davis et al., 2023). Although there is a paucity of studies in understanding the origin of biomarkers, Slopen et al. (2010) found that being expelled from school and parental substance abuse were associated with biomarkers for inflammation. Indirect health impacts may include the development of negative health-related behaviors (Forster et al., 2020), poor psychosocial well-being (Hughes et al., 2017), and lack of socioeconomic resources (Stewart-Tufescu et al., 2022; Walsh et al., 2019).

Exposure to trauma and stressors, such as ACEs, can impair the stress response system, often referred to as the “fight or flight mechanism” (Chrousos, 2009). Studies show that exposure to early adversity causes over-activation of the hypothalamic-pituitary-adrenal (HPA) axis
(Clemens et al., 2020), thereby affecting the development of the brain (Luby et al., 2019) and
disease susceptibility (Maniam et al., 2014). This impact is particularly pronounced when
children have repeated ACE exposures (Gerra et al., 2016). The repetitive activation of the stress
response system has repercussions on the nucleus accumbens, a brain region associated with the
pleasure and reward system, which is also linked to substance use (Wang, 2019). Not all children
who experienced adversity faces negative outcomes, sometimes they can cope with the
adversities if they find an adaptive environment (e.g., family support and social support;
Friedman, 2021), whereas adolescents who do not find support or develop resilience are at
greater risk of behavioral problems and mental health problems.

The concept of the ‘Pair of ACEs,’ as elucidated by Ellis et al. (2022), offers a
compelling diagram that helps us understand the indirect pathways through which ACEs lead to
behavioral and mental health problems. This conceptualization presents a visual analogy of an
ACEs tree, with its roots delving into the contributing factors of family adversity and systemic
inequities, while the leaves represent the outward, easily recognizable ‘symptoms’ of ACEs often
observed in clinical settings. These symptoms encompass a range of challenges, including SUD
and depression, which are the manifested branches of this intricate tree. The metaphorical roots,
existing in impoverished soil, symbolize the systemic inequities that deplete the essential
nutrients required for a thriving community, showing the significant role of individual, family,
and neighborhood factors in protecting against the far-reaching consequences of ACEs (Ellis et
al., 2022). This multifaceted diagram not only helps us understand the indirect pathways through
which ACEs can lead to negative outcomes but also underscores the importance of addressing
the underlying factors and systemic issues, strengthening child and family resilience, and
fostering safe and supportive neighborhood for the families and children.
Resilience theory (Masten & Cicchetti, 2016) explains why some adolescents can confront adversity with minimal impact on their health while others cannot. In this case, resilience is defined as the ability to maintain flexibility and adaptability in the face of life’s challenges (Boniwell et al., 2019). The notion of resilience focuses on positive environmental, interpersonal, and individual characteristics that interfere and protect children from behavioral issues, mental health problems, and poor health outcomes (Fergus & Zimmerman, 2005). While there are several models of resiliency theory, this study focuses on the protective factors model, which assumes that certain resources, known as promotive factors, can change the way risk interacts with outcomes (Zimmerman, 2013). There are two types of protective models: risk-
protective and protective-protective. Risk-protective models suggest that protective factors mitigate the connection between risks and adverse outcomes. On the other hand, protective-protective models amplify the predictive power of each individual protective factor and enhance the predictive ability of each protective factor (Hurd & Zimmerman, 2010). Since the purpose of this study is to explore the moderation effects of different types of resilience on the outcome of behavioral health and mental health after exposure to ACEs, we will focus on the risk-protective model of resilience to mitigate the risk of negative consequences of ACEs on behavioral health. In line with these theories, we propose a resilient model that interacts with children at various levels.

**HOPE Framework**

One of the popular frameworks for ACE interventions that is well aligned with the aforementioned theories is the HOPE framework (Healthy Outcome from Positive Experiences; Sege & Browne, 2017). It is based on Bronfenbrenner’s ecological theory which explains the influence of interconnected environments in human growth. From a human development perspective, Bronfenbrenner’s theory explains child development by emphasizing the interaction among processes, people, contexts, and time (Bronfenbrenner, 1979). He proposed four systems that influence a child’s development: the microsystem, the mesosystem, the exosystem, and the macrosystem. The HOPE framework is built upon Bronfenbrenner’s model which focuses a strong emphasis on the necessity of making conscious efforts to improve all children’s lives, particularly those who are exposed to stressors such as ACEs (Sege & Browne, 2017). It focuses on fostering early pleasant experiences to build a strong foundation for learning, behavior, and the general well-being of children. This approach underscores the importance of strengthening the support system (e.g., parents and caregivers) to support healthy child development. Three
guiding principles of the HOPE framework include the three following acknowledgements: (1) all spheres of the social ecology contain both beneficial and harmful elements that have an impact on children's health, (2) the health and well-being of parents and children are intricately intertwined; positive experiences must therefore support the well-being of the kid, the parent, and the parent-child bond, and (3) physical, cognitive, social, and emotional outcomes are all part of child health (Sege & Browne, 2017).

The combination of these theories and frameworks offers a holistic perspective on the intricate interplay between ACEs and resilience, and their collective health impacts. Cumulative inequality theory and life course epidemiology lay the foundation, underscoring the lasting effects of early exposures on adult well-being. The overactivation of the stress response system and its alteration on brain development and disease susceptibility further validate these associations. Resilience theory reveals the potential for protective factors to minimize the adverse effects of ACEs. The ‘Pair of ACEs’ concept by Ellis et al. (2022) provides a visual bridge between ACEs and the ensuing behavioral and mental health problems. Finally, the HOPE framework encapsulates these theories, emphasizing the importance of a comprehensive approach to child health and well-being. We utilized the HOPE framework to understand the role of different types of resilience acting on ACEs in the outcome of substance use and depression among children and adolescents. In this study, resilience is supported within the four features of the HOPE framework as (1) opportunities for emotional growth (child resilience); (2) being in nurturing, supportive relationships (family resilience), (3) living in safe, equitable, stable environments (safe neighborhood), (4) social and civic engagement (neighborhood support) (Sege & Browne, 2017).
Figure 2. Study variables according to the Hope Framework

Trends and Gap in the Literature

Many studies have found strong associations between ACEs and behavioral problems (Bomysoad & Francis, 2020; Bryant et al., 2020; Dube et al., 2003; Leza et al., 2021), mental health problems (Bomysoad & Francis, 2020; Felitti et al., 1998; Karatekin, 2018) and excessive healthcare utilization (Hargreaves et al., 2019; Koball et al., 2021; Okeson et al., 2022). Most of these studies have targeted adult populations but a few studies focus on children and adolescents (Hargreaves et al., 2019; Leza et al., 2021). Furthermore, to our knowledge, there has been limited study investigating the association between ACEs and mental healthcare utilization.

Because of the broad impacts of ACEs on physical health (Felitti et al., 1998; Godoy et al., 2021; SmithBattle et al., 2022), mental health (Bomysoad & Francis, 2020; Karatekin, 2018;
Petruccelli et al., 2019), academic standing (Bae, 2020; Duke, 2020; Stempel et al., 2017), and quality of life (Gilgoff et al., 2020), studies on ACEs are now seeking ways to both minimize the effects of ACEs and prevent ACEs.

Resilience is gradually getting attention in the ACEs literature as one of the potential upstream approaches to mitigate the effects of ACEs (Bethell et al., 2019; Bhushan et al., 2020; Elmore et al., 2020; Leitch, 2017; Morris et al., 2021). The development of resilience may include personal characteristics, environmental influences, and a learned capacity acquired through experience (Boniwell et al., 2019). In the public health approach, protective childhood experiences (PCES), which are the counterpart of ACEs, could act to bolster resilience after ACEs (Hanson et al., 2022). PCEs are known to protect against negative health outcomes among young adults and college students (Hanson et al., 2022). For instance, in a recent study, PCEs were negatively linked with six health issues (i.e., poor self-rated physical and mental health, depression, anxiety, suicide attempt, and physical inactivity) among adults with ACEs (Kuhar & Kocjan, 2021). In another study, it was found that adolescents with PCEs had a significantly reduced likelihood of developing depression (Qu et al., 2022). Furthermore, the presence of PCEs (i.e., harmonious family relationships, supportive friends, and fair treatment in school) moderated the association between increasing ACEs and decreased child flourishing (Yu et al., 2022). However, most of the studies on PCEs do not represent the US population (Kuhar & Kocjan, 2021; Qu et al., 2022; Yu et al., 2022).

PCEs have a positive relationship with four family health domains (i.e., family healthy lifestyle, family health resources, family external social supports, family social and emotional health processes) irrespective of the presence of ACEs (Daines et al., 2021). Few other studies have particularly focused on the relationship between PCEs and mental health. Elmore et al.
(2020) found that the odds of depression among people with more than four ACEs was twice that of people without ACEs, while the odds of depression increased to about 8 times in the absence of PCES. Another study reported that the odds of a depression diagnosis were 72.0% lower among people with 6-7 protective childhood experiences, and 50.0% lower among people with 3-5 PCES compared to people with 0-2 PCEs (Bethell et al., 2019).

Various familial characteristics such as family cohesion, family support, and positive environmental influences have been linked to the positive mental health of children. For instance, family closeness and parental supervision were related to fewer problem behaviors among adolescents (Viner et al., 2012), while children with less family support are linked with negative mental health conditions. Children from single-parent homes have greater symptoms of internalizing and externalizing issues than those from two-parent families (Viner et al., 2012). However, there are very few studies on the impact of family-level resilience on children exposed to ACEs.

Likewise, there have been very few studies on the effects of resilience at the neighborhood level (i.e., neighborhood support and neighborhood safety) on ACEs. Some of the evidence includes findings of positive behavioral and mental health outcomes among those living in resourceful neighborhoods (Alderton et al., 2022). In addition, living in communities with strong social ties has been associated with positive outcomes favorable for early child development (Bell et al., 2020). Identifying these potential compensatory characteristics is crucial for understanding resilience strategies for children and adolescents at high risk for ACEs (Southwick et al., 2014).

Given the multifaceted problems of ACEs on physical health, mental health, behavioral problems, and healthcare utilization, there is a need for early prevention strategies. According to
the CDC, the current strategy for ACEs interventions are broadly focused on strengthening economic support to families, changing social norms to support parents and positive parenting, providing quality care and education early in life, enhancing parenting skills to promote healthy child development, and intervening to lessen harms and prevent future risk (CDC, 2021). In clinical settings, there are three main types of interventions suggested in the ACEs literature. One such effort is trauma-informed care. Trauma-informed care is defined by the Substance Abuse and Mental Health Services Administration (SAMHSA) as a comprehensive approach to patient treatment that considers the effects of childhood trauma on individuals, families, communities, and society. It aims to provide sensitive and effective care for trauma survivors (Esden, 2018).

The second important model of trauma-informed care and ACEs intervention is the educational component of the 4 E’s model (Educate, Empathize, Explain, and Empower; Mollard & Hudson, 2015) which refers to the systematic education for health staff. This component of the 4E’s model includes training on ACEs’ prevalence, their impact on children’s brain development, their effects on bodily functions, and their role in later-life mental illness, chronic illness, and health-risk behaviors (Mollard & Hudson, 2015). Finally, studies suggest routine screening of ACEs as a part of regular medical treatment (Asheh et al., 2023; Fortson et al., 2021; Rariden et al., 2021). During ACE screening, a physician may provide brief counseling to support and inform (Purewal et al., 2016). Lastly, Purewal et al. (2016) suggest interdisciplinary services including psychiatric counseling, home visits, and the involvement of social workers. Home visits for children with ACEs (e.g., abuse and neglect) have been found to reduce juvenile arrests and delinquency and protect adults from engaging in criminal activity (Olds et al., 1998).

Although these are evidence-based strategies used in ACE interventions and helpful for individual patients, it is hard to make them scalable to disseminate across the large population as
they are patient centric (Finkelhor, 2018). Furthermore, within these models, there is a lack of understanding of the role of different levels of resilience (i.e., child resilience, family resilience, safe neighborhood, and neighborhood support). The information from this study can be utilized to prepare educational and counseling materials for ACE interventions and can aid in the development of new family and community-focused ACE interventions.

**Purpose of the Study**

Children and adolescents exposed to ACEs have been shown to initiate substance use earlier (Gomez et al., 2018; Leza et al., 2021; Stein et al., 2017), progress to regular use at rapid rates (Dube et al., 2003), and be at greater risk for developing a SUD compared to those who are not exposed to ACEs (Bomysoad & Francis, 2020; Dube et al., 2003). In addition, there is a strong correlation between ACEs and the diagnosis of depression among adults (De Venter et al., 2013; Karatekin, 2018). Resilience may buffer the negative effects of ACEs (Kuo et al., 2012) and may decrease the negative behavioral and mental health problems among children and adolescents. Self-esteem and flourishing in children, positive family relationships, and social interaction (Cahill et al., 2022) may contribute to developing resilience as a counter-point to adversities (i.e., ACEs) (Kwong & Hayes, 2017). Therefore, the need to examine the role of resilience in the association between ACEs and SUD is evident in the literature. Previous studies highlight the need to identify protective factors for SUD among adolescents who experienced ACEs (Davis et al., 2021; Rogers et al., 2022).

To this end, this study aimed to examine: (1) the relationship between ACE score and diagnosis of SUD among US adolescents; (2) whether child resilience, family resilience, safe neighborhoods, and supportive neighborhoods moderate the relationship between ACEs and SUD among US adolescents; (3) the relationship between ACE scores and diagnosis of...
depression among US children and adolescents; (4) whether child resilience, family resilience, safe neighborhoods, and supportive neighborhoods moderate the relationship between ACEs and diagnosis of depression among US children and adolescents; (5) the relationship between ACE score and the diagnosis of mental emotional, developmental, and behavioral problems among US children and adolescents; and (6) the relationship between ACE score and the utilization of mental health care among US children and adolescents.

**Specific Aims**

In the three-paper format, this dissertation examines the association of ACEs and risky healthy behaviors among children and adolescents. In addition, this study explores the moderating role of different types of resilience in mitigating the effects of ACEs on behavioral outcomes. The objectives of the first paper, *Adverse Childhood Experiences, Substance Use*...
Disorder, and Moderating Effect of Resilience: Findings from the National Survey of Children's Health are:

1. to explore the association between ACEs and SUD among US adolescents.
2. to explore the role of different types of resilience (i.e., child resilience, family resilience, neighborhood support, and neighborhood safety) in the relationship between ACEs and SUD.

The objectives of the second paper, Roles of Child Resilience, Family Resilience, Safe Neighborhood, and Supportive Neighborhood on Depression among Children and Adolescents with Adverse Childhood Experiences are:

1. to explore the association between ACEs and depression among US children and adolescents.
2. to explore the role of different types of resilience (i.e., child resilience, family resilience, neighborhood support and neighborhood safety) in the relationship between ACEs and depression among children and adolescents.

The objectives of the third paper, Utilization of Mental Health Services among Children and Adolescents with Adverse Childhood Experiences (ACEs) are:

1. to explore the relationship between ACEs and mental health care needs among children and adolescents,
2. to understand the relationship between ACEs and mental health care utilization in children and adolescents.

This dissertation contributes to the existing literature by providing an understanding of possible intervention strategies to deal with major public health problems like ACEs, substance use disorders, and mental health, especially among children and adolescents.
Significance of the Study

ACEs, SUD, and depression are pressing public health problems among children and adolescents in the US. ACEs are directly and indirectly linked with the leading causes of death among adolescents (SmithBattle et al., 2022; Thompson & Kingree, 2022). SUD puts an adolescent at an increased risk of preventable deaths (Kinner et al., 2015), and childhood depression poses a significant public health concern due to its high prevalence and increasing incidence (Bitsko, 2022; Lebrun-Harris et al., 2022; The American Academy of Pediatrics (AAP), 2021). Even though the association of ACEs is linked with SUD and depression, relatively few studies to date have explored the moderating role of different types of resilience that may buffer the impact of ACEs on SUD and depression.

This study makes three unique contributions to the current knowledgebase of these subjects. First, this study examines the relationship between ACEs and SUD in a nationally representative sample of US adolescents using propensity score matching. Second, this study tests the moderating role of different types of resilience (i.e., child resilience, family resilience, safe neighborhood, and supportive neighborhood) on the outcome of SUD and depression among a nationally representative sample of US children and adolescents. Third, this study explores the unique relationship between ACEs and mental health care utilization among a nationally representative sample of US children and adolescents.

Finally, this study holds significant implications for public health practice and policymaking. Given the limited research on the impact of child resilience, family resilience, safe neighborhoods, and supportive neighborhoods on SUD and depression, the study's findings can contribute to the development of both local and national programs and policies that protect and promote the behavioral and mental health of ACEs-affected children and adolescents.
Organization of the Study

The current study, as a dissertation, proposes the “manuscript-oriented dissertation option” according to the dissertation guidelines of the University of Memphis School of Public Health. This option requires students to write a minimum of three manuscripts suitable for publication in peer-reviewed journals.

Chapter two is the first journal manuscript. This chapter explores the relationship between ACEs and SUD and tests the moderating effect of different types of resilience according to the HOPE framework among adolescents in the United States.

Chapter three is a research paper examining the relationship between ACEs and childhood depression and tests the moderating effect of resilience on the outcome of depression among children and adolescents in the United States.

Chapter four, which is the last journal manuscript, tests the relationship of mental health care utilization and the difficulty of receiving mental health care among children and adolescents with ACEs.

Finally, Chapter five delves into the study’s findings, their implications for practice and policy, limitations, and potential avenues for future research.
CHAPTER II

Adverse Childhood Experiences, Substance Use Disorder, and Moderating Effect of Resilience: Findings from the National Survey of Children’s Health

Introduction

Adverse childhood experiences (ACEs) are a major public health issue in the US. ACEs include traumatic events, such as physical and sexual abuse, neglect, household dysfunction, and other challenging life experiences, that occur during the first 18 years of a person’s life (Centers for Disease Control and Prevention [CDC], 2022; Sherfinski et al., 2019). ACEs are broadly categorized into ten types, including physical abuse, sexual abuse, physical neglect, emotional neglect, and five household dysfunctions (Krinner et al., 2021). Approximately 64% of the US population reports experiencing at least one of these adversities, around 16.1% have experienced 1-2 ACEs, and around 17.3% have experienced four or more ACEs (Bomysoad & Francis, 2020; CDC, 2022b).

ACEs are associated with substance use-related problems among adolescents (Rogers et al., 2022), including an increased risk of misusing substances later in life. (Anda, Brown, Felitti, et al., 1998; Dube et al., 2003; Swedo et al., 2020). Children exposed to ACEs initiate substance use earlier in life (Gomez et al., 2018; Leza et al., 2021), progress to regular use at rapid rates (Dube et al., 2003), and are at greater risk for developing a SUD compared to children who are not exposed to ACEs (Bomysoad & Francis, 2020; Dube et al., 2003). ACEs are also associated with increased odds of opioid use (Tang et al., 2020; Winstanley et al., 2020).

Studies have found that people with higher cumulative ACEs are also more likely to initiate substance use at earlier ages (Stein et al., 2017) and are more likely to report recent and
severity of substance use (Gomez et al., 2018; Leza et al., 2021). For instance, having more than four cumulative ACEs increases the odds of opioid use, alcohol use, and smoking (Campbell et al., 2016) and is associated with a seven-fold increased risk of substance use disorder (Gomez et al., 2018). A few studies examining the association of ACEs and specific substances indicate that experiencing more than four ACEs is linked to current cigarette smoking (aOR = 1.56; 95% CI [1.37, 1.78]) and lifetime cigarette use (aOR = 1.81; 95% CI [1.59, 2.05]) (Martinasek et al., 2021).

Substance use at an early age can cause substance dependence (Flórez-Salamanca et al., 2013), dramatically increase the risk of SUD (Jordan & Andersen, 2017), use of higher dosages of substances (Cappelli et al., 2021), polysubstance use (Cappelli et al., 2021; Thrul et al., 2021), and overdose problems later in life (Lyons et al., 2019). Developing a SUD places adolescents at an increased risk for serious harm, such as overdose (Yue & Pena, 2023), accidents involving motor vehicles (Tsai et al., 2023), and violent behaviors (Kedia et al., 2021). Furthermore, earlier onset of substance use among adolescents is associated with poorer cognitive functioning (Gruber et al., 2012), an increased risk of mental health problems (Bravo et al., 2019), and suicidality (Gobbi et al., 2019). Additionally, SUD is associated with negative academic performance, delinquent behavior, and engaging in high-risk activities (e.g., early initiation of sexual intercourse among high school students) (Cavazos-Rehg et al., 2011); SUD among adolescents can also lead to several other social and public health problems, including drug-related crimes (Chen & Wu, 2016).

The relationship between ACEs and SUD is complex. It is critical to understand the cumulative effect of ACEs on SUD as well as to identify protective factors, such as resilience, during the developmental stages of childhood and adolescence (Ungar, 2013). Equally important
is the need to examine the role of different types of resilience among adolescents with ACEs and the development of SUD in order to aid prevention efforts. Resilience is an adaptive behavior that allows a person to cope with the stressors associated with ACEs in a positive way (Cahill et al., 2022). Resilience involves a complex interplay of genetics, self-efficacy, family support, social support, and societal resources (Fergus & Zimmerman, 2005). Cahill et al. (2022) report that resilience to adolescent psychopathology can be predicted by self-esteem, flourishing, positive family relationships, and social interaction. These different protective factors may contribute to developing resilience to deal with adversities (Kwong & Hayes, 2017).

There are various types of resilience, such as child resilience, family resilience, safe neighborhood, and supportive neighborhood. In this study, we define child resilience as receptivity to opportunities for emotional growth, family resilience as being in nurturing, supportive relationships, safe neighborhood as living in safe, equitable, and stable environments, and supportive neighborhood as social and civic engagement (Sege & Browne, 2017). Child resilience plays a vital role in promoting healthy coping skills (Elrefaay & Ely zal, 2023), therefore fostering child resilience in the context of ACEs can provide positive behavioral outcomes to children and adolescents. Family resilience plays an important role in promoting resilience after ACEs (Heard-Garris et al., 2018), which may result in decreased SUD among adolescents. For instance, adolescents who live with their parents and are inclined to keep the rules what their parents want to follow are linked with decreased substance use later in their lives (Ewing et al., 2015). According to life course theory, behavior (e.g., substance use) in adolescence is associated with their childhood environment (Elder, 1998). Physical resilience, environmental resilience, social environment, and neighborhood resilience are also inversely
associated with substance dependence (Kadushin et al., 1998). Therefore, different types of resilience could potentially disrupt the pathway from ACEs to SUD.

As a counterpoint to ACEs, the Healthy Outcomes from Positive Experiences (HOPE) framework has been developed as a holistic approach to child healthcare (Sege & Browne, 2017) and a structured program from which to promote positive childhood experiences (PCEs) to serve as a buffer against stressful ACEs. PCEs may attenuate the negative effects of ACEs (Kuo et al., 2012) and may result in lower SUD among adolescents. The HOPE framework incorporates PCEs as 1) opportunities for emotional growth, 2) being in nurturing, supportive relationships, 3) living in safe, equitable, and stable environments with 4) social and civic engagement (Sege & Browne, 2017). This framework emphasizes the need for promoting PCEs that contribute to resilience and healthy development, thus mitigating the impact of ACEs (Sege & Browne, 2017).

By using the HOPE framework, our study explores the moderating role of different types of resilience on SUD among adolescents with ACEs. Previous studies have highlighted the need for identifying protective factors for SUD among adolescents who experienced ACEs (Davis et al., 2021; Rogers et al., 2022). Although a few studies have identified resilience as having protective effects (Cahill et al., 2022; Ewing et al., 2015; Heard-Garris et al., 2018; Kuo et al., 2012; Kwong & Hayes, 2017), current understandings of how child resilience, family resilience, safe neighborhoods, and supportive neighborhoods interact with ACEs and SUD is limited. Our study addresses this need by examining the relationship between levels of ACE exposure and SUD and the role of different types of resilience factors on SUD among adolescents with ACEs. We hypothesize that 1) ACEs increase the risk factor for SUD; 2) A higher number of ACEs increases the likelihood of SUD; and 3) Four different types of resilience (i.e., child resilience, family resilience, safe neighborhoods, and neighborhood support) may moderate the association
between ACEs and SUD. Understanding the potential moderating role of different types of resilience in the association of ACEs and SUD is critical for developing both SUD interventions and to mitigate the effects of ACEs.

**Methods**

**Data Source and Study Sample**

For this study, we utilized publicly accessible data from the National Survey of Children’s Health (NSCH). The NSCH survey collects data from non-institutionalized children in the US, aged 0-17 years; it focuses on their health and well-being, as well as family and community characteristics. This survey is distributed via mail and online questionnaires and is completed by the children’s parents or caregivers (NSCH, 2020). We combined four years of data (i.e., 2016 to 2019) using two datasets 2016-2017 and 2018-2019. A total of 71,811 surveys were completed in 2016-2017, and 72,210 surveys were completed in 2019-2020. For this study, we limited our sample to adolescents aged 12-17 years \( N = 54,434 \). Children under the age of 12 \( n = 25 \) were excluded due to rarity of reported SUD diagnoses in this age range (NSCH, 2020).

**Measures**

**Dependent Variable.** The dependent variable in this study was a SUD diagnosis by a physician or health care professional that was reported by the adolescents’ caregiver respondents. It was measured by the question “Has a doctor or other healthcare provider ever told you that this child has substance use disorder?” The question has three categories of responses: 1 = does not have the condition, 2 = ever told but does not currently have condition, and 3 = currently has condition. The focus of this study is SUD among adolescents, so we combined 2) and 3) together
to make it a dichotomous variable of ever diagnosed with SUD and recoded it as 1 = ever diagnosed with SUD and 0 = Not ever diagnosed with SUD.

**Adverse Childhood Experiences.** The ACEs measure in the NSCH was modified from the CDC and Kaiser Permanente’s ACEs Study (Felitti et al., 1998). Caregivers were asked if the child had experienced any of the nine types of ACEs, as captured by the NSCH survey: difficulty covering basic needs on family’s income (ACE1); parents or guardians divorced or separated (ACE3); parent or guardian died (ACE4); parent or guardian served time in jail (ACE5); saw or heard parents or adults slap, hit, kick, punch one another in the home (ACE6); was a victim of violence or witnessed violence in neighborhood (ACE7); lived with anyone who was mentally ill, suicidal, or severely depressed (ACE8); lived with anyone who had a problem with alcohol or drugs (ACE9); and treated or judged unfairly due to race/ethnicity (ACE 10).

The first question (ACE1) was asked as “Since this child was born, how often has it been very hard to cover the basics, like food or housing, on your family’s income? This question has four responses: 1= never hard to get by on family income; 2 = rarely hard to get by on family income; 3 = somewhat often hard to get by on family income; and 4 = very often hard to get by on family income. We combined the responses 3 and 4 and recoded them into two categories: 1 = exposed (“somewhat often” or “very often”) and 2 = not exposed (“rarely” or “never”). The other ACE questions two thru nine were asked as: “To the best of your knowledge, has this child ever experienced any of the following?” parents or guardians divorced or separated (ACE3), parent or guardian died (ACE4), parent or guardian served time in jail (ACE5), saw or heard parents or adults slap, hit, kick punch one another in the home (ACE6), was a victim of violence or witnessed violence in his or her neighborhood (ACE7), lived with anyone who was mentally ill, suicidal, or severely depressed (ACE8), lived with anyone who had a problem with alcohol or drugs (ACE9), and treated or judged unfairly due to race/ethnicity (ACE 10).
drugs (ACE9), and treated or judged unfairly because of his or her race or ethnic group (ACE10).

All these questions had only two options: 1 = yes and 2 = no. We also calculated exposure to multiple adversities, known as cumulative ACE score, to make a continuous variable ranging from 0-9 (Leza et al., 2021). The summed ACEs were divided into 4 ACEs categories; No ACEs, 1 ACE, 2-3 ACEs, and ≥ 4 ACEs following prior studies (Bethell et al., 2017; Heerman et al., 2021; Xu et al., 2022) to examine the increasing impact of ACE scores on SUD. For logistic regression analysis we treated ACE score as continuous variables range from 0-9.

**Resilience Factors.** The construct of resilience were identified from the NSCH data based on the previous literature that measured different types of resilience from NSCH data (Heard-Garris et al., 2018; Heerman et al., 2021; Khanijahani & Sualp, 2022). Questions from NSCH were used to assess four types of resilience factors: child resilience, family resilience, neighborhood support, and neighborhood safety.

**Child resilience.** This variable was measured by three items. “How often does this child: (1) show interest and curiosity in learning new things, (2) work to finish tasks he or she starts, and (3) stay calm and in control when faced with a challenge.” The response categories for these items were: 1 = always, 2 = usually, 3 = sometimes, and 4 = never. The child resilience scores range from 3 to 12, where 3 represents that child always show resilient characteristics and 12 represents poor child resilience. The Cronbach’s alpha value for the child resilience questions in this dataset was 0.78, good enough to show the acceptable validity (Lim et al., 2021). The construct child resilience from NSCH data was measured by previous study (Heard-Garris et al., 2018).

**Family resilience.** was measured using 4 items, which is consistent with previous research (Heerman et al., 2021). The questions were asked in the survey as “When your family
faces problems, how often are you likely to do each of the following?” (1) talk together about what to do, (2) work together to solve our problems, (3) know we have strengths to draw on, and (4) stay hopeful even in difficult times. Response options to the four items are 1 = all the time, 2 = most of the time, 3 = some/none of the time. All three items were summed together to identify a family resilience score ranging from 3 to 12, where 3 represents high level of family resilience and 12 represents low levels of family resilience. The Cronbach’s alpha value for the family resilience questions in this dataset was 0.89, good enough to show the acceptable validity (Lim et al., 2021).

**Safe neighborhood.** was measured using one question: “How much do you agree that this child is safe in your neighborhood?” The response options were: 1 = definitely agree, 2 = somewhat agree, 3 = somewhat disagree 4 = definitely disagree.

**Supportive neighborhood.** was measured using three items (Khanijahani & Sualp, 2022). The three items include: (1) People in this neighborhood help each other out; (2) We watch out for each other’s children in this neighborhood; and (3) When we encounter difficulties, we know where to go for help in our community. Participants response was coded as 1 = definitely agree, 2 = somewhat agree, 3 = somewhat disagree, and 4 = definitely disagree. All three items were summed together to identify supportive neighborhood scores, again ranging from 3 to 12; in this case, 3 represents a supportive neighborhood and 12 represents a non-supportive neighborhood. The Cronbach’s alpha value for the supportive neighborhood was 0.80, good enough to show the acceptable validity (Lim et al., 2021).

**Study Covariates**

The covariates for this study were age (in years), sex (0 = female or 1 = male), race and ethnicity (1 = Hispanic, 2 = non-Hispanic white, 3 = non-Hispanic black, and 4 =
multiracial/other). The household characteristics included household income level as a percentage of the federal poverty level (1 = 0-99% FPL, 2 = 100-199% FPL, 3 = 200-399% FPL, 4 = 400% FPL or higher).

**Statistical Analysis**

We followed NSCH data guidance to weight the variables (NSCH, 2023) with the study sample of 54,434. The missing values for dependent variables were between 1.19% to 3% for dependent and independent variables. According to the MCAR test ($\chi^2 = 2108; \text{df} = 823; p < .001$), which indicated data were not missing completely at random, thus, these missing values were included in our analysis (Little, 1988). The data included a very small portion of participants ($n = 249; 0.37\%$) who diagnosed with a SUD. Propensity score matching is the statistical methods that can simulate experimental designs and can be interpreted the result to suggest causation. Therefore, we used propensity score matching to assess the association and moderation more accurately (Piccone, 2015; Williams & Lawrence Aber, 2016). We used 1:4 propensity score matching to select controls for SUD cases for further analysis. The matching variables were age, gender, race, and household income level. The final sample totaled 1,245 respondents, which includes 249 subjects with SUD diagnosis and 996 matched controls. We ran frequencies for categorical variables and mean with standard deviation for continuous variables. For categorical variables, we used a Chi-square test ($\chi^2$) to compare the distribution of SUD (i.e., no reported diagnosis and ever reported diagnosis) with ACEs categories, different resilience factors, and other study covariates.

We utilized a hierarchically well-formulated model (HWF) of logistic regression that identifies moderation effects (Kleinbaum & Klein, 2010) of different types of resilience on SUD (Ungar & Theron, 2020). The results of the moderation effects are presented as $\beta$ estimates with
standard error and p-value. All models are presented with the direct effects of the crude relationship and adjusted models controlling for covariates. The results are presented by using odds ratios (OR) showing a crude relationship and an adjusted odds ratio (aOR) with a 95% confidence interval (CI). We present the following models: (1) Model 1A: Crude association between 4 categories of ACEs and SUD; Model 1B: Association of ACEs and SUD adjusting for covariates; (2) Model 2A: Interaction effect of different types of resilience and ACEs on SUD; Model 2B: Interaction effect of different types of resilience adjusting for covariates.

All analyses were carried out using established survey weights and NSCH guidelines from the codebook (NSCH, 2020). We applied statistical testing at the significance level of 0.05 to assess the interaction effects of resilience on ACEs. We used R program to combine and clean the data and SAS (9.4) to analyze the data.

Results

Participant Characteristics

The majority of the adolescents in the total sample were non-Hispanic White (48.73%), male (51.12%), and were at the 400% or above the federal poverty level (35.74%), while among the participants with SUD 54.18% non-Hispanic White, 59.23% male, and 29.71% in the lowest income level 0-99% FPL (See Table 1).

Table 1.

Sociodemographic variables based on SUD diagnosis in the study sample

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>Total Sample</th>
<th>No substance use disorder</th>
<th>Substance use disorder</th>
<th>p value c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%) a</td>
<td>n (%) b</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,245 (100)</td>
<td>996 (80)</td>
<td>249 (20)</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
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<td></td>
<td></td>
<td>0.38</td>
</tr>
<tr>
<td>White, Non-Hispanic</td>
<td>805 (48.73)</td>
<td>644 (47.74)</td>
<td>161 (54.18)</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. (continued)

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>Total Sample</th>
<th>No substance use disorder</th>
<th>Substance use disorder</th>
<th>p value (^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black, Non-Hispanic</td>
<td>85 (17.72)</td>
<td>68 (16.93)</td>
<td>17 (22.03)</td>
<td></td>
</tr>
<tr>
<td>Black, Non-Hispanic</td>
<td>85 (17.72)</td>
<td>68 (16.93)</td>
<td>17 (22.03)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>160 (21.22)</td>
<td>128 (22.21)</td>
<td>32 (15.80)</td>
<td></td>
</tr>
<tr>
<td>Other/Multi-racial (^d)</td>
<td>195 (12.34)</td>
<td>156 (13.12)</td>
<td>39 (8.01)</td>
<td></td>
</tr>
</tbody>
</table>

Gender

Male 790 (51.12) 632 (69.17) 158 (59.23)

Female 455 (48.88) 364 (30.83) 91 (40.77)

Household Income level

0-99% FPL \(^e\) 210 (16.87) 168 (32.76) 42 (29.71)

100-199% FPL 215 (17.27) 172 (17.96) 43 (26.20)

200-399% FPL 375 (30.12) 300 (22.33) 75 (17.91)

400% FPL or greater 445 (35.74) 356 (26.96) 89 (26.18)

Note

\(^a\) Frequencies are obtained from the propensity score matching

\(^b\) Actual cases of SUD in combined NSCH survey of 2016-2019

\(^c\) Chi-square test

\(^d\) Other/Multiracial includes Asian, American Indian or Alaska Native, Native Hawaiian or other

\(^e\) FPL = Federal Poverty Level

Continuous Variables

The “ACE score” represents the number of adverse childhood experiences reported by parents. On average, participants reported approximately 1.26 ACEs \((S.D. = 1.82, \text{ range } = 9-0)\).

The mean child resilience score is 5.47 \((S.D. = 1.88, \text{ range } = 12 - 3)\). The mean resilience score for family resilience is 6.53 \((S.D. = 2.50, \text{ range } = 12 - 4)\). The mean score for safe neighborhood is 1.51 \((S.D. = 0.61, \text{ range } = 4-1)\). The mean score for supportive neighborhoods is 5.60 \((S.D. = 2.06, \text{ range } = 12-3)\) (See Table 2). All types of resilience showed a weak positive correlation
with the ACE score. The value of correlation ranged from 0.22 - 0.31 at the level of significance \( p < .001 \) (Table 4).

**Table 2.**

*Description of continuous variables in the study*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Mean</th>
<th>Median</th>
<th>Standard deviation (S.D.)</th>
<th>Variance</th>
<th>Range (Highest-lowest)</th>
<th>Correlationa</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Score</td>
<td>1.26</td>
<td>0.12</td>
<td>1.82</td>
<td>0.00</td>
<td>9-0</td>
<td>Correlated with 0.31***</td>
</tr>
<tr>
<td>Child Resilience</td>
<td>5.47</td>
<td>4.97</td>
<td>1.88</td>
<td>0.01</td>
<td>12-3</td>
<td>0.25***</td>
</tr>
<tr>
<td>Family Resilience</td>
<td>6.53</td>
<td>5.79</td>
<td>2.50</td>
<td>0.02</td>
<td>12-4</td>
<td>0.25***</td>
</tr>
<tr>
<td>Safe Neighborhood</td>
<td>1.51</td>
<td>1</td>
<td>0.61</td>
<td>0.00</td>
<td>4-1</td>
<td>0.22***</td>
</tr>
<tr>
<td>Supportive Neighborhood</td>
<td>5.60</td>
<td>5.06</td>
<td>2.06</td>
<td>0.02</td>
<td>12-3</td>
<td>0.26***</td>
</tr>
</tbody>
</table>

*Note:* Range = difference between the highest and lowest values

a Pearson Correlation Coefficients with ACE score

*** \( p < .001 \)

**Prevalence of ACEs**

While 42.69% adolescents in the study sample did not report experiencing any ACEs, more than half of the adolescents (57.31%) had at least one ACE. About a quarter (23.54%) adolescents experienced 1 ACE, 19.68% adolescents experienced 2-3 ACEs, and 12.78% adolescents experienced 4 or more ACEs (Table 5). Adolescents with any ACEs reported higher prevalence of SUD, compared to those without ACEs. Adolescents reporting one ACE represented 23.73 weighted percentage of SUD cases, and adolescents with two to three ACEs represented around 23.37 weighted percentage of SUD cases. Notably, the prevalence of SUD
was much higher among adolescents reporting four or more ACEs, representing 35.29 weighted percentage (see Table 3).

**Table 3.**

*Prevalence of ACEs according to SUD among US adolescents aged 12-17*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Total prevalence $(n; %)^a$</th>
<th>No SUD $(n; %)^a$</th>
<th>SUD $(n; %)^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ACEs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No ACE</td>
<td>532 (42.69)</td>
<td>495 (52.39)</td>
<td>37 (17.61)</td>
</tr>
<tr>
<td>1 ACE</td>
<td>293 (23.54)</td>
<td>248 (24.71)</td>
<td>45 (23.73)</td>
</tr>
<tr>
<td>2-3 ACEs</td>
<td>245 (19.68)</td>
<td>171 (15.38)</td>
<td>74 (23.37)</td>
</tr>
<tr>
<td>$\geq$ 4 ACEs</td>
<td>159 (12.78)</td>
<td>68 (7.52)</td>
<td>91 (35.29)</td>
</tr>
</tbody>
</table>

^a Frequencies are obtained from the propensity score matching

^b Actual cases of SUD in combined NSCH survey of 2016-2019

**Association between ACEs and SUD**

Compared to adolescents with no ACEs, adolescents with one ACE had around three times higher odds of SUD (OR = 3.14; 95% CI: 1.24-7.98; $p < .05$). Similarly, adolescents with 2-3 ACEs had around 5 times higher odds of SUD (OR = 4.86; 95% CI: 2.03-11.65; $p < .001$), and adolescents with four or more ACEs had 16 times higher odds of SUD (OR = 16.16; 95% CI: 6.21-42.10; $p < .001$; see Table 4).

**Table 4. Relationship of ACEs with SUD**

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Model 1</th>
<th></th>
<th></th>
<th>Model 1 A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% [CI]</td>
<td>$p$ value</td>
<td>aOR</td>
<td>95% [CI]</td>
</tr>
<tr>
<td>0 ACE</td>
<td>Ref</td>
<td></td>
<td></td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>1 ACE</td>
<td>2.86</td>
<td>[1.07, 7.64]</td>
<td>&lt; .05 *</td>
<td>3.14</td>
<td>[1.24, 7.98]</td>
</tr>
<tr>
<td>2-3 ACEs</td>
<td>4.52</td>
<td>[1.86, 10.99]</td>
<td>&lt; .001*</td>
<td>4.86</td>
<td>[2.03, 11.65]</td>
</tr>
</tbody>
</table>
Table 4. (Continued)

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Model 1</th>
<th>Model 1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 4 ACEs</td>
<td>13.96</td>
<td>[5.27, 37.03]</td>
</tr>
<tr>
<td></td>
<td>16.16</td>
<td>[6.21, 42.10]</td>
</tr>
</tbody>
</table>

*Significant results, ACE is categorical variable  
Model 1 = Crude association  
Model 1B = adjusted association after controlling gender, race, and income, Ref = Reference

Role of different resilience on SUD

The logistic models show child resilience, family resilience, and safe neighborhood were significant in predicting SUD without regards to ACE scoring. Each point with worsening child resilience increased the log-odds of SUD by 0.49 unit while holding ACEs = 0 and all other variables constant ($B = 0.49$, SE = 0.10, $p < .001$). Each point in worsening family resilience increased the log-odds of SUD by 0.51 unit while holding ACEs = 0 and all other variables constant ($B = 0.52$, SE = 0.10, $p < .001$). However, each point increase in safe neighborhood (i.e., each point worsening safety) decreased the log-odds of substance use by 0.37 unit while holding ACEs = 0 and all other variables constant ($B = -0.37$, SE = 0.39, $p < .001$; see Table 5). However, the effect of supportive neighborhood did not have the significant effect on SUD.

Interaction of different types of resilience and ACEs on SUD

Family resilience played a significant moderating role between the ACEs and SUD (i.e., family resilience buffered the negative effects of ACEs on SUD ($B = -0.07$, SE = 0.02, $p < .01$). However, family resilience is more effective for children and adolescents who experience fewer ACEs. As family resilience score decreases by 1 (resilience improves by 1 unit), the log odds of SUD decrease faster for low ACES group (ACES ≤ 3; steeper bottom lines) than middle ACES
group (ACES 4-6; less steep middle 3 lines), and the log odds of SUD is opposite for very high ACEs group (ACES > 6; top 3 opposite slope; see Figure 3).

The moderation effect of child resilience, safe neighborhood and supportive neighborhood with ACEs predicting SUD was not statistically significant (Table 5).

Table 5.

Moderation effect of different types of resilience and ACEs predicting SUD

<table>
<thead>
<tr>
<th></th>
<th>Model 2</th>
<th>Model 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B Estimates</td>
<td>Standard error</td>
</tr>
<tr>
<td><strong>Moderation effect of child resilience and ACEs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Resilience</td>
<td>0.46</td>
<td>0.10</td>
</tr>
<tr>
<td>ACEs</td>
<td>0.54</td>
<td>0.21</td>
</tr>
<tr>
<td>Child Resilience: ACEs</td>
<td>-0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Race/ethnicity&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moderation effect of family resilience and ACEs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Resilience</td>
<td>0.51</td>
<td>0.08</td>
</tr>
<tr>
<td>ACEs</td>
<td>1.06</td>
<td>0.22</td>
</tr>
<tr>
<td>Family Resilience*ACEs</td>
<td>-0.08</td>
<td>0.03</td>
</tr>
<tr>
<td>Race/ethnicity&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
</tr>
<tr>
<td>Household income&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moderation effect of safe neighborhood and ACEs</strong></td>
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<td></td>
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<tr>
<td>Safe Neighborhood</td>
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<td>0.56</td>
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<tr>
<td>ACEs</td>
<td>0.43</td>
<td>0.16</td>
</tr>
<tr>
<td>Safe Neighborhood</td>
<td>0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>*ACEs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Household income&lt;sup&gt;c&lt;/sup&gt;</td>
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<td></td>
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</table>
Table 5. (Continued)

<table>
<thead>
<tr>
<th></th>
<th>Model 2</th>
<th></th>
<th>P value</th>
<th></th>
<th>B Estimates</th>
<th>Standard error</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B Estimates</td>
<td>Standar d error</td>
<td>P value</td>
<td></td>
<td>B Estimates</td>
<td>Standard error</td>
<td>P value</td>
</tr>
<tr>
<td><strong>Moderation effect of supportive neighborhood and ACEs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supportive Neighborhood</td>
<td>0.16</td>
<td>0.05</td>
<td>&lt; .001*</td>
<td>0.03</td>
<td>0.09</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>ACEs</td>
<td>0.67</td>
<td>0.08</td>
<td>&lt; .001*</td>
<td>0.72</td>
<td>0.20</td>
<td>&lt; .005*</td>
<td></td>
</tr>
<tr>
<td>Supportive Neighborhood * ACEs</td>
<td>-0.03</td>
<td>0.01</td>
<td>&lt; .50</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.46</td>
<td>0.54</td>
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<td>0.4</td>
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<tr>
<td>Sex&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>0.38</td>
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<td>0.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.65</td>
<td>0.52</td>
<td></td>
<td>0.21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant results, p < 0.05

Note: ACEs is continuous variable, Model 2 = crude association, Model 2A = adjusted

<sup>a</sup>African American vs White (ref)

<sup>b</sup>Male vs Female (ref)

<sup>c</sup>0-99% federal poverty level vs 100-199% federal poverty level (ref)

Figure 4. Moderating effect of family resilience and ACE score on SUD
Discussion

This study examined the relationship between ACEs and adolescent SUD, and the moderating effects of various types of resilience (i.e., child resilience, family resilience, safe neighborhood, and supportive neighborhood) on SUD among adolescents in the US. We found that elevated ACE scores significantly increase the odds of SUD among adolescents. The result of this study aligned with previous studies that found ACEs to be positively associated with SUD diagnosis among adolescents (Afifi et al., 2020; Leza et al., 2021). Other studies that are not from the US also showed a positive association between ACEs and SUD among adolescents (Gomez et al., 2018) and youth (Oei et al., 2021). In the US, most studies focused on the relationship between ACEs and SUD among adults (Bryant et al., 2020; Cavanaugh et al., 2015; Hughes et al., 2017). The current study adds value to current literature by testing the relationship between ACEs and SUD specifically among US adolescents as well as by examining how resilience moderates this association.

This study finds that child resilience and family resilience decrease the odds of SUD. While there are very few studies that examined the association between resilience and SUD, studies have found that adolescents who lived with their parents and placed a greater value on family had greater protection from alcohol use later in their lives (Ewing et al., 2015). In line with the result from this study, resilience is shown to have a protective role for long-lasting emotional health both in adolescence and adulthood (Forkey et al., 2021). One interesting finding from the study was that better neighborhood safety was associated with increased odds of having been diagnosed with a SUD. A previous study similarly reported that the perception of greater neighborhood safety among adolescents was associated with higher odds of binge drinking.
(Tucker et al., 2013). SUD may be more likely to get diagnosed in higher income neighborhoods, which are safer.

This study provides a unique contribution to the existing literature by highlighting the moderating role of various resilience factors in buffering the impact of ACEs on SUD among adolescents in the US. This study finds that family resilience decreases the odds of SUD among children with ACEs. Previous studies have agreed that family resilience plays an important role in mitigating ACEs-related associations (Heard-Garris et al., 2018). One interesting finding is that the interaction effect of family resilience on adolescents with very high ACE scores did not decrease the odds of SUD, rather it negligibly increased the odds of SUD. One explanation for this may be that the child with multiple ACEs might experience weaker parental attachment (Godbout et al., 2019). This situation could potentially result in diluting the impact of family resilience or, in certain instances, trigger a contrary response to family resilience. Therefore, family based interventions may not be effective to prevent SUD among adolescents with very high numbers of adversities. The ACEs score and resilience exhibited a weak positive association, indicating that as the number of adversities increased, resilience is less protective. A prior study by Heard-Garris et al. (2018) found a similar dose-dependent association between ACEs and child resilience. This study used cross sectional data to examine the association. Future studies should qualitatively investigate the role of child resilience in the association by focusing specifically on children and adolescents with ACEs.

The current study has several additional implications for the potential reduction of SUD among adolescents. This study shows that experiencing ACEs at an early age drastically increases the odds for SUD diagnosis in adolescence. Therefore, ACEs interventions should be started as early as possible to offer the best protection from SUD. Early ACEs interventions after
the experience of childhood adversity can buffer the effects of ACEs (Sapienza & Masten, 2011) and strengthen resilience among adolescents to prevent SUD. We suggest several approaches to strengthen the resilience among adolescents. First, family training programs can help reduce SUD cases among adolescents (Sporh et al., 2001; National Institute of Health and Care Excellence, 2014), especially those with ACEs and lower resilience (Sy & Hechanova, 2020; Kaminer et al., 2002; Macdonald et al., 2016). Second, we can integrate ACEs component by informing and providing training about family resilience into ongoing successful federal interventions, such as the Head Start Program, which promotes the cognitive, social, and emotional development of preschool-aged children from low-income families (Bauer & Schanzenbach, 2016).

In addition, the current study provides both clinical and public health implications to reduce SUD among adolescents with ACEs. In the clinical settings, ACE screening among children has been widely suggested in ACEs literatures (Asheh et al., 2023; Fortson et al., 2021; Rariden et al., 2021; Stein et al., 2017). However, there are few recommendations and very little understanding as to what can be offered to patients with high ACE scores. The current study suggests the development of clinical counselling guidelines and training resources for parents and children to focus on family resilience (Yoon et al., 2021) before, during, and after adversities. In addition, this study’s findings suggest that family resilience moderates the impact of ACEs and reduces the likelihood of SUD. Family support and involvement in the treatment of SUD among adolescents have shown promise in achieving success. Therefore, future studies should investigate the extent to which involving families in SUD treatment can be effective (Hogue et al., 2021). Next, public health practitioners may target strengthening family resilience to support adolescents who suffered from adversities, as family support and resilience have the
potential to buffer the negative impacts of ACEs. Furthermore, by endorsing child development
and family welfare policies aimed at enhancing family resilience among children at high risk for
ACEs, policy makers can play a crucial role to reduce the SUD cases in the US (Gray &
Squeglia, 2018).

As ACEs prevalent and ongoing public health concern, our study suggests evidence for
mitigating the impact of ACEs and offers guidance and direction for future research and public
health interventions. However, these findings should be approached with consideration of certain
limitations. First, the ACE scores and resilience measures were reported by parents and
caregivers, which may not fully capture the experiences and thoughts of the adolescents
(Salbach-Andrae et al., 2009). Parents and caregivers answered to the survey questionnaires on
behalf of adolescents, this might lead inaccuracy of responding. In future studies, we recommend
getting responses from the adolescents themselves which can better reflect their ideas on
resilience. Second, the ACEs screening tool used may not encompass the full extent of ACEs
(Baldwin et al., 2021). The ACE questionnaire in NSCH was mainly focused on household
dysfunctions and did not cover other childhood maltreatments such as sexual abuse and neglect.
The numerical measurement of the nine ACE categories that we used for the study do not
account for the duration, intensity (Bethell et al., 2017), or the time of first ACE exposure.
Future studies should account for all these dimensions of ACEs to ensure the accuracy of ACE
scores (Krinner et al., 2021). Third, although we adapted the concept of resilience that was
discussed in previous studies (Heard-Garris et al., 2018; Heerman et al., 2021; Khanijahani &
Sualp, 2022), the resilience questionnaire we employed in the study may not have fully captured
the extent of resilience. This opens the possibility for the inclusion of additional factors, such as
the stability of family relationships (e.g. stability in the family relationship) in the resilience
questionnaire (Heerman et al., 2021). Future studies assessing resilience should design a strong resilience questionnaire adding other aspects of resilience (e.g., spirituality, mindfulness; Jones et al., 2016). Last, because we used cross-sectional data, our findings provide limited predictive strength (e.g., SUD followed by ACEs) (Wang & Cheng, 2020). Because of the nature of cross-sectional nature of the data, it’s possible that the SUD predated the ACEs. Moving forward, future studies would benefit from the use of longitudinal design to explore the association between ACEs and SUD. Despite these limitations, our study benefits from a generalizable sample of the noninstitutionalized adolescents in the US. We applied appropriate statistical modeling, propensity score matching, to examine the relationship and role of different types of resilience on the association between ACEs and SUD. The findings of the current study can be generalized to the broader population of adolescents in the US.

Conclusion

This study identified a dose-dependent association between ACEs and SUD among adolescents. The data also suggests child resilience, family resilience and safe neighborhoods decrease the odds of SUD. Family resilience was found to moderate the association between ACEs and SUD. However, child resilience, safe neighborhood, and supportive neighborhood did not have the moderation effects on the association between ACEs and SUD. Future studies should continue to investigate the role of resilience on SUD among adolescents with ACEs. Given the findings of this study, the authors suggest that implementing family focused interventions would be an effective way to reduce SUD among adolescents with ACEs. Addressing ACEs through a family-focused approach has the potential to reduce SUD during adolescence, which in turn, reduces public health problems after all.
CHAPTER III
Role of Child Resilience, Family Resilience, Safe Neighborhood, and Supportive Neighborhood on Depression among Children and Adolescents with Adverse Childhood Experiences

Introduction

Adverse childhood experiences (ACEs) are a growing public health concern in the United States. ACEs are defined as traumatic events that occur before the age of 18 (Centers for Disease Control and Prevention [CDC], 2022). The CDC has sorted ACEs into up to 10 categories; three pertaining to abuse – emotional abuse, physical abuse, and sexual abuse; two categories of neglect – emotional neglect and physical neglect; and five for other household challenges – parental mental illness, parental separation, parental substance use, domestic violence, and incarcerated parents (CDC, 2022; Sherfinski et al., 2019). Depression is common among children and adolescents who have had traumatic experiences (Vibhakar et al., 2019), and several studies have identified a strong correlation between the diagnosis of depression and ACEs (De Venter et al., 2013; Karatekin, 2018). If ACEs can be avoided, or their effects mitigated, it is possible that as many as 21 million cases of depression could be prevented (CDC, 2023). Studies of the impact of individual ACEs have shown that experiences of parental mental illness and sexual abuse are strongly associated with the diagnosis of depression among children and adolescents (Fitzgerald & Kawar, 2022; Lee et al., 2020). One study (Lee et al., 2020) found that some high-risk ACEs (i.e., parents’ divorce, witnessing domestic or neighborhood violence, and witnessing drug use) contribute to an even higher risk of depression among children and adolescents than individual ACEs. The cumulative count of different ACEs is termed the “ACE score” (Leza et al., 2021) and is a significant predictor of depression (Karatekin, 2018). Higher ACE scores
(Hughes et al., 2017) have been shown to predict greater risk of depression than individual ACEs (Lee et al., 2020).

Depression is defined as a prolonged and persistent repetitive cycle of sadness, unwillingness to perform day to day work, hopelessness, helplessness, and fear (CDC, 2022a; Pine, 1997). It is recognized as a clinical condition (Patra & Kumar, 2022), and the diagnostic criteria for identifying depression in children were developed decades ago (Carlson & Cantwell, 1982). However, even in modern times, a significant problem of underdiagnosis and underreporting of depression persists (Patra & Kumar, 2022), particularly among pediatric populations. Depression is a major public health concern among children and adolescents because of its increasing prevalence in recent decades (The American Academy of Pediatrics [AAP], 2021). In the U.S. in 2019, approximately 2.7 million children under 17 years old experienced depression (Bitsko, 2022). One survey conducted in 2017 indicated that 4% of children aged 8 to 17 years old experience depression (Elmore & Crouch, 2020). Another study shows that 0.9% of all adolescents have experienced depression (CDC, 2020). Mental health problems such as depression among children and adolescents can negatively affect the children’s physiological health and impact their development by interfering with their cognitive functioning (Wade et al., 2022), emotional, and academic performance (Larson et al., 2017). In addition, it affects their confidence and day-to-day functioning (Yoon et al., 2021). Furthermore, early age depression increases the risk of other dangerous mental comorbidities (e.g., anxiety and suicidal ideation; Fleisher & Katz, 2001).

Children and adolescents have an inherent capacity to handle small stressors (e.g., learning stress; Honig, 1986), but if they face more severe adversities (e.g., abuse, neglect) or multiple adversities over a period of time, they are more likely to develop negative mental health
conditions such as depression (Lanier et al., 2018; Turner & Butler, 2003). The stress response, or "fight or flight" response, is the physiological response to stressors such as ACEs, and the underlying mechanism of ACEs’ connection with mental health conditions (Gerra et al., 2016; Navalta et al., 2018).

Resilience in childhood, defined as the ability to overcome challenges (REF), influences positive outcomes (e.g., improved mental health conditions) among children and adolescents with ACEs (Bethell et al., 2019). Resilience promotes growth, overall wellness, and healthy development (Sege & Browne, 2017) of children, and thus can mitigate the effects of ACEs on different types of psychopathologies (Goldenson et al., 2021). For example, in times of exposure to adversity, children are less likely to experience sorrow and anxiety if they have trustworthy family and friends compared to those who lack such support systems (Bekiros et al., 2022; Lamb, 2009; Tyler et al., 2018). Although there is limited understanding of the moderating role of resilience in the relationship between ACEs and depression, some evidence (Elmore et al., 2020; Hayes et al., 2022; Song et al., 2021) suggesting that resilience can mitigate the association between ACEs and depression. Studies show that childhood resilience (Elmore et al., 2020), family resilience (Song et al., 2021), and social support (Cheong et al., 2017; Gonzales et al., 2014; Hayes et al., 2022; Khanijahani & Sualp, 2022), may serve as a protective factors that lead to a decrease in negative mental health symptoms (e.g., depression), even in the face of elevated ACEs. A collection of different types of resilience, like support from family, friends, and community, all work together to help decrease the severity with depression and mental health conditions (Ungar & Theron, 2020). Family resilience and early interactions with family impact the long-term learning, behavior, and health of children (Franke, 2014). For example, students at risk for emotional difficulties have been shown to have improved mental health as a
result of interventions that encourage adult mentorship in family and school (Troy et al., 2022). Dowrick (2008) found that individuals who have experienced emotional adversities perceived individual resilience is important for them to build and expand positive emotions. Additionally, adolescents who have coping skills have a lower likelihood of suffering from depression (Noble & McGrath, 2005) and maintain healthy mental equilibrium (Masten, 2015).

For this study, we utilized the Healthy Outcomes from Positive Experiences (HOPE) framework (Sege & Browne, 2017) to understand the role of different protective factors on depression. The HOPE framework, a recently developed holistic approach to child health care (Guo et al., 2022), has four building blocks including emotional growth, relationships, neighborhood safety, and civic engagement (Sege & Browne, 2017). In alignment with the HOPE framework, we consider childhood resilience to be engendered by opportunities for emotional growth, family resilience comes from being in nurturing, supportive relationships, safe neighborhoods are safe, equitable, and stable environments, and supportive neighborhoods are defined by a high degree of social and civic engagement (Sege & Browne, 2017). This study examined the moderating effect of various resilience types on depression among children and adolescents with high ACE scores. Using a larger NSCH dataset from 2016 to 2019, the current study extends earlier research (Elmore et al., 2020) on the concept of resilience to include all HOPE framework dimensions (i.e., child resilience, family resilience, safe neighborhood, and supportive neighborhood) on lifetime diagnosis of depression. We hypothesized that 1) ACEs increases the risk factor for depression among children and adolescents, 2) A higher number of ACEs increases the likelihood of depression; and 3) types of resilience (i.e., child resilience, family resilience, safe neighborhood, and neighborhood support) may decrease the likelihood of depression and 4) types of resilience (i.e., child resilience, family resilience, safe neighborhood,
and neighborhood support) may moderate the association between ACEs and depression. Understanding the moderating impact of these various forms of resilience in the progression from ACEs to depression is crucial for recommending ACEs intervention strategies and preventing childhood depression for children with ACEs.

**Figure 5.** Moderation effect of different resilience according to HOPE framework of ACEs to the outcome of depression

**Methods**

**Data Source and Study Sample**

We utilized publicly accessible data from the National Survey of Children’s Health (NSCH). The survey collects information concerning the health and well-being of children, including aspects such as family interactions, parental health, and community influences. This survey is distributed through mail and online questionnaires and is completed by the parents or caregivers of children. We combined the two datasets, 2016-2017, and 2018-2019. We limited
our sample to children and adolescents aged 6-17 years due to rarity \((n = 35)\) of reported depression diagnoses below this age range (NSCH, 2020).

**Measures**

**Dependent Variable.** In this study, the dependent variable was the diagnosis of depression by a physician or health care professional that was reported by the caregivers of children, in response to the question “Has a doctor or other healthcare provider ever told you that this child has depression?” The question has three categories of responses: 1 = does not have the condition, 2 = ever told but does not currently have condition, and 3 = currently has condition. Given the study’s focus on the association between ACEs with depression, we combined 2) and 3) together to make it a dichotomous variable of ever diagnosed with depression and recoded it as yes = ever diagnosed with depression or no = Not ever diagnosed with depression.

**Adverse Childhood Experiences.** In the NSCH survey, parents and caregivers were asked about their child’s exposure to nine ACEs, which we have compared and categorized with the CDC’s panel of ten ACEs (ACE1-ACE10, as follows: hard to cover basics on family's income (ACE1); parent or guardian divorced or separated (ACE3); parent or guardian died (ACE4); parent or guardian served time in jail (ACE5); saw or heard parents or adults slap, hit, kick punch one another in the home (ACE6); was a victim of violence or witnessed violence in neighborhood (ACE7); lived with anyone who was mentally ill, suicidal, or severely depressed (ACE8); lived with anyone who had a problem with alcohol or drugs (ACE9); and treated or judged unfairly due to race/ethnicity (ACE 10). The first question (ACE1) was asked as “Since this child was born, how often has it been very hard to cover the basics, like food or housing, on your family’s income? This question has four responses: 1= never hard to get by on family income; 2 = rarely hard to get by on family income; 3 = somewhat often hard to get by on family income; 4 = very hard to get by on family income.
income; and 4 = very often hard to get by on family income. We combined the responses 3 and 4 and recoded them into two categories: 1 = exposed (“somewhat often” or “very often”) and 2 = not exposed (“rarely” or “never”). The other ACE questions two thru nine were asked as: “To the best of your knowledge, has this child ever experienced any of the following?” parent or guardian divorced or separated (ACE3), parent or guardian died (ACE4), parent or guardian served time in jail (ACE5), saw or heard parents or adults slap, hit, kick, punch one another in the home (ACE6), was a victim of violence or witnessed violence in his or her neighborhood (ACE7), lived with anyone who was mentally ill, suicidal, or severely depressed (ACE8), lived with anyone who had a problem with alcohol or drugs (ACE9), and treated or judged unfairly because of his or her race or ethnic group (ACE10). All these questions had only two options: 1 = yes and 2 = no. We also calculated exposure to multiple adversities, known as cumulative ACE score, to make a continuous variable ranging from 0-9 (Leza et al., 2021). The summed ACEs were divided into 4 ACEs categories; No ACEs, 1 ACE, 2-3 ACEs, and ≥ 4 ACEs following the prior studies (Bethell et al., 2017; Heerman et al., 2021; Xu et al., 2022).

**Resilience Factors.** For this study, measures of resilience were used based on the previous literature that measured different types of resilience from NSCH data (Heard-Garris et al., 2018; Heerman et al., 2021; Khanijahani & Sualp, 2022). Questions from NSCH were used to assess four types of resilience factors: child resilience, family resilience, neighborhood support, and neighborhood safety.

**Child resilience.** It was measured by responses to three questions: “How often does this child: (1) show interest and curiosity in learning new things, (2) work to finish tasks he or she starts, and (3) stay calm and in control when faced with a challenge.” The response categories for these items were: 1 = always, 2 = usually, 3 = sometimes, and 4 = never. The child resilience
scores range from 3 to 12, where 3 represents that a child always shows resilient characteristics and 12 represents poor child resilience. The construct child resilience from NSCH data was utilized by previous study (Heard-Garris et al., 2018), and the Cronbach’s alpha for the child resilience questions in this dataset was $\alpha = 0.78$, which is acceptable (Lim et al., 2021).

**Family resilience.** It was measured using 4 items that was constructed in the previous research (Heerman et al., 2021). The relevant question was: “When your family faces problems, how often are you likely to do each of the following?” (1) talk together about what to do, (2) work together to solve our problems, (3) know we have strengths to draw on, and (4) stay hopeful even in difficult times. Response options to the four items are 1 = all the time, 2 = most of the time, 3 = some/none of the time. All three items were summed together to identify a family resilience scoring ranging from 3 to 12, where 3 represents good family resilience and 12 represents poor family resilience. The Cronbach’s alpha for the family resilience questions in this dataset was $\alpha = 0.89$, which is acceptable (Lim et al., 2021).

**Safe neighborhood.** It was measured using one question: “How much do you agree that this child is safe in your neighborhood?” The response options were: 1 = definitely agree, 2 = somewhat agree, 3 = somewhat disagree 4 = definitely disagree.

**Supportive neighborhood.** It was measured using three items (Khanijahani & Sualp, 2022). The three items include: (1) People in this neighborhood help each other out; (2) We watch out for each other’s children in this neighborhood; and (3) When we encounter difficulties, we know where to go for help in our community. Participants response was coded as 1 = definitely agree, 2 = somewhat agree, 3 = somewhat disagree, and 4 = definitely disagree. All three items were summed together to identify supportive neighborhood scores, again ranging from 3 to 12; in this case, 3 represents a supportive neighborhood and 12 represents a non-
supportive neighborhood. The Cronbach’s alpha for the supportive neighborhood was $\alpha = 0.80$, which is acceptable (Lim et al., 2021).

**Study Covariates**

The covariates for this study were age (in years), sex (0 = female or 1 = male), race and ethnicity (1 = Hispanic, 2 = non-Hispanic white, 3 = non-Hispanic black, and 4 = multiracial/other), insurance of children (1 = public health insurance only, 2 = private health insurance only, 3 = public and private insurance, 4 = uninsured). The household characteristics included household income level as a percentage of the federal poverty level (1 = 0-99% FPL, 2 = 100-199% FPL, 3 = 200-399% FPL, 4 = 400% FPL or higher).

**Statistical Analysis**

All analyses were carried out using established survey weights and NSCH guidelines from the codebook (NSCH, 2020). The missing values for dependent variables were < 2%, and < 3% for independent variables. We included all the missing values in our analysis.

We utilized a hierarchically well-formulated model (HWF) of logistic regression that identifies moderation effects of resilience on the depression. For categorical variables, we used $\chi^2$ to compare the distribution of depression (i.e., no reported diagnosis and ever reported diagnosis) with ACEs categories, different resilience factors, and other study covariates. We presented mean and standard deviation for continuous variables. Next, the association between ACEs and depression was tested using two models of logistic regression (Model 1 A = crude and Model 1B = adjusted). The results of the association are presented by using odds ratios (OR) showing a crude relationship and an adjusted odds ratio (aOR) with a 95% confidence interval (CI). Finally, we tested the relationship of resilience with moderation effect by using interaction term in the logistic regression with two models (Model 2A= crude and Model 2B= adjusted).
The results of the moderation effects are presented as β estimates with standard error and p-value. We used R Studio to combine and clean the data and SAS 9.4 to analyze the data. We used PROC SURVEYFREQ and PROC SURVEYLOGISTIC.

**Results**

*Participant Characteristics*

Among total surveyed population ($N = 144,021$), we limited the sample of this study to aged 6-17 years old ($N = 94,369$). The depression cases were $6,150$ (5.33%) of the sample. In the overall sample, there were almost equal number of children in age group 6-11 (49.89%) and 12-17 (50.11%). Half the children were non-Hispanic white (50.36%) and male (51.08%), and about one third (30.71%) were at the 400% or above the federal poverty level. Slightly more than half had private health insurance (58.35%). Demographics of participants with depression were 55.36% non-Hispanic White, and 53.52% female (See Table 6).

**Table 6.**

*Sociodemographic variables according to the prevalence of depression among US adolescents aged 12-17 years.*

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>Total Sample</th>
<th>No Depression</th>
<th>Depression</th>
<th>$p$ value $^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$ (%)</td>
<td>$n$ (%)</td>
<td>$n$ (%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>94,369 (100)</td>
<td>87,740 (94.66)</td>
<td>6,150 (5.33)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11</td>
<td>39,780 (49.89)</td>
<td>38,819 (51.51)</td>
<td>961 (21.05)</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>12-17</td>
<td>54,110 (50.11)</td>
<td>48,921 (48.49)</td>
<td>5,189 (78.95)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>479 (0.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.01*</td>
</tr>
<tr>
<td>White, Non-Hispanic</td>
<td>65,502 (50.36)</td>
<td>61,040 (50.07)</td>
<td>4,462 (55.36)</td>
<td></td>
</tr>
<tr>
<td>Black, Non-Hispanic</td>
<td>5,995 (13.84)</td>
<td>5,643 (13.86)</td>
<td>352 (13.44)</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. (Continued)

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>Total Sample</th>
<th>No Depression</th>
<th>Depression</th>
<th>( p ) value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>10,760 (25.55)</td>
<td>10,076 (25.69)</td>
<td>684 (23.07)</td>
<td></td>
</tr>
<tr>
<td>Other/Multi-racial&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11,633 (10.26)</td>
<td>10,981 (10.38)</td>
<td>652 (8.13)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>479 (0.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td>(&lt; .01^*)</td>
</tr>
<tr>
<td>Male</td>
<td>48,411 (51.08)</td>
<td>45,676 (51.34)</td>
<td>2,735 (46.48)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>45,479 (48.92)</td>
<td>42,064 (48.66)</td>
<td>3,415 (53.52)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>479 (0.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Income level</td>
<td></td>
<td></td>
<td></td>
<td>(&lt; .001^*)</td>
</tr>
<tr>
<td>0-99% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>10,278 (20.16)</td>
<td>9,338 (19.83)</td>
<td>940 (25.86)</td>
<td></td>
</tr>
<tr>
<td>100-199% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>14,918 (21.82)</td>
<td>13,706 (21.76)</td>
<td>1,212 (22.87)</td>
<td></td>
</tr>
<tr>
<td>200-399% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>28,662 (27.32)</td>
<td>26,825 (27.43)</td>
<td>1,837 (25.30)</td>
<td></td>
</tr>
<tr>
<td>400% FPL&lt;sup&gt;d&lt;/sup&gt; or greater</td>
<td>40,032 (30.71)</td>
<td>37,871 (30.98)</td>
<td>2,161 (25.97)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>479 (0.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
<td></td>
<td></td>
<td>(&lt; .001^*)</td>
</tr>
<tr>
<td>Public insurance only</td>
<td>17,443 (30.12)</td>
<td>15,570 (29.48)</td>
<td>1,873 (41.53)</td>
<td></td>
</tr>
<tr>
<td>Private insurance only</td>
<td>67,438 (58.35)</td>
<td>63,954 (59.16)</td>
<td>3,484 (44.04)</td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>3,486 (4.58)</td>
<td>3,023 (4.39)</td>
<td>463 (7.95)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>4,034 (6.95)</td>
<td>3,795 (6.98)</td>
<td>239 (6.48)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>1968 (2.13)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *Significant results, \( p < .05 \)
<sup>a</sup> Frequencies represent unweighted sample frequencies while percentages are national-level estimates of values
<sup>b</sup> Wald Chi Square test for two-way analysis
<sup>c</sup> non-Hispanic
<sup>d</sup> FPL, Federal Poverty Level

Prevalence of ACEs

Just less than half of the children and adolescents (47.92%) had at least one ACE, and 52.08% children did not experience any ACEs. A quarter (24.28%) of children experienced 1
ACE, 16.48% children experienced 2-3 ACEs, and 7.16% children experienced 4 or more ACEs (Table 3).

Children with ACEs reported greater prevalence of having depression compared to those without ACEs ($p < .001$). Children reporting one ACE represented 23.86 weighted percentage of depression cases, and adolescents with two to three ACEs represented 28.03. Notably, the prevalence of depression was highest among children reporting four or more ACEs, representing 28.12 weighted percentage (Table 7).

Table 7.

Prevalence of ACEs and according to depression among US adolescents aged 12-17

<table>
<thead>
<tr>
<th>Categories</th>
<th>Total prevalence (n; %)$^a$</th>
<th>No Depression (n; %)$^b$</th>
<th>Depression (n; %)$^b$</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ACEs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No ACE</td>
<td>51,249 (52.08)</td>
<td>49,717 (53.89)</td>
<td>1,532 (19.99)</td>
<td>&lt; .001 *</td>
</tr>
<tr>
<td>1 ACE</td>
<td>21,289 (24.28)</td>
<td>19,892 (24.31)</td>
<td>1,397 (23.86)</td>
<td></td>
</tr>
<tr>
<td>2-3 ACEs</td>
<td>14,222 (16.48)</td>
<td>12,479 (15.82)</td>
<td>1,743 (28.03)</td>
<td></td>
</tr>
<tr>
<td>$\geq$ 4 ACEs</td>
<td>5,856 (7.16)</td>
<td>4,443 (5.98)</td>
<td>1,413 (28.12)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>1,753 (1.85)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* $^a$ Unweighted percentage, $^b$ Weightage, *Significant result $p < 0.05$

ACEs are categorical

**Distribution of continuous variables**

The “ACE score” represents the number of ACEs reported. The mean reported ACE score is 0.90 ACEs (S.D. = 1.38, range = 0-9). The mean child resilience score is 4.67 (S.D. = 1.58, range =3-12). The mean resilience score for family resilience is 6.59 (S.D. = 2.38, range =
On average, participants rated their safe neighborhood at 1.33 (S.D. = 0.56, range = 1-4). The mean score for supportive neighborhoods is 5.03 (S.D. = 1.96, range = 3-12) (See Table 3). All types of resilience showed a weak positive correlation with the ACE score. The value of correlation ranged from 0.15-0.24 at the level of significance p < .001 (Table 8).

**Table 8.**
*Descriptive table of continuous variables*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Number</th>
<th>Mean</th>
<th>Standard deviation (S.D.)</th>
<th>Variance</th>
<th>Range (Lowest-Highest)</th>
<th>Correlationa</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE score</td>
<td>93,087</td>
<td>0.90</td>
<td>1.38</td>
<td>1.91</td>
<td>0-9</td>
<td>Corelate</td>
</tr>
<tr>
<td>Child Resilience</td>
<td>92,310</td>
<td>4.67</td>
<td>1.58</td>
<td>2.49</td>
<td>3-12</td>
<td>0.22*</td>
</tr>
<tr>
<td>Family Resilience</td>
<td>91,798</td>
<td>6.59</td>
<td>2.38</td>
<td>5.68</td>
<td>4-16</td>
<td>0.15*</td>
</tr>
<tr>
<td>Safe Neighborhood</td>
<td>92,329</td>
<td>1.33</td>
<td>0.56</td>
<td>0.32</td>
<td>1-4</td>
<td>0.18*</td>
</tr>
<tr>
<td>Supportive</td>
<td>91,544</td>
<td>5.03</td>
<td>1.96</td>
<td>3.82</td>
<td>3-12</td>
<td>0.24*</td>
</tr>
</tbody>
</table>

Note: Range = difference between the highest and lowest values

aPearson Correlation Coefficients with ACE score

*** p < .001, ACEs is continuous

**Association between ACEs and childhood depression**

Compared to children with no ACEs, children with one ACE had 2.47 times higher odds of depression (OR = 2.47; 95% CI: 2.08-2.93; p < .001). Similarly, children with 2-3 ACEs had four times higher odds of depression (OR = 4.43; 95% CI: 3.76-5.23; p < .001), and children with 4 or more ACEs had around 12 times higher odds of depression (OR = 11.91; 95% CI: 9.82 –14.45, p < .001) (Table 9). Age and gender had a significant association with depression. Each year increase in age had higher odds of depression controlling for other variables (OR = 1.24; 95% CI: 1.21-1.27; p < .001). Males were less likely to be diagnosed with depression than females (OR = 0.82; 95% CI: 0.72-0.94; p < .01) (Table 9).
Table 9.

Relationship of ACEs with depression

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Model 1</th>
<th>p value</th>
<th>OR</th>
<th>95% [CI]</th>
<th>p value</th>
<th>Model 1 A</th>
<th>OR</th>
<th>95% [CI]</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ACE</td>
<td>Ref</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ACE</td>
<td>2.65</td>
<td>[2.23, 3.15]</td>
<td>&lt; .05 *</td>
<td>2.47</td>
<td>[2.08, 2.93]</td>
<td>&lt; .001 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3 ACEs</td>
<td>4.78</td>
<td>[4.09, 5.57]</td>
<td>&lt; .001*</td>
<td>4.43</td>
<td>[3.76, 5.23]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 4 ACEs</td>
<td>12.68</td>
<td>[10.67, 15.06]</td>
<td>&lt; .001*</td>
<td>11.91</td>
<td>[9.82, 14.45]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1.24</td>
<td>[1.21, 1.27]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gendera</td>
<td>0.821</td>
<td>[0.72, 0.94]</td>
<td>&lt;.01*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>0.92</td>
<td>[0.85, 0.99]</td>
<td>.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPLb</td>
<td>1.06</td>
<td>[0.99, 1.13]</td>
<td>.07</td>
<td></td>
<td></td>
<td></td>
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<tr>
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*Significant results, *p* < .05, ACEs is categorical
Model 1 = Crude association
Model 1B = adjusted association after controlling gender, race, and income
a male vs female (reference)
b Federal Poverty Level

Role of different resilience on Depression

The logistic models show that all resilience (i.e., child resilience, family resilience, safe neighborhood, and supportive neighborhood) were significant in predicting the likelihood of depression among children and adolescents. Each point of worsening child resilience increased the log-odds of depression by 0.52 unit while holding ACEs = 0 and all other variables constant (B = 0.52, SE = 0.03, *p* < .001). Each point in worsening family resilience increased the log-odds of depression by 0.16 unit while holding ACEs = 0 and all other variables constant (B = 0.16, SE = 0.02, *p* < .001). Each point increase in safe neighborhood (i.e., each point worsening safety) increased the log-odds of depression by 0.29 unit while holding ACEs = 0 and all other variables constant (B = 0.29, SE = 0.07, *p* < .001) and each point increase in supportive neighborhood (i.e.,
worsening supportive neighborhood) increased the log-odds of depression by 0.09 unit while holding ACEs = 0 and all other variables constant (B = 0.09, SE = 0.02, p < .001) (Table 10).

**Moderation of different types of resilience and ACEs on depression**

Child resilience and family resilience played a significant moderating role between the ACEs and depression. Child resilience buffered the negative effects of ACEs on depression (B = -0.03, SE = 0.01, p < .001). However, child resilience is more effective for children and adolescents with lower ACE scores. As one unit differences in the child resilience score (resilience improves by 1 unit), the log odds of depression decrease faster for low ACES group (ACES ≤ 6; bottom lines) than high ACES group (ACES > 6; the top 3 lines), as the slope tends to be flatter for top lines (high ACES group) but steeper for lower lines (low ACES group) (Fig 6).

Family resilience also buffered the negative effects of ACEs on depression (B = -0.02, SE = 0.01, p < .05). As family resilience score decreases by 1 (resilience improves by 1 unit), the log odds of depression decrease faster for low ACES group (ACES ≤ 6; bottom lines) than high ACES group (ACES > 6; the top 3 lines), as the slope tends to be steeper for lower lines (low ACES group) but flatter for top lines (high ACES group) and slope is opposite for ACE score of 9 (Fig 7).

The moderation effect of safe neighborhood and supportive neighborhood with ACEs predicting depression was not statistically significant (Table 10).
Table 10.

Moderation effect of child resilience and ACEs on depression

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Moderation effect of family resilience and Aces on depression

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Moderation effect of Safe Neighborhood and Aces on depression

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Moderation effect of Supportive neighborhood and Aces on depression

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<td>&lt;.001*</td>
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### Table 10. (Continued)

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<td>0.09</td>
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Note: Model 2A = Crude logistic regression  
Model 2B = Multivariate logistic regression adjusted for age, gender, race/ethnicity, household income and insurance type  
ACEs is a continuous variable  
*Significant results  
\( \text{a} \) Gender Male vs Female (ref)  
\( \text{b} \) Race Black vs White (ref) 3 vs 2  
\( \text{c} \) Household income 400% federal poverty level vs 100-199% federal poverty level (ref)  
\( \text{d} \) Insurance private health insurance only vs public health insurance only (ref)

![Figure 6. Moderation effect of child resilience on depression](image-url)
Discussion

This study investigated the relationship between ACEs and depression, considering the moderating influence of several types of resilience, namely child resilience, family resilience, safe neighborhoods, and supportive neighborhoods. There are three main findings from the study. First, this study uncovered a dose-dependent relationship: as ACE scores increased, the likelihood of depression significantly increased. The results of this study align with previous studies showing that ACEs are positively associated with depression among children (Hunt et al.,
Most studies focused on the relationship between ACEs and diagnosis of depression during adulthood (Chang et al., 2019; Cheong et al., 2017; Merrick et al., 2017; Zhang et al., 2023) and in the general population (De Venter et al., 2013). The current study adds value to the literature by testing the relationship between ACEs and diagnosis of depression among US children and adolescents.

Second, this study finds that weak resilience scores across four resilience types (i.e., child resilience, family resilience, safe neighborhood, and supportive neighborhood) increase the prediction of depression. Previous study shows a similar result, that the resilience measured by the presence of protective factors like supportive relationships and personal control factors was associated with less symptomatology of depression (Goldenson et al., 2021). Also, individuals without resilience experienced a significantly higher likelihood of depression (Elmore et al., 2020) and the probability of depression diagnosis was notably lower for children with 6-7 PCEs compared to those with 0-2 PCEs (Bethell et al., 2019).

Third, this study finds that child resilience and family resilience were significant moderators for the association between ACEs and depression and decrease the odds of depression among children and adolescents with ACEs. Our study results are in line with previous studies which highlight that personal resilience attributes (i.e., self-esteem and positive temperament) in adolescents with ACEs buffer psychological and emotional disorders associated with traumatic experiences (Cahill et al., 2022; Kim et al., 2022; Sapienza & Masten, 2011). Extrinsic resilience like family resilience were found to be inversely associated with depression among adolescents exposed to ACEs as well (McGowan et al., 2023). While previous study have found the significant interaction of neighborhood support with mental disorders (e.g.,
depression, ADHD; Khanijahani & Sualp, 2022), our study did not find a significant moderating effect of neighborhood support on depression.

This study’s results show that a higher ACE score is linked with decreased resilience, and vice versa. As the ACE score increased, all forms of resilience decreased. Similarly, one previous research (Heard-Garris et al., 2018) demonstrated that ACEs were negatively associated with the resilience of children. The present study revealed a high prevalence of depression (5.33%) among children and adolescents which shows the widespread of depression among children and adolescents. Thus, authors emphasize the importance of broadening options for children’s mental health screening. The behavioral and emotional screening system (e.g., BESS; Kamphaus et al., 2010) for school and social/emotional/behavioral (e.g., SEB screening: Benheim et al., 2023) for hospitals could be effective screening tools for expanding mental health screening options among children and adolescents.

The current study has several implications for reducing depression among children and adolescents. First, this study shows that having ACEs in early childhood drastically increases the odds of depression diagnosis among children and adolescents. Thus, it is imperative that immediate attention can be directed towards preventing these household dysfunctions, such as parental divorce, which stands as a prominent contributor to adversity among US children and adolescents. To combat adversities, early ACEs interventions should be employed during adolescence (Asmussen et al., 2019), serving as a protective measure against the heightened risk of depression. Moreover, the study highlights the important role of child resilience in mitigating the impact of ACEs on depression. Early childhood resilience interventions for children at high risk of ACEs could act as a buffer against the adverse effects, strengthening the coping skills of children and adolescents (Sapienza & Masten, 2011). Some effective approaches has been
identified to enhance children and adolescents’ resilience and decrease depression (Elrefaay & Elyzal, 2023). For instance, promoting coping skills may significantly improve the mental health of those who have experienced trauma (Elrefaay & Elyzal, 2023). Cognitive Behavioral Therapy (CBT) stands out as an evident method to foster coping skills among children and adolescents facing adversities (Happer et al., 2017). Additionally, encouraging prosocial behavior in children exposed to adversity can positively influence their brain physiology (Sassi, 2013). Likewise, interventions that focus on relational support and strengthening family bonds could effectively address depression among children who have faced adversity (Dehnel et al., 2022). These strategies can be seamlessly integrated into existing federal interventions, such as the Head Start Program, which prioritizes the cognitive, social, and emotional development of preschool-aged children from low-income families (Bauer & Schanzenbach, 2016). The National Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents (Hagan et al., 2017) also offer recommendations for policies and programs, providing strategies to promote resilience and bolster the mental health of children (Macdonald et al., 2016). These insights can help professionals and programs working with children devise effective resilience-promoting strategies. Furthermore, the study underscores the significant role of family resilience in reducing the risk of depression among children. Therefore, parental training emerges as a highly effective means of mitigating the effects of ACEs among children and adolescents, particularly those exposed to domestic violence (National Institute of Health and Care Excellence, 2014). Policymakers can play a crucial role by endorsing child development and family welfare policies aimed at enhancing resilience among children who have experienced ACEs (Membride, 2016).

In the clinical settings, ACE screening among children has become increasingly common (Asheh et al., 2023; Fortson et al., 2021; Rariden et al., 2021), but there is little understanding or
agreement about the types of intervention to offer for patients with high ACE scores. This study highlights the importance of different types of resilience in buffering the role against ACE-related depression. This knowledge can contribute to content development for ACEs counselling guidelines and training resources for parents and children to focus on resilience (Yoon et al., 2021). In addition, this study’s findings suggest that child resilience and family resilience can buffer the effect of ACEs to reduce the likelihood of depression among children with ACEs. Family support and involvement in the treatment of depression among children and adolescents could be one of the successful strategies (Hogue et al., 2021).

This study provides evidence for means to mitigate the effects of ACEs on depression and provides guidance for future research and public health interventions. However, certain limitations should be considered when interpreting these results. First, the ACE scores and resilience measures were reported by parents and caregivers, which may not accurately reflect the adolescents’ experiences and beliefs (Salbach-Andrae et al., 2009). Additionally, since the questions were about family dysfunctions and the strength and weakness of family and were asked to parent and caregivers, the honesty of the parents and caregivers in response to these critical questions could be another limitation. In the future research, we suggest obtaining responses from adolescents themselves, which will more accurately reflect their perspectives on both traumatic experiences and resilience. Second, the screening tool for ACEs may not capture the complete scope of ACEs (Baldwin et al., 2021). The ACE questionnaire in the NSCH focused primarily on household dysfunctions and did not include other important ACEs (i.e., physical abuse, sexual abuse, and neglect). To assure the accuracy of ACE scores, future research should account for all of the ACE dimensions including the extent, intensity, or timing of the first ACE exposure (Krinner et al., 2021). Third, although we adapted the resilience
concept discussed in previous studies (Heard-Garris et al., 2018; Heerman et al., 2021; Khanijahani & Sualp, 2022), the resilience questionnaire we used in this study may not have captured the complete extent of resilience. This allows for the inclusion of additional factors, such as the stability of familial relationships, in the resilience questionnaire (Heerman et al., 2021). Future studies assessing resilience should develop a robust resilience questionnaire that includes other aspects of family resilience (e.g., spirituality and mindfulness; Jones et al., 2016). Because we used a cross-sectional survey, our findings do not suggest causality (e.g., depression followed by ACEs; Carlson & Morrison, 2009), and we are unable to ascertain which specific adversities are more closely associated with depression. Future studies should employ a longitudinal design to investigate the relationship between individual ACEs and depression.

Despite these limitations, our study benefits from a representative sample of non-institutionalized children and adolescents in the US. We used appropriate statistical modeling of HWF logistic regression with interaction to examine the role of various types of resilience in the association between Aces and depression among children and adolescents. The findings of this study are generalizable to the larger population of children and adolescents in the US.

**Conclusion**

The present study identified a dose-dependent relationship between ACEs and depression among children and adolescents. Using the HOPE framework for childhood development, the current study suggests different types of resilience, specifically child resilience and family resilience, moderated the association of ACEs on depression. These findings can guide public health practitioners and policy makers to design a tailored interventions to increase resilience among children and adolescents with ACEs. Future research should aim to validate these associations in a broader range of age groups, and to develop resilience interventions that are
specifically tailored to children and families facing ACEs. Child resilience and family resilience-centered approaches to ACE interventions have the potential to reduce depression among children and adolescents, thus paving the way for a healthier future for generations to come.
CHAPTER IV

Utilization of Mental Health Services among Children and Adolescents with Adverse Childhood Experiences (ACEs)

Introduction

Mental health care utilization among children and adolescents who have experienced adverse childhood experiences (ACEs) is an important public health concern to reduce the overall burden of mental health disorders. The growing concern regarding the prevalence and severity of these issues among children and adolescents, reflected in the remarkable 34.6% increase in diagnosed mental health conditions among children from 11.0% in 2012 to 14.8% in 2018 (Tkacz & Brady, 2021). The consequences of the COVID-19 pandemic on child and adolescent mental health is still being investigated, but medical practitioners are reporting alarming increases in mental health problems in these age groups since the onset of the pandemic (Meherali et al., 2021). In 2016, approximately 16.5% of children aged 5-17 years in the US received a diagnosis of a mental health disorder (Whitney & Peterson, 2019). However, recent NSCH 2021 data shows that 23.4% of children aged 3-17 years are diagnosed with mental health conditions (National Survey of Children’s Health [NSCH], 2021). The gravity of the situation was further underscored by the declaration of a national emergency in child and adolescent mental health by the American Academy of Pediatrics (AAP), the American Academy of Child and Adolescent Psychiatry (AACAP), and the Children’s Hospital Association in 2021 (AAP, 2021). The repercussions of mental health issues in children and adolescents are significant and extend beyond emotional well-being (Bomysoad & Francis, 2020). Mental health problems in children and adolescents can adversely impact their physical health (Morabito et al., 2021),
emotional stability, cognitive and social skills, and even their educational progress (CDC, 2020; Larson et al., 2017; Wade et al., 2022). Given these concerning trends and their far-reaching consequences, it is imperative to study mental health care utilization among children and adolescents with ACEs to better address and alleviate the burden of mental health disorders in this vulnerable population.

Adverse Childhood Experiences (ACEs) have emerged as a critical risk factor in the development and progression of mental health conditions among children and adolescents (Bomysoad & Francis, 2020; Hughes et al., 2017; Lee et al., 2020). ACEs include traumatic events such as abuse, neglect, and household dysfunction before the age of 18 (CDC, 2021). ACEs are typically categorized into ten types, including physical abuse, sexual abuse, physical neglect, emotional neglect, parental separation, parental mental illness, parental substance use, incarcerated parents, and being a victim or witness to domestic violence (Krinner et al., 2021). Alarmingly, approximately 64% of the U.S. population reports experiencing at least one of these adversities (CDC, 2022b). Studies revealed that ACEs can significantly impact brain development in children (Luby et al., 2019), with long-lasting negative effects on their mental, emotional, and psychological well-being that endure into adulthood (Tan & Mao, 2023). Moreover, ACEs have been linked to Mental Emotional Developmental, and Behavioral problems (MEDB; Lackova Rebicova et al., 2019), which often require regular visits to mental health care services to resolve. ACEs are linked to various types of mental health conditions like Tourette syndrome (Yang et al., 2022), ADHD diagnosis (Hunt et al., 2017), and learning disabilities (Vervoort-Schel et al., 2021). Furthermore, ACEs are associated with a higher likelihood of experiencing poverty (Walsh et al., 2019) and attaining lower levels of education (Stewart-Tufescu et al., 2022), which, in turn, amplify susceptibility to mental health issues.
Sadly, while children who have experienced ACEs often require more extensive mental health care (Karatekin, 2018), those same children have a lower likelihood of having current insurance and receiving a physician checkup in the past year (Alcalá et al., 2018).

Unfortunately, only half of the children with mental health problems receive treatment from mental health professionals (Merikangas et al., 2010). Even more concerning is the fact that only 20.0% of children with mental health issues receive specialized mental health care (Martini et al., 2012). Access to mental health care is constrained by various barriers, including the absence of insurance coverage, extended waiting times, complexities in navigating available treatment options (Modi et al., 2022), and the pervasive stigma associated with mental health (Doherty, 2009). These barriers are compounded for children and adolescents who are from lower socio-economic status (Economou et al., 2020) and are particularly pertinent to those who have experienced ACEs (Purtle et al., 2022). ACEs may negatively influence mental health care access in various ways (Alcalá et al., 2018; Bloom et al., 2019; Koball et al., 2021). First, individuals with ACEs may have lower socioeconomic status, which can result in limited access to mental health care and health insurance (Testa et al., 2022). Second, ACEs are associated with risky health behaviors such as substance use that may lead to avoiding health care services (Campbell et al., 2016).

A significant body of research suggests that ACEs have far-reaching implications for the quality of healthcare received by individuals as they navigate the healthcare system. Schweer-Collins & Lanier (2021) highlighted how a high number of childhood adversities is closely linked to a myriad of challenges within healthcare settings, including reduced care coordination, limited family-centered care, limited shared decision-making, and fewer referrals for necessary care. Furthermore, their findings also emphasized that a greater number of ACEs can lead to
subpar medical care quality and heightened obstacles in accessing essential mental health
treatment. These challenges in accessing mental health services were further underscored in
Nyiramana et al.’s (2021) study, which revealed that all patients at the neuropsychiatric referral
hospital had experienced some form of childhood adversities, with a staggering 77.9% of them
having encountered at least four ACEs. Furthermore, ACEs can contribute to conditions that lead
patients to seek rehabilitation care (Ranjbar & Erb, 2019).

Despite the growing recognition of the impact of ACEs on healthcare, community mental
health service providers remain largely unprepared to effectively address the unique needs of this
population (Pendygraft, 2013). Additionally, prior research has shown that children with ACEs
are more likely to miss appointments with healthcare providers (Koball et al., 2021), resort to
emergency services more frequently (Okeson et al., 2022), and have a higher unmet need for
specialist care (Alcalá et al., 2018), emphasizing the multifaceted challenges they encounter
within the healthcare system. Furthermore, studies have identified specific associations between
ACEs, such as sexual assault, and increased utilization of mental health care services (New &
Berliner, 2000; Price et al., 2014).

While there is well-established knowledge regarding the long-term impact of ACEs on
mental health (Bomysoad & Francis, 2020; Hughes et al., 2017; Lee et al., 2020), there has been
a lack of attention directed towards understanding how ACEs affect access to mental health care
utilization among children and adolescents. Given the urgency of addressing these issues, it is
imperative to not only comprehend the relationship between ACEs and the need for mental
health care services but also to investigate how ACEs influence the utilization of mental health
care services among children and adolescents. To fill the gap, the objectives of this study are: 1)
to explore the relationship between ACEs and mental health care needs among children and
adolescents, and 2) to understand the relationship between ACEs and mental health care utilization in children and adolescents. Identifying the needs and utilization patterns of mental health care services among children and adolescents can provide essential insights for policymakers and public health practitioners. Furthermore, the information on a distinct requirement for mental health care services among children and adolescents with ACEs serves as a valuable resource for shaping effective policies and interventions to improve mental health outcomes in this vulnerable population.

**Methods**

**Data Source and Study Sample**

We utilized publicly accessible data from the National Survey of Children’s Health (NSCH). The survey collects information concerning the health and well-being of children, including childhood experiences such as ACEs, healthcare need, access, and utilization. This survey is distributed through mail and online questionnaires and is completed by the parents or caregivers of children. We utilized the combined two years datasets, 2018-2019 ($N = 59,963$). We included all 6-17-year-old children ($N = 43,213$) in our analysis as a result.

**Measures**

**Need for mental health care.** As used by a previous study (Lu, 2017), we measured the need for mental health care among children by assessing their range of Mental Emotional Developmental and Behavioral (MEDB) problems. For a child to qualify as needing mental health services, the child must have any of 10 conditions currently and/or meet requirements within their medical home as defined by the Children with Special Health Care Needs (CSHCN) screener for ongoing emotional, developmental, or behavioral conditions criteria. This measure is used by previous studies (e.g., REF, REF, REF). These 10 conditions for MEDB measure by the
question: “Has a doctor or other health care provider ever told you that this child has: 1) Tourette Syndrome, 2) anxiety problems, 3) depression, 4) behavioral and conduct problem, 5) developmental delay, 6) intellectual disability, 7) speech or other language disorder, 8) learning disability, 9) Autism or autism spectrum disorder (ASD), 10) attention deficit disorder (ADD) or ADHD. The question has three categories of responses: 1 = does not have the condition, 2 = ever told but does not currently have condition, and 3 = currently has condition.

The NSCH uses the three parts CSHCN Screener questions to identify children with special health care needs. The first part consists of 5 questions that ask about a child’s medical experiences: 1) Does this child currently need or use medicine prescribed by a doctor, other than vitamins? 2) Does this child need or use more medical care, mental health, or educational services than is usual for most children of the same age? 3) Is this child limited or prevented in any way in his or her ability to do the things most children of the same age can do? 4) Does this child need or get special therapy, such as physical, occupational, or speech therapy? 5) Does this child have any kind of emotional, developmental, or behavioral problem for which he or she needs treatment or counseling? The questions have two categories of responses: 1 = yes, and 2 = no. If a caregiver responds “yes” to any of these questions, the second and third parts of each screener question will be asked: 6) Is this because of any medical, behavioral, or other health condition? 7) Is this a condition that has lasted or is expected to last 12 months or longer? If the answer to questions 6 and 7 is “yes”, then one follow-up question is asked: “Has his or her emotional, developmental, or behavioral problem lasted or is it expected to last 12 months or longer?” All three parts of at least one screener question (or in the case of question 6 and 7: two parts) must be answered “yes” for a child to meet CSHCN Screener criteria for having a special health care need.
**Mental health utilization.** Another dependent variable in this study was mental health care utilization, which was asked in the NSCH as follows: “During the past 12 months, has this child received any treatment or counseling from a mental health professional?” The response options were recorded and coded as 1 = yes, received mental health care; 2 = no, but needed to see a mental health professional and 3 = no, and did not need to see a mental health professional. We dichotomized the responses into two categories; 1 = yes, for those who received the mental health care and 2 = no, for those who did not receive the mental health care.

**Adverse Childhood Experiences.** The NSCH survey included questions to parents/caregivers regarding their child’s exposure to any of nine ACEs: difficulty covering basic needs on family's income (ACE1); parent or guardian divorced or separated (ACE3); parent or guardian died (ACE4); parent or guardian served time in jail (ACE5); saw or heard parents or adults slap, hit, kick punch one another in the home (ACE6); was a victim of violence or witnessed violence in neighborhood (ACE7); lived with anyone who was mentally ill, suicidal, or severely depressed (ACE8); lived with anyone who had a problem with alcohol or drugs (ACE9); and treated or judged unfairly due to race/ethnicity (ACE 10). The first question (ACE1) was asked as “Since this child was born, how often has it been very hard to cover the basics, like food or housing, on your family’s income? This question has four responses: 1= never hard to get by on family income; 2 = rarely hard to get by on family income; 3 = somewhat often hard to get by on family income; and 4 = very often hard to get by on family income. We combined the responses 3 and 4 and recoded them into two categories: 1 = exposed (“somewhat often” or “very often”) and 2 = not exposed (“rarely” or “never”). The other ACE questions (two thru nine) were asked as: “To the best of your knowledge, has this child ever experienced any of the following? parent or guardian divorced or separated (ACE3), parent or guardian died
(ACE4), parent or guardian served time in jail (ACE5), saw or heard parents or adults slap, hit, kick punch one another in the home (ACE6), was a victim of violence or witnessed violence in his or her neighborhood (ACE7), lived with anyone who was mentally ill, suicidal, or severely depressed (ACE8), lived with anyone who had a problem with alcohol or drugs (ACE9), and treated or judged unfairly because of his or her race or ethnic group (ACE10).” All these questions had only two options: 1 = yes and 2 = no. We also calculated exposure to multiple adversities, known as the cumulative ACE score, to make a continuous variable ranging from 0-9 (Leza et al., 2021). The summed ACEs were divided into 4 ACEs categories; No ACEs, 1 ACE, 2-3 ACEs, and ≥ 4 ACEs following prior studies (Bethell et al., 2017; Heerman et al., 2021; Xu et al., 2022).

**Study Covariates.** The covariates for this study were age (in years), sex (0 = female or 1 = male), race and ethnicity (1 = Hispanic, 2 = non-Hispanic white, 3 = non-Hispanic black, and 4 = multiracial/other), Insurance of children (1 = public health insurance only, 2 = private health insurance only, 3 = public and private health insurance both, 4 = uninsured). The household characteristics included household income level as a percentage of the federal poverty level (1 = 0-99% FPL, 2 = 100-199% FPL, 3 = 200-399% FPL, 4 = 400% FPL or higher).

**Statistical Analysis**

We used $\chi^2$ to compare the distribution of prevalence of mental health care needs among children and adolescents (has mental health care needs, and no mental health care needs) with sociodemographic variables and ACEs categories. We employed two models of logistic regression: 1) to explore the association between ACEs and mental health care needs (Model 1 A = crude and Model 1B = adjusted); 2) to explore the association between ACEs and mental health care utilization (Model 2 A = crude and Model 2B = crude association). All analyses were
carried out using established survey weights and NSCH guidelines from the codebook (NSCH, 2020). The results of the association are presented by using odds ratios (OR) showing a crude relationship and an adjusted odds ratio (aOR) with a 95% confidence interval (CI). We used SAS 9.4 to analyze the data. The missing values for outcomes variables were > 2% and > 3% for independent variables and we included them in our analysis.

Results

Participant Characteristics

Among the total surveyed population aged 6-17 years old (N = 43,213), about half of the population were aged 12-17 years (50.38%), and the other half were 6-11 years (49.62%). The majority of the participants were non-Hispanic White (49.82%), followed by Hispanic (25.77%), Black, non-Hispanic (13.93%) and Other/Multi-racial (10.48%). A little more than half were male participants (51.13%), and female participants constituted 48.87%. In terms of household income level, 31.07% of participants fell into the 400% FPL or greater category, followed by 200-399% FPL category (28.08%), 100-199% FPL category (21.62%), and 0-99% FPL category (19.23%). More than half of the participants had private health insurance only (58.75%), followed by public health insurance only (29.49%), and 7.32% did not have any health insurance (see Table 1).

Among the participated children and adolescents, 11,937 individuals (27.64%) had one or more mental health care needs, while 31,276 individuals (72.23%) had no mental health care need. The majority of participants with one or more MEDB problems were Non-Hispanic White (56.15%), male (56.15%) and were living at 400% or above the federal poverty level (28.22%) and had a private health insurance only (51.80%) (see table 1).

Prevalence of ACEs and mental health care needs
Among the participants in the study, 45.90% had at least one ACE, and more than half of the participants did not report experiencing any ACEs (54.10%). Specifically, around one quarter of the participants experienced 1 ACE (23.25%), 15.55% experienced 2-3 ACEs, and 7.10% experienced 4 or more ACEs (see Table 1).

Adolescents with any ACEs reported higher mental health care needs (61.53%) compared to those without ACEs. Participants reporting one ACE accounted for 23.70% of the weighted cases of mental health care needs, and participants with two to three ACEs represented around 22.33% of the weighted cases of mental health care needs. Participants reporting four or more ACEs, represented 15.50% of the weighted cases of mental health care needs.

Table 11.

Sociodemographic variables according to the mental health care needs among US children and adolescents aged 6-17 years.

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>Total Sample</th>
<th>Has mental health care needs</th>
<th>No mental health care needs</th>
<th>p value b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>43,213 (100)</td>
<td>11,937 (27.64)</td>
<td>31,276 (72.23)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11</td>
<td>18,396 (49.62)</td>
<td>4,658 (11.34)</td>
<td>13,738 (38.28)</td>
<td></td>
</tr>
<tr>
<td>12-17</td>
<td>24,817 (50.38)</td>
<td>7,279 (13.05)</td>
<td>17,538 (37.32)</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>White c</td>
<td>30,015 (49.82)</td>
<td>8,740 (56.15)</td>
<td>21,275 (47.77)</td>
<td></td>
</tr>
<tr>
<td>Black c</td>
<td>2,890 (13.93)</td>
<td>768 (13.11)</td>
<td>2,122 (14.20)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>5,097 (25.77)</td>
<td>1,293 (22.59)</td>
<td>3,804 (26.80)</td>
<td></td>
</tr>
<tr>
<td>Other/Multi-racial</td>
<td>5,211 (10.48)</td>
<td>1,136 (8.15)</td>
<td>4,075 (11.23)</td>
<td></td>
</tr>
<tr>
<td>Sociodemographic Variables</td>
<td>Total Sample</td>
<td>Has mental health care needs</td>
<td>No mental health care needs</td>
<td>p value&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Male</td>
<td>22,527 (51.13)</td>
<td>6,833 (14.09)</td>
<td>15,694 (37.04)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20,686 (48.87)</td>
<td>5,104 (10.31)</td>
<td>15,582 (38.56)</td>
<td></td>
</tr>
<tr>
<td>Household Income level</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>0-99% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4,953 (19.23)</td>
<td>1,667 (21.39)</td>
<td>3,286 (18.54)</td>
<td></td>
</tr>
<tr>
<td>100-199% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>7,057 (21.62)</td>
<td>2,201 (23.15)</td>
<td>4,856 (21.13)</td>
<td></td>
</tr>
<tr>
<td>200-399% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>13,342 (28.08)</td>
<td>3,644 (27.24)</td>
<td>9,698 (28.35)</td>
<td></td>
</tr>
<tr>
<td>≥ 400% FPL&lt;sup&gt;d&lt;/sup&gt;</td>
<td>17,861 (31.07)</td>
<td>4,425 (28.22)</td>
<td>13,436 (31.98)</td>
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</tr>
<tr>
<td>Health Insurance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public insurance only</td>
<td>8,411 (29.49)</td>
<td>3,197 (35.67)</td>
<td>5,214 (27.49)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Private insurance only</td>
<td>30,387 (58.75)</td>
<td>7,287 (51.80)</td>
<td>23,100 (60.99)</td>
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</tr>
<tr>
<td>Public &amp; private</td>
<td>1,657 (4.45)</td>
<td>821 (7.14)</td>
<td>836 (3.58)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2,071 (7.32)</td>
<td>462 (5.39)</td>
<td>1,609 (7.94)</td>
<td></td>
</tr>
<tr>
<td>ACE categories</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>1 ACE</td>
<td>9,708 (23.25)</td>
<td>2,797 (23.70)</td>
<td>6,911 (23.10)</td>
<td></td>
</tr>
<tr>
<td>2-3 AC</td>
<td>6,358 (15.55)</td>
<td>2,542 (22.33)</td>
<td>3,816 (13.38)</td>
<td></td>
</tr>
<tr>
<td>4 or m</td>
<td>2,760 (7.10)</td>
<td>1,577 (15.50)</td>
<td>1,183 (4.41)</td>
<td></td>
</tr>
<tr>
<td>No ACE</td>
<td>23,792 (54.10)</td>
<td>4,873 (38.47)</td>
<td>18,919 (59.10)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Frequencies represent unweighted sample frequencies while percentages are national-level estimates of values

<sup>b</sup> Wald Chi Square test for two-way analysis

<sup>c</sup> non-Hispanic

<sup>d</sup> FPL, Federal Poverty Level
Association between ACEs and mental health care needs

Compared to children and adolescents with no ACEs, children and adolescents with 1 ACE had around 57% higher odds of mental health care needs (aOR = 1.57; 95% CI: 1.40-1.76; \( p < .001 \)). Children and adolescents with 2-3 ACEs had more than 2 and a half times higher odds of mental health care needs (aOR = 2.53; 95% CI: 2.21-2.90; \( p < .001 \)). Children and adolescents with 4 or more ACEs had substantially higher odds, approximately around 5 times higher odds of mental health care needs (aOR = 5.20; 95% CI: 4.26-6.35; \( p < .001 \)) (see Table 2).

Other sociodemographic variables also demonstrated significant associations with mental health care needs. Children and adolescents in the age group 12-17 years had approximately 11% higher odds of mental health care needs compared to those in the 6-11 age group (aOR = 1.11; 95% CI: 1.01-1.22; \( p < .001 \)). Males had about 45% higher odds of mental health care needs compared to females (aOR = 1.45; 95% CI: 1.32-1.59; \( p < .001 \)). Hispanic children and adolescents had approximately 39% lower odds of mental health care needs compared to non-Hispanic White individuals (aOR = 0.61; 95% CI: 0.53-0.71; \( p < .001 \)). Non-Hispanic Black children and adolescents also had lower odds, approximately 36% lower, of mental health care needs compared to non-Hispanic White individuals (aOR = 0.64; 95% CI: 0.55-0.74; \( p < .001 \)). Similarly, children and adolescents from the Other/Multi-racial group had lower odds, approximately 42% lower, mental health care needs compared to non-Hispanic White individuals (aOR = 0.58; 95% CI: 0.50-0.67; \( p < .001 \)). Household income did not play a significant role in predicting mental health care needs. Differences in insurance type showed significant associations, however, with children and adolescents with private health insurance having about 26% lower odds of mental health care needs compared to those with public health insurance only (aOR = 0.74; 95% CI: 0.64-0.85; \( p < .001 \)). Children and adolescents with both public and
private insurance had approximately 46% higher odds (aOR = 1.46; 95% CI: 1.18-1.82; p < .001), while those with no insurance had about 37% lower odds (aOR = 0.63; 95% CI: 0.49-0.81; p < .001) of mental health care needs (see Table 2).

### Table 12.

*Association between ACEs and mental health care needs among children and adolescents*

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Model 1A OR 95% [CI]a</th>
<th>p value</th>
<th>Model 1 B aOR 95% [CI]a</th>
<th>p value</th>
</tr>
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<tbody>
<tr>
<td>0 ACE</td>
<td>Ref</td>
<td></td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>1 ACE</td>
<td>1.58 [1.41, 1.76]</td>
<td>&lt; .001*</td>
<td>1.57 [1.40, 1.76]</td>
<td>&lt; .001*</td>
</tr>
<tr>
<td>2-3 ACEs</td>
<td>2.56 [2.26, 2.91]</td>
<td>&lt; .001*</td>
<td>2.53 [2.21, 2.90]</td>
<td>&lt; .001*</td>
</tr>
<tr>
<td>≥ 4 ACEs</td>
<td>5.40 [4.50, 6.48]</td>
<td>&lt; .001*</td>
<td>5.20 [4.26, 6.35]</td>
<td>&lt; .001*</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11 years</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-17 years</td>
<td>1.11 [1.01, 1.22]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.45 [1.32, 1.59]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.61 [0.53, 0.71]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.64 [0.55, 0.74]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other/Multi-racial</td>
<td>0.58 [0.50, 0.67]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Income level</td>
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<td></td>
<td></td>
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<tr>
<td>100-199% FPLc</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-99% FPLc</td>
<td>0.97 [0.81, 1.15]</td>
<td>.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200-399% FPLc</td>
<td>1.05 [0.90, 1.22]</td>
<td>&lt; .05*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 400% FPLc</td>
<td>1.15 [0.98, 1.33]</td>
<td>&lt; .001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Insurance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public only</td>
<td>Ref</td>
<td></td>
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<td></td>
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</tbody>
</table>
Table 12. (Continued)

<table>
<thead>
<tr>
<th></th>
<th>Model 1A</th>
<th></th>
<th></th>
<th>Model 1 B</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% [CI]</td>
<td>p value</td>
<td>aOR</td>
<td>95% [CI]</td>
<td>p value</td>
</tr>
<tr>
<td>Private only</td>
<td>0.74</td>
<td>[0.64, 0.85]</td>
<td>&lt;.001*</td>
<td>0.74</td>
<td>[0.59, 0.85]</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>Both public</td>
<td>1.46</td>
<td>[1.18, 1.82]</td>
<td>&lt;.001*</td>
<td>1.46</td>
<td>[1.18, 1.82]</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td>and private</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No insurance</td>
<td>0.63</td>
<td>[0.49, 0.81]</td>
<td>&lt;.001*</td>
<td>0.63</td>
<td>[0.49, 0.81]</td>
<td>&lt;.001*</td>
</tr>
</tbody>
</table>

Note: *Significant results
Model 1A = Crude association, Model 1B = adjusted association after controlling age, gender, race, and income, and insurance types
\(^a\) 95% OR CI
\(^c\) Federal Poverty Level

Association between ACEs and receiving mental health care.

Among children and adolescents with at least one MEDB problem (\(N = 11,937\)), there was a significant association between ACEs and the receipt of mental health care in the past 12 months. Children and adolescents with 1 ACE had approximately 28% higher odds of receiving mental health care (aOR = 1.28; 95% CI: 1.05-1.57; \(p < .05\)). Those with 2-3 ACEs were even more likely to receive care, with more than a 2-fold increase in odds (aOR = 2.11; 95% CI: 1.66-2.67; \(p < .001\)). Similarly, children and adolescents with 4 or more ACEs had significantly higher odds, approximately 2.30 times higher odds of receiving mental health care (aOR = 2.30; 95% CI: 1.74-3.05; \(p < .001\)) (see Table 3).

Gender also played a significant role, as males had around 20% lower odds of receiving mental health care compared to females (aOR = 0.80; 95% CI: 0.68-0.94; \(p < .01\)). Children and adolescents from the Other/Multi-racial group were about 93% more likely to receive mental health care (aOR = 1.93; 95% CI: 1.51-2.46; \(p < .001\)). Other races and ethnic groups did not show significant association. Additionally, children and adolescents with private health insurance had approximately 25% lower odds of receiving mental health care (aOR = 0.75; 95% CI: 0.59-
0.94; \( p < .05 \)), and children and adolescents with no insurance had approximately 47% lower odds of receiving mental health care (aOR = 0.53; 95% CI: 0.32-0.89; \( p < .05 \)).

**Table 13.**

*Association between ACEs and receiving mental health care in last 12 months among children and adolescents with mental health care needs.*

<table>
<thead>
<tr>
<th>ACE Score</th>
<th>Model 2A</th>
<th>Model 2B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR 95% [CI] (^a) ( p ) value</td>
<td>aOR 95% [CI] (^a) ( p ) value</td>
</tr>
<tr>
<td>0 ACE</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>1 ACE</td>
<td>1.26 [1.04, 1.52] (&lt; .05^*)</td>
<td>1.28 [1.05, 1.57] (&lt; .05^*)</td>
</tr>
<tr>
<td>2-3 ACEs</td>
<td>1.91 [1.54, 2.36] (&lt; .001^*)</td>
<td>2.11 [1.66, 2.67] (&lt; .001^*)</td>
</tr>
<tr>
<td>≥ 4 ACEs</td>
<td>2.08 [1.61, 2.69] (&lt; .001^*)</td>
<td>2.30 [1.74, 3.05] (&lt; .001^*)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11 years</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>12-17 years</td>
<td></td>
<td>1.62 [1.38, 1.91] (&lt; .001^*)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.80 [0.68, 0.94] (&lt; .01^*)</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.11 [0.84, 1.49] (.46)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1.27 [0.99, 1.62] (.06)</td>
<td></td>
</tr>
<tr>
<td>Other/Multi-racial</td>
<td>1.93 [1.51, 2.46] (&lt; .001^*)</td>
<td></td>
</tr>
<tr>
<td>Household Income level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100-199% FPL(^c)</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td>0-99% FPL(^c)</td>
<td>0.84 [0.65, 1.10] (.22)</td>
<td></td>
</tr>
<tr>
<td>200-399% FPL(^c)</td>
<td>0.90 [0.69, 1.17] (.41)</td>
<td></td>
</tr>
<tr>
<td>≥ 400% FPL(^c)</td>
<td>0.90 [0.72, 1.12] (.35)</td>
<td></td>
</tr>
<tr>
<td>Health Insurance</td>
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<td></td>
</tr>
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</table>
Table 13. (Continued)

<table>
<thead>
<tr>
<th></th>
<th>Model 2A</th>
<th></th>
<th></th>
<th>Model 2B</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% [CI]^a</td>
<td>p value</td>
<td>aOR</td>
<td>95% [CI]^a</td>
<td>p value</td>
</tr>
<tr>
<td>Public only</td>
<td>Ref</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private only</td>
<td>0.75</td>
<td>[0.59, 0.94]</td>
<td>&lt; .05*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both public and private</td>
<td>1.29</td>
<td>[0.94, 1.78]</td>
<td>.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No insurance</td>
<td>0.53</td>
<td>[0.32, 0.89]</td>
<td>&lt; .05*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *Significant results
Model 2A = Crude association, Model 2B = adjusted association after controlling age, gender, race, and income, and insurance types
^a 95% OR CI
^c Federal Poverty Level

Discussion

The current study found the relationship between ACEs, mental health care needs, and the utilization of mental health care services among children and adolescents. A significant number of children and adolescents (27.64%) reported mental health care needs. Around 61.37% of the children and adolescents with mental health care needs had exposure to at least one type of the adversities in their life. This finding suggests the commonality of ACEs among children and adolescents with mental health care needs. ACEs has positive and dose-response association with the mental health care needs and receiving mental health care in the last year. Children and adolescents with one ACE had a 57% higher odds of mental health care needs, while those with 2-3 ACEs had over two and a half times higher odds of mental health care needs, and those with 4 or more ACEs had roughly five times higher odds of mental health care needs compared to those with no ACEs. Additionally, children and adolescents with 1 ACE had a 28% higher odds of receiving mental health care, while 2-3 ACEs were associated with more than a 2-fold increase in odds and 4 or more ACEs resulted in approximately 2.30 times higher odds of receiving mental health care in the past year. This finding underscores the pronounced demand
for mental health care among children and adolescents, especially for those with ACEs, highlighting the necessity of addressing their mental health needs.

Previous study shows similar increased mental health care needs among children and adolescents with ACEs (Ranjbar & Erb, 2019). Another study shows that nearly all patients receiving mental health care have experienced some form of childhood adversities, and with a striking 77.9% of them having encountered at least four ACEs (Nyirmana et al., 2021). A similar dose-response relationship is observed in the literature for ACEs and other behavioral (Clarkson Freeman, 2014) and mental health problems (Tan & Mao, 2023) among children and adolescents (Lackova Rebicova et al., 2019). This study is also in line with previous literature which found the strong association between ACEs and different types of mental health care needs (Lackova Rebicova et al., 2019).

This finding underscores the importance of recognizing the mental health needs of individuals with ACEs and ensuring that they receive the appropriate care and support. First, it’s very important to identify children with ACEs. ACE screening in the clinical settings is discussed in the literature (Asheh et al., 2023; Fortson et al., 2021; Rariden et al., 2021), however, it is also suggested for public health practitioners and policymakers to make an effort to screen ACEs in school settings (Baldwin et al., 2021; Blodgett & Lanigan, 2018) and communities to provide increased access to tailored care. It is also important to broaden the options for children’s mental health screening. The behavioral and emotional screening system (BESS; Kamphaus et al., 2010) for school and social/emotional/behavioral (SEB screening: Benheim et al., 2023) for hospitals could be effective screening tools for increasing screening for depression and anxiety among children and adolescents. Collaborative efforts between public health agencies, schools, and community organizations can establish support systems for
children with ACEs, creating a safety net to address their mental health care needs (Hall et al., 2012).

The findings from this study are somewhat encouraging, as we found that individuals with a higher number of ACEs and who are in greater need of mental health care services are reported increased access to mental health services. This indicates a degree of responsiveness within the healthcare system towards children and adolescents with ACEs. However, it’s noteworthy that healthcare utilization among children and adolescents with 4 or more ACEs is similar to that of children with 2-3 ACEs, despite the almost doubled need for mental health care. This implies an unmet need for mental health care among children and adolescents with greater ACEs. The unmet need of mental health care among children with ACEs is discussed in previous literatures (Berg et al., 2018; Kowalski, 2019). To bridge this gap, individuals with ACEs should be actively encouraged to seek mental health care services. Future research should aim to further explore and confirm to unmet need of health care utilization among children and adolescents with high ACEs.

The relationship between ACEs and mental health care needs and utilization is multifaceted and further complicated by sociodemographic disparities. The current study found that adolescents in the age group of 12-17 years, males, non-Hispanic White, and those with both public and private insurance exhibit higher odds of being diagnosed with mental health care needs. This higher likelihood of mental health care needs in adolescents aged 12-17 may be attributed to their enhanced communication skills, facilitating healthcare professionals in confirming diagnoses (Milton & Mullan, 2015). Additionally, children and adolescents with both public and private insurance show a higher likelihood of mental health care needs may be due to timely and comprehensive screening practices, leading to early identification and intervention.
(McAlpine & Mechanic, 2000). Conversely, this trend also suggests potential underdiagnosis of mental health care needs among children and adolescents with no insurance or insurance plans with high out-of-pocket expenses (Tkacz & Brady, 2021).

The current study also highlights the influence of sociodemographic variables on the receipt of mental health care. Gender, age, and insurance status were significant factors affecting the utilization of mental health care services. The results suggest a slight indication of potential gender disparities in mental health care utilization, with males having increased odds of mental health care needs but slightly lower odds of receiving mental health care compared to females (Bertakis et al., 2000). This gender difference in help-seeking behavior has been discussed in the literature and may have its roots in childhood, warranting further investigation (Galdas et al., 2005). Furthermore, children and adolescents with private health insurance had lower odds of receiving mental health care compared to those with public insurance, which may be attributed to issues related to access and affordability (Choi et al., 2016) as highlighting the role of insurance coverage in facilitating access to mental health services.

This study investigates the relationship between ACEs and mental health care utilization. However, several limitations should be considered. First, the ACE scores and health care needs and utilization were reported by parents and caregivers, which may not accurately reflect the experiences of children and adolescents themselves (Salbach-Andrae et al., 2009). Additionally, parents and caregivers answered the survey questionnaires on behalf of adolescents, this might lead inaccuracy of responding. Thus, the future research should gather responses directly from children and adolescents to enhance the accuracy of the measures. Second, the screening tool for ACEs may not capture the full scope of ACEs (Baldwin et al., 2021). The ACE questionnaire used in the NSCH primarily focused on household dysfunctions and did not encompass other
crucial ACEs such as physical abuse, sexual abuse, and neglect. To ensure the accuracy of ACE scores, future research should encompass all dimensions of ACEs, including the extent, intensity, or timing of the first ACE exposure (Krinner et al., 2021). Third, given the cross-sectional nature of our survey, our findings do not establish causality, such as whether mental health care needs preceded ACEs (Carlson & Morrison, 2009). Future studies should employ a longitudinal design to investigate the relationship between ACEs and mental health care needs and utilization over time. Finally, we were unable to determine which specific adversities are more closely associated with mental health care needs and utilization. Future studies should explore the relative impact of different ACEs on health care needs and utilization. Despite these limitations, our study benefits from a representative sample of non-institutionalized adolescents in the US. We used appropriate statistical modeling to examine the association between ACEs and mental health care needs and utilization among children and adolescents. The findings of this study are generalizable to the larger population of children and adolescents in the US.

**Conclusion**

This study provides valuable insights into the substantial impact of ACEs on the prevalence of mental health care needs and the mental health care services utilization among children and adolescents. These findings highlight the necessity of targeted interventions for mental health care among children and adolescents with ACEs especially who are in greater needs of mental health care. Children and adolescents, particularly those with ACEs should be encouraged to access mental health care services. The authors urge policymakers to provide universal access to mental health care for children and adolescents with ACEs, irrespective of their sociodemographic background. We also strongly suggest that further research is warranted
to gain a deeper understanding of mental health care utilization among children and adolescents with greater ACEs.
CHAPTER V

Discussion And Conclusion

The present study provides valuable insights on the association between ACEs and SUD, ACEs and childhood depression, and ACEs and mental health care needs and mental health care utilization among children and adolescents in the US. To the current study identifies a novel finding by examining the moderating relationship of various types of resilience on the pathway between ACEs and SUD among US adolescents. To our knowledge, this is also the first study that investigates the association between ACEs and mental health care utilization among children and adolescents in the US. Our results suggest that ACEs are strongly and positively associated with SUD among adolescents, diagnosis of depression among children and adolescents, mental health care needs among children and adolescents in the US. Similarly, we found that ACEs are strongly and positively associated with increased mental health care utilization among children and adolescents in the US. The unique finding of this study is in statistical evidence that family resilience acts as a moderator between ACEs and SUD. This study found that both child resilience and family resilience act as moderators to mitigate the effect of ACEs, especially on the tendency toward depression. We also found that all types of resilience (i.e., child resilience, family resilience, safe neighborhoods, and supportive neighborhoods) decreased the prevalence of SUD and depression among children and adolescents in the study sample. These findings suggest policymakers to develop and implement multi-level intervention strategies to mitigate the effects of ACEs. Additionally, these findings can assist public health advocates with the task of educating the public about the impact of ACEs. Clinicians can use information on resilience to stay informed and as a guide for counseling individuals and their families who have suffered from ACEs. The results of this study are also valuable for stakeholders working with children in
school settings, as they must seriously consider ACEs as a risk factor for SUD and depression among children. We have opportunities to help combat these challenges by promoting resilience among the children they see every day.

**Association between ACEs with SUD and diagnosis of depression among children and adolescents in the US**

One of the significant findings from this study is that ACEs are strongly associated with SUD, depression, and the need for mental health care services. Previous studies have also demonstrated a strong link between ACEs and SUD (Gomez et al., 2018; Leza et al., 2021) and depression later in life (Chang et al., 2019; Cheong et al., 2017; Merrick et al., 2017; Zhang et al., 2023). The results of this research suggest that ACEs can have both immediate and long-term effects, affecting individuals not only in their later years but also during their early childhood and adolescence. This underscores the reality of ACEs as a significant risk factor for behavioral and mental health problems across the lifespan. Therefore, it is crucial to consider the influence of ACEs when intervening in the behavioral and mental health of children and adolescents. This suggests that policymakers in the field of behavioral and mental health should be more aware of ACEs and their strong influence on these outcomes.

Our study clearly shows that ACEs are a risk factor contributing to the current epidemic of mental health problems among children and adolescents in the US. Consequently, our focus should be on identifying children and adolescents at high risk for ACEs and subsequent behavioral problems and the mental health conditions. Thus far, literature on the subject has discussed the importance of ACEs screening for children and adolescents with SUD and mental health issues so tailored interventions may be provided (Asheh et al., 2023; Fortson et al., 2021; Rariden et al., 2021; Stein et al., 2017). There is much discussion in the ACEs literature that
clients with elevated ACE scores should receive trauma-informed care (Esden, 2018; Mollard & Hudson, 2015). The author recommends a proactive public health strategy that involves identifying individuals with high ACEs as a high-risk group and recognizing children with ACEs at an earlier stage. This approach would enable preemptive interventions rather than waiting for diseases to develop and then providing tailored treatment.

Identifying and providing early intervention for at-risk children and adolescents can be a critical component of public health strategies (Southwick et al., 2014). To identify children and adolescents with ACEs, we can implement mass screening in schools (Fletcher-Janzen & Harrington, 2021), with each school having a dedicated task force for ACEs screening and providing essential support to mitigate the negative impacts. By identifying children experiencing or at high risk for ACEs, teachers, counselors, and medical providers can provide interventions for depression and behavioral problems at an early stage in their lives. Timely support and counseling for children with ACEs can help them mitigate the negative influence of ACEs on behavioral and mental health conditions. By addressing ACEs, SUD, and depressions problems early on, public health efforts can potentially reduce the long-term healthcare costs associated with treating these issues (CDC, 2023).

**Association between ACEs and Mental Health Care Needs and Utilization among Children and Adolescents in the US**

Another important finding from this study is the strong dose-response association between ACEs and the need for mental health care services among children and adolescents. This finding emphasizes the critical importance of recognizing the mental health needs of individuals with ACEs and ensuring that they receive the necessary care and support. To translate this finding into clinical interventions, it is essential to take a proactive approach in
identifying children with ACEs at an early stage. While ACE screening in clinical settings has been discussed in the literature (Asheh et al., 2023; Fortson et al., 2021; Rariden et al., 2021), public health practitioners and policymakers should make a concerted effort to introduce ACE screening in schools and communities, providing a broader and more accessible platform for early intervention and tailored care. Expanding the options for children’s mental health screening is another crucial step. Tools including the behavioral and emotional screening system (BESS) for schools and social/emotional/behavioral (SEB) screening for hospitals can be highly effective in increasing the screening for depression and anxiety among children and adolescents (Benheim et al., 2023; Kamphaus et al., 2010). A collaborative effort involving public health agencies, schools, and community organizations can help establish robust support systems for children with ACEs. This collaborative approach also creates a safety net to address the mental health care needs of these vulnerable children and adolescents with ACEs (W. R. Ellis & Dietz, 2017).

The study also reveals a significant and positive relationship between ACEs and the receipt of mental health care among children and adolescents with mental, emotional, and behavioral problems. Notably, those with more ACEs were more likely to access mental health care. This indicates a degree of responsiveness within the healthcare system towards children and adolescents with ACEs, which is an encouraging sign. However, it is important to note that healthcare utilization among children with 4 or more ACEs is similar to that of children with 2-3 ACEs, despite the significantly higher need for mental health care among children with higher ACEs. This suggests that there is still an unmet need for mental health care among children and adolescents with a high number of ACEs. To bridge this gap and ensure that individuals with ACEs receive the care they require, active support should be provided to encourage them to seek mental health care services. This may include raising awareness about the importance of mental health care among children and adolescents with ACEs.
health care and reducing the stigma associated with seeking help for mental health issues (Doherty, 2009). Expanding free and tele-health services to children and adolescents with ACEs could be another way to encourage them to utilize mental health care services. By actively promoting access to mental health care services, we can better support the well-being of children and adolescents with ACEs, ultimately improving their mental health outcomes.

**Family Resilience as the Moderator between ACEs and SUD among Adolescents in the US**

Results from this study indicated that family resilience is a safeguard against the detrimental consequences of ACEs on SUD among adolescents in the US. This finding holds profound implications for clinicians, counselors, public health practitioners, policymakers, social workers, and others working in the field of trauma and violence, child health, family health, and substance use.

Clinicians and counselors at the forefront of providing support to adolescents grappling with SUD can use the information from this study to inform counselling and training materials. By promoting the significance of family resilience and its core components to both adolescents and their families, counsellors can empower their clients to effectively address the challenges posed by ACEs. Health practitioners practicing routine ACE screening can utilize this knowledge to educate families of children and adolescents with ACEs about the components and potential benefits of family resilience, offering them strategies to mitigate the risks of adverse health outcomes associated with high ACEs.

Public health practitioners can use this information of resilience to advocate for the importance of family resilience in the community. A strong family unit contributes to the strength and health of the larger society (Alvarez et al., 2017). Public health advocates should strongly promote the idea of strong family bonding for better health outcomes in children and
adolescents. This means strong consideration around issues of parental separation, which is one of the ACEs we are trying to examine and address. Policies about family separation should be examined with ACEs in mind, and policies that advance strong family bonding and connection should be encouraged (Anderson, 2014).

To enhance family resilience, it’s crucial to identify and provide targeted support for at-risk families facing challenges such as substance abuse, domestic violence, or poverty (Isaacs et al., 2018). Offering parenting support programs, workshops, and resources can help parents develop strong relationships with their children and improve their parenting skills (Saltzman et al., 2013). Furthermore, building community-support systems within neighborhoods is recommended, as strong communities can provide elevated assistance to families during times of need (Villanueva et al., 2016).

Policymakers and planners can play a vital role in promoting strong family resilience through various measures. This includes implementing family-friendly parental leave policies, which include paid family and medical leave, allowing parents to spend quality time with their children while easing financial stress during family transitions (Pihl & Basso, 2019). Additionally, policies should focus on economic stability for families, including establishing living wage standards, affordable housing options, and job training programs, as economic security is a key element of family resilience (Greenberg, 2007).

**Child Resilience and Family Resilience as a Moderator between ACEs and Depression among Children and Adolescents in the US**

This study found that child resilience can play a significant role alongside family resilience in influencing depression outcomes among children and adolescents in the US. Helping children develop their own naturally coping skills, such as their ability to complete
tasks, maintain calm, regulate their actions and emotions, and retain their inquisitive nature, can help mitigate the negative effects of ACEs (Kern & Wehmeyer, 2021).

Clinicians and counselors working with children should encourage the development of coping skills among children and adolescents. This information can be incorporated into existing ACEs screening programs for counselling children and adolescents who are screened positive for ACEs. Once identified as ACEs, children should be encouraged to cultivate these coping skills through activities, workshops, and available resources. This knowledge can also be integrated into parenting training, guiding parents to both foster resilient characteristics in their children and take steps toward making their family more resilient.

Public health practitioners, social workers, and public health agencies should share this information on resilience and raise public awareness about the importance of child and family resilience for those who have experienced ACEs, as a protective measure against behavioral and mental health problems. Researchers should design and implement community-based child and family resilience programs for those affected by ACEs and evaluate the effectiveness of these interventions. Moreover, public health agencies and practitioners should offer specialized training for teachers and educators working with children and adolescents (Cotta et al., 2000), to equip them with the skills to promote activities that enhance child and family resilience. Schools and teachers can integrate resilience education into school curricula (Frydenberg et al., 2004) for helping children and adolescents to develop coping skills and emotional intelligence to safeguard children and adolescents against ACEs and create a safer and thriving environment for those with ACEs.
All resilience acts as a protective factor for SUD and depression among children and adolescents

The findings of this study indicate that various forms of resilience, including child resilience, family resilience, and living in a safe neighborhood reduce the likelihood of SUD, and all forms of resilience (i.e., child resilience, family resilience, safe neighborhood, and supportive neighborhood) reduce the likelihood of depression among children and adolescents. This information recommends for professionals working in the field of children’s behavioral and mental health. Recognizing the significance of resilience and supportive environments can prevent negative behavioral and mental health outcomes (Davydov et al., 2010; Mesman et al., 2021), thus reducing the prevalence of SUD and depression. This may involve the implementation of resilience programs in schools and communities that can aid children and adolescents in developing coping skills, emotional intelligence, and a robust support network (Fenwick-Smith et al., 2018).

Clinicians and practitioners should incorporate resilience-building activities into their strategies for mitigating adverse outcomes in children. Caregivers, including parents and guardians, can also be educated about the importance of resilience and adopt a more active role in fostering resilience in children. Promoting resilience as protective factors for mental health can contribute to reducing the stigma surrounding mental health issues (Eisenberg et al., 2016), encouraging open discussions, and seeking help when necessary. Policymakers may need to consider enacting policies that enhance family resilience, such as introducing parental leave and economic stability measures. Furthermore, policies that promote safe neighborhoods and community support can play a pivotal role in reducing the risk of SUD and childhood depression (Meyer et al., 2014). Emphasizing the importance of safe and supportive neighborhoods can
contribute to the overall well-being of communities (Bird et al., 2018), potentially leading to a reduction in various social issues, including crime, substance abuse, and family dysfunction.

Addressing the implications of these protective factors necessitates an interdisciplinary approach, involving collaboration among healthcare providers, educators, social workers, policymakers, and community organizations. Recognizing the protective roles of child and family resilience, safe neighborhoods, and supportive communities provides a framework for more effective prevention and intervention strategies (W. R. Ellis & Dietz, 2017). It underscores the importance of different levels of support within the ecological model and offers potential strategies for promoting healthier and more resilient children and adolescents.

**Limitations, and Future Research Directions**

This study identifies several important findings, but with some limitations considered. First, the measures of the study variables were self-reported by parents and caregivers, and thus may not have fully captured the perspectives of the children and adolescents themselves. In future research, gathering responses directly from children and adolescents can enhance the accuracy of these measures (Salbach-Andrae et al., 2009). Second, the ACE screening tool does not include the full scope of ACEs and focuses mainly on household dysfunction. Other crucial ACEs like physical abuse, sexual abuse, and neglect were not included. Future research should incorporate all dimensions of ACEs, considering factors such as duration, intensity, and timing of the first ACE exposure (Krinner et al., 2021). The need for a standardized and comprehensive ACE screening tool is very crucial and urgent. Future research should proactively spearhead the development of a standardized ACEs tool. Third, although this study focused on specific resilience factors based on previous studies found in the dataset (Heard-Garris et al., 2018; Heerman et al., 2021; Khanijahani & Sualp, 2022), there is potential to explore other core...
resilience traits, such as mindfulness and spiritual wellbeing (Bagereka et al., 2023). Investigating how these additional dimensions of resilience contribute to children and adolescents’ ability to overcome the challenges posed by ACEs can enhance our understanding of protective mechanisms. Future research should examine the role of additional resilience in the association between ACEs and behavioral health. Fourth, the cross-sectional nature of this survey does not establish causality (Carlson & Morrison, 2009). Future studies should employ a longitudinal design to explore relationships over time. Such studies could reveal critical periods for intervention and the development of resilience factors that evolve throughout an individual’s life, contributing to a more comprehensive understanding of effective interventions strategies. Furthermore, the study’s broad perspective on ACEs, SUD, depression, and healthcare utilization offers a solid foundation. However, future research should delve deeper into specific ACEs to pinpoint the most critical risk factors. By investigating the relationship between individual ACEs and behavioral outcomes, researchers can inform more targeted and effective interventions and policies. Finally, recognizing the influence of cultural and sociodemographic factors on the relationship between ACEs, SUD, depression, and mental health care utilization is critical. Future research should adopt a multicultural perspective to explore how different cultural backgrounds and socioeconomic contexts shape individuals’ experiences and responses to ACEs. This approach can pave the way for more tailored and culturally sensitive interventions and policies (Hodge et al., 2012), thus ensuring that children and adolescents with ACEs receive the support they need. Despite these limitations, our study offers valuable insights, utilizing a representative sample of non-institutionalized US children and adolescents and applying appropriate statistical modeling to examine the relationship between ACEs and behavioral health.
outcomes. These findings can be generalized to the larger population of children and adolescents in the US.

Conclusion

These findings underscore the profound impact of ACEs on behavioral health and mental health care needs. Although all levels of resilience can decrease the negative behavioral health outcomes, proximal intervention strategies, specifically those focusing on childhood resilience and family resilience, may be more effective in addressing the impact of ACEs. These findings provide a roadmap for public health practitioners and policymakers to design tailored interventions aimed at strengthening resilience among children and adolescents with ACEs.
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124


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factors among children with intellectual disabilities and borderline intellectual functioning.

https://doi.org/10.1016/j.ridd.2021.103935*


Institutional Review Board Approval

Institutional Review Board
Division of Research and Innovation
Office of Research Compliance
University of Memphis
315 Administrative Building
Memphis, TN 38152-3370

August 17, 2023

PI Name: Sanjaya Regmi
Co-Investigators: Advisor and/or Co-PI: Satish Kedia
Submission Type: Admin Withdrawal
Title: Association of Adverse Childhood Experiences and Behavioral Health among Children and Adolescents in the United States
IRB ID: PRO-FY2024-36

From the information provided on your determination review request for “Association of Adverse Childhood Experiences and Behavioral Health among Children and Adolescents in the United States”, the IRB has determined that your activity does not meet the Office of Human Subjects Research Protections definition of human subjects research and 45 CFR part 46 does not apply. This determination applies only to the activities described in the submission noted above and does not apply to any changes to this project. Please submit a new request to the IRB for a determination if any changes are made which lead to any questions about whether the activities are research involving human subjects.

This study does not require IRB approval nor review. Your determination will be administratively withdrawn from Cayuse IRB and you will receive an email similar to this correspondence from irb@memphis.edu. This submission will be archived in Cayuse IRB.

Thanks,

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