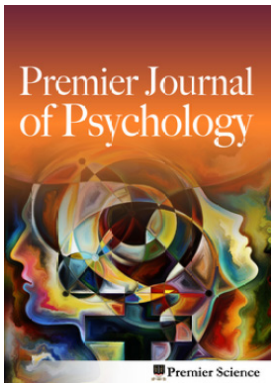

Scars That Shape Us: The Long-Term Impact of Adverse Childhood Experiences on Mental Health

Khadija Kamene

ABSTRACT

Adverse childhood experiences (ACEs) are significant predictors of long-term mental health outcomes, yet their impact is profoundly shaped by the cultural, socioeconomic, and structural contexts in which individuals live. This scoping review explores the complex interplay between ACEs and mental health across diverse populations, highlighting how cultural beliefs, social support systems, economic disparities, historical trauma, gender norms, and intersectional identities influence both the experience of childhood adversity and the availability of protective mechanisms. The review emphasizes the need for culturally adapted, trauma-informed interventions that are responsive to local realities, especially in underserved and marginalized communities. It further outlines comprehensive public health and policy strategies aimed at preventing ACEs, promoting resilience, and integrating trauma-informed care into health, education, and social service systems. By adopting a holistic and equity-centered lens, this review underscores the importance of context-sensitive approaches to breaking the cycle of trauma and fostering mental health across the lifespan.

Keywords: Adverse childhood experiences, Trauma-informed interventions, Neurobiological impact, Epigenetic modifications, Cultural considerations

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Introduction

This work complies with the TITAN 2025 reporting guidelines for the use of artificial intelligence in scientific writing and research transparency, which is in accordance with changing academic norms.[1] Childhood is often idealized as a period of innocence, safety, and carefree development. However, for many individuals, it is instead characterized by trauma, instability, and chronic stress. Far from being universally nurturing, childhood can be a time of profound adversity marked by abuse, neglect, and exposure to dysfunctional family environments.[2] These early disruptions, commonly referred to as adverse childhood experiences (ACEs), encompass a range of harmful events—including physical, emotional, and sexual abuse, household substance use, domestic violence, and parental incarceration—that significantly compromise a child's sense of safety and emotional well-being.

A growing body of research has demonstrated that ACEs are powerful predictors of a broad spectrum of negative developmental and health outcomes. Among the most consequential are long-term mental health challenges, including depression, anxiety disorders, and post-traumatic stress disorder (PTSD), as well as behavioral issues such as substance use and antisocial conduct. The cumulative nature of ACEs.[3] often contributes to complex trauma, which not only undermines psychological resilience but also shapes neurobiological and social functioning well into adulthood.

The disproportionate prevalence of ACEs among incarcerated populations—particularly among women—amplifies the urgency of addressing their long-term impacts. Empirical evidence indicates strong correlations between childhood trauma and subsequent criminal behavior, including the perpetration and victimization of intimate partner violence. These findings underscore the necessity of trauma-informed frameworks across mental health, legal, and correctional systems to adequately support individuals affected by early adversity. Recognizing and addressing the legacy of ACEs is essential not only for effective clinical care but also for the development of just, rehabilitative, and humane social policies.[4]

Purpose and Scope of the Manuscript

This manuscript aims to examine the long-term effects of ACEs on mental health, integrating neurobiological, psychosocial, and epigenetic perspectives to provide a comprehensive understanding of how early adversity shapes adult psychological outcomes. By synthesizing current research across multiple domains, the scoping review highlights the pathways through which ACEs contribute to mental health disorders such as depression, anxiety, PTSD, and personality disorders. Additionally, the manuscript emphasizes the critical need for early identification and trauma-informed interventions, particularly among vulnerable populations, to mitigate the enduring consequences of childhood trauma and promote psychological resilience.

Methodology

This review used the Arksey and O'Malley framework, enhanced by Levac, to explore the long-term impact of ACEs on adult mental health. It addressed three key questions: What are the long-term psychological, neurobiological, and behavioral effects of ACEs? How do resilience and social support influence outcomes? What clinical and policy responses have emerged?

Literature from 2000 to 2024 was sourced via PubMed, PsycINFO, and Google Scholar using ACEs-related terms. After screening ~100 records, 47 peer-reviewed studies on adult ACE outcomes were included. Data were thematically synthesized across five domains: neurobiological effects, psychosocial outcomes, psychopathology risk, protective factors, and trauma-informed/public health interventions.

AI tools were used under human oversight for literature mapping, keyword analysis, and citation organization, in line with TITAN 2025 guidelines. Manual review and synthesis remained central to the process.

Overview of ACEs

ACEs refer to potentially traumatic events occurring between the ages of 1 and 17, including various forms of abuse (emotional, physical, sexual), neglect, and household dysfunction, such as domestic violence, substance abuse, mental illness, or parental separation/incarceration.[1,3] These adversities are strongly linked to long-term mental and physical health issues, including anxiety, depression, PTSD, substance use, and chronic diseases. Expanded ACE frameworks now include peer bullying, community violence, and other socioecological stressors.

While studies in Western adult populations have established robust links between ACEs and mental health disorders, such as depression and anxiety, there is a scarcity of large-scale research on ACEs in adolescent populations, particularly in non-Western contexts. According to the CDC, nearly 61% of adults report experiencing at least one ACE,[5] with one in six reporting four or more. Exposure to ACEs is shown to increase the risk of depression, PTSD, and behavioral problems, disrupting emotional and social development, which can hinder the formation of healthy relationships in adolescence and adulthood.

In China, research on ACEs in adolescence is limited by small sample sizes or geographic constraints, but estimates suggest that 27%–70% of Chinese adolescents experience at least one ACE, emphasizing the need for more comprehensive, nationally representative studies. Similarly, in the U.S., prevalence studies show that 60%–80% of adults report at least one ACE, with children from marginalized or socioeconomically disadvantaged backgrounds facing higher risks. The impact of ACEs manifests in behavioral and emotional difficulties during childhood and maladaptive behaviors or health challenges in adulthood. Mersky et al. found that children exposed to ACEs are at increased risk for both externalizing behaviors (e.g., aggression, conduct disorders) and internalizing disorders (e.g., depression, anxiety).[5]

Theoretical Framework

Neurobiological Impact of Childhood Trauma

ACEs disrupt neurodevelopment, particularly affecting brain regions such as the hippocampus, prefrontal cortex, and amygdala due to prolonged exposure to toxic stress. This stress can alter brain architecture and impair emotional regulation, increasing vulnerability to psychiatric disorders, including PTSD, anxiety, mood disorders, and substance use. Higher ACE scores are strongly associated with an elevated risk for these conditions.

Neuroimaging studies reveal structural and functional changes in the prefrontal cortex, amygdala, hippocampus, and striatum—regions integral to emotion regulation, decision-making, and reward processing.[6] These neurobiological alterations often mediate the relationship between ACEs and mental health outcomes. For instance, individuals with high ACE exposure often exhibit overactivity in the prefrontal cortex and underactivity in the dorsal striatum and orbital frontal cortex.

The hippocampus, crucial for memory and learning, is particularly sensitive to elevated cortisol levels, often showing reduced volume in individuals with significant early-life stress. The amygdala, responsible for fear processing, tends to become hyperactive and enlarged, contributing to heightened emotional reactivity.[7] Meanwhile, the prefrontal cortex, which governs executive functions such as impulse control and decision-making, typically shows diminished activity and connectivity, leading to impaired emotional regulation and cognitive flexibility.

Beyond cortisol, other biological markers such as elevated pro-inflammatory cytokines (e.g., IL-6, TNF-α) reflect a chronic inflammatory state induced by ACEs. This inflammation compromises immune functioning and contributes to both mental and physical health disorders. Furthermore, epigenetic alterations in genes involved in stress-response systems suggest that ACEs leave enduring molecular imprints.[8,9]

The cumulative impact of these neurobiological and physiological disruptions can derail healthy development, increase vulnerability to psychiatric conditions, and raise the risk of somatic illnesses such as cardiovascular disease, autoimmune disorders, and metabolic syndromes. These findings underscore the critical need for early intervention and trauma-informed care to mitigate the long-term effects of ACEs (Figure 1).[8]

Psychosocial Model of ACEs

ACEs—including abuse, neglect, and household dysfunction—are consistently linked to long-term mental and physical health issues such as depression, PTSD, substance use, and personality disorders. As shown in neuroimaging studies, these experiences cause structural and functional changes in brain areas such as the hippocampus, amygdala, and anterior cingulate cortex, contributing to emotional dysregulation and increased susceptibility to psychiatric disorders.[6] The impact of ACEs is often dose-dependent, with the type and timing of trauma—such as early sexual abuse or chronic emotional neglect—shaping specific neurodevelopmental outcomes.

ACEs also impair emotional regulation, attention, and social functioning, leading to more severe psychiatric symptoms. However, resilience factors—particularly the presence of stable, supportive relationships—can buffer these effects. Attachment theory offers a valuable framework for understanding how early adversity, particularly disrupted caregiving, influences later emotional and relational functioning.[6,7,9,10] Insecure attachment styles, frequently seen in individuals with histories of ACEs, often persist into adulthood, compromising emotional regulation and relationship quality.

Children raised in alternative care systems face unique and compounded adversities before, during, and after separation from their biological families. These individuals are particularly vulnerable to

attachment disruptions, often presenting with high levels of attachment insecurity. This highlights the need for trauma- and attachment-informed interventions within care systems to promote healing and reduce long-term harm.[5,6,11]

Ongoing research is essential to better understand the differential impact of ACE types, timing, and context, and to develop integrative interventions that address both biological and psychosocial dimensions of trauma recovery (Figure 2).

The Role of Epigenetics in ACEs

ACEs—including emotional trauma and neglect—are increasingly recognized for their role in shaping long-term mental health outcomes through epigenetic modifications and mitochondrial dysfunction.[12] One important factor is acetyl-L-carnitine (LAC), a molecule involved in mitochondrial metabolism that regulates genes associated with neuroplasticity and stress responses. Lower levels of LAC, commonly observed in individuals with childhood trauma histories, have been linked to depression, treatment resistance, and increased vulnerability to conditions such as major depressive disorder and anxiety.[13]

Deficient LAC affects brain regions crucial for emotional regulation, including the hippocampus and prefrontal cortex, heightening susceptibility to mental health disorders. Moreover, mitochondrial dysfunction contributes to metabolic complications like insulin resistance, which further exacerbate mental health challenges.

ACEs are also associated with epigenetic changes that influence the expression of genes related to stress regulation, immune response, and neuroplasticity. These alterations may disrupt emotional regulation and heighten the risk of depression, anxiety, and PTSD.[14] Alarmingly, some epigenetic changes can be transmitted across generations, potentially compounding mental health vulnerabilities in future generations (Figure 3).

The Impact of ACEs on Mental Health

ACEs are strongly associated with a range of psychiatric disorders, including depression, anxiety, PTSD, substance use, and personality disorders. Anda et al. demonstrated a dose-dependent relationship between ACEs and mental health outcomes, with higher ACE scores correlating with greater psychiatric risk.[8] Additional studies confirm that both the number and severity of ACEs increase vulnerability to mood, behavioral, and sleep disorders, though the biological mechanisms remain complex.[1]

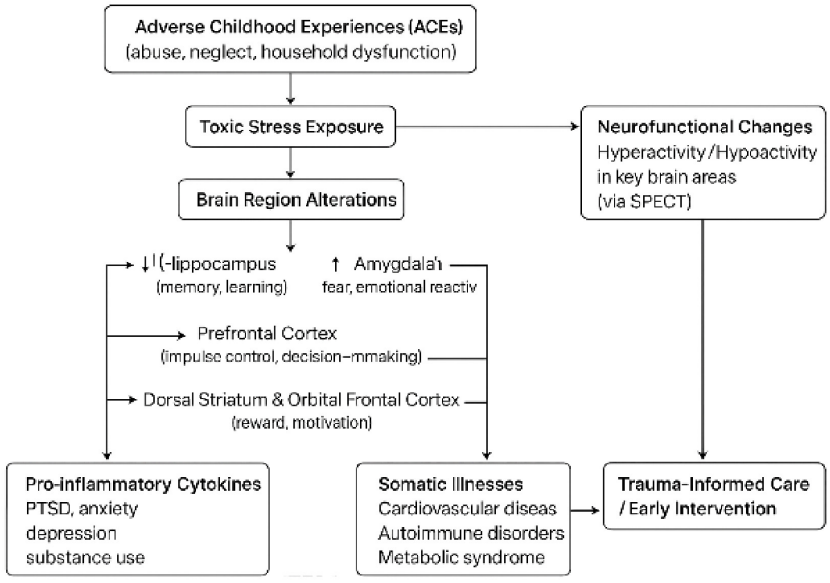

Fig 1 | Neurobiological impact of trauma

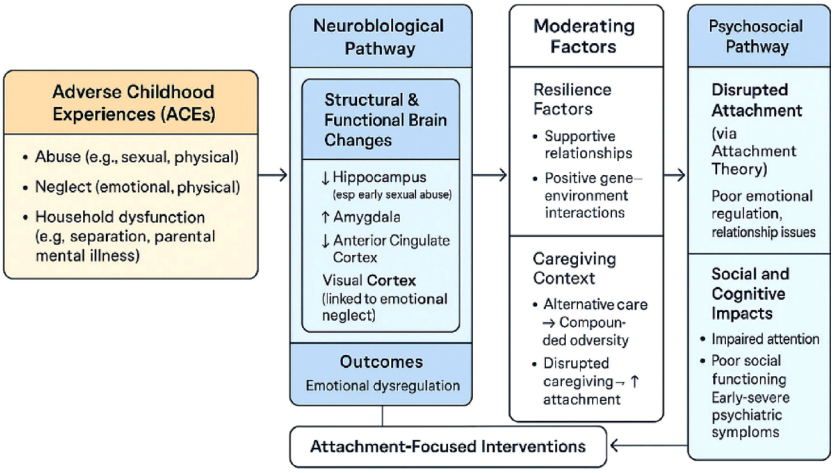

Fig 2 | Psychosocial model of ACEs

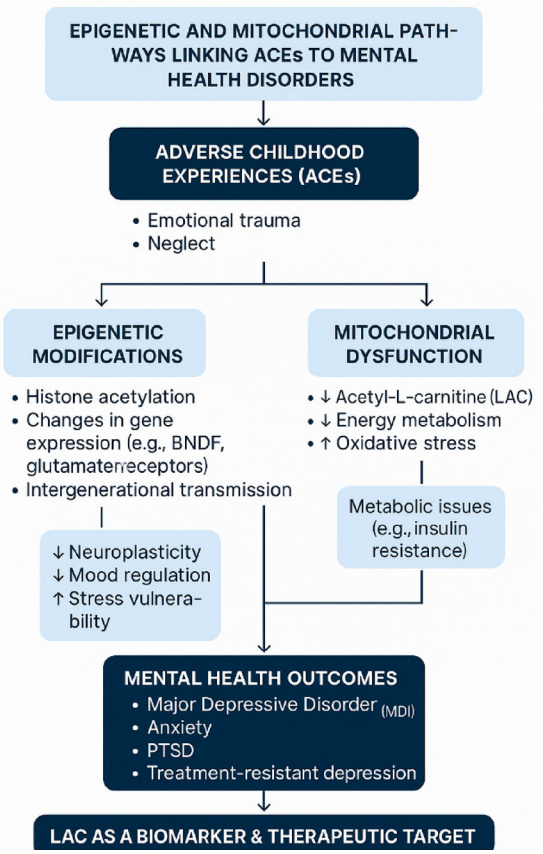

Fig 3 | Role of epigenetics in ACEs

Incarcerated women report disproportionately high rates of ACEs, with studies by Grella and Sharp indicating that 70%–90% experienced childhood trauma.[15] This cumulative adversity is linked to complex PTSD (C-PTSD), characterized by emotional dysregulation, negative self-image, and interpersonal difficulties—conditions prevalent among justice-involved women.[16]

ACEs also significantly elevate the risk of suicidal behavior and substance use. Data from the NESARC survey show that individuals with multiple ACEs are at greater risk of suicide attempts, even after controlling for mental and substance use disorders. Specific ACEs, like sexual abuse and emotional neglect, are particularly predictive, with gender-specific patterns noted.[17]

International research highlights the high prevalence of ACEs in prison populations, where affected individuals report poorer mental well-being, higher rates of self-harm,[18] and greater suicide risk. Trauma-informed interventions within correctional settings are essential for improving mental health outcomes and reducing recidivism.[19]

Moreover, childhood trauma is a known risk factor for mood and personality disorders, particularly borderline and antisocial types. These conditions often involve affective instability and maladaptive coping rooted in disrupted early attachments.[20] High ACE exposure is linked to more severe symptoms, earlier onset, and chronicity of illness. Early, trauma-informed intervention is crucial to mitigating long-term psychiatric consequences.[21]

Long-Term Psychological Effects of ACEs Chronic Stress and Anxiety in Adulthood

Childhood trauma has lasting effects on stress regulation and anxiety in adulthood, primarily through dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis. Chronic early stress—such as abuse, neglect, or household dysfunction—can lead to either hyperresponsive or blunted physiological reactions to stress, increasing vulnerability to anxiety disorders.[22] Neuroimaging studies show structural and functional changes in the amygdala, hippocampus, and prefrontal cortex among trauma-exposed individuals, affecting fear processing, emotional memory, and executive functioning.[21,22] As a result, adults with a trauma history often experience hyperarousal, intrusive thoughts, and difficulty regulating emotions. Maladaptive coping strategies such as dissociation, avoidance, or substance misuse are common, further perpetuating anxiety and emotional dysregulation.[16] These neurobiological and psychological disruptions also compromise immune function and heighten the risk for chronic illness, compounding emotional distress and impairing overall functioning. Trauma-informed interventions are, therefore, essential for restoring regulatory capacity and promoting long-term emotional resilience.

Attachment and Relationship Issues

Childhood trauma—especially within caregiving relationships—can severely disrupt attachment development, leading to insecure or disorganized attachment styles. According to Bowlby's theory, early caregiver interactions shape internal working models of self and others, guiding future relationships.[23] Adverse experiences such as abuse or emotional neglect often result in relational patterns marked by mistrust, emotional avoidance, or dependency.[24] Adults with trauma histories frequently struggle with intimacy, fear of abandonment, and emotional dysregulation, contributing to relationship dissatisfaction and instability.[25] Recent research confirms that emotion suppression—a coping mechanism linked to trauma—is associated with lower romantic relationship satisfaction.[26] Attachment insecurity also mediates the relationship between trauma and adult relational outcomes, while strong social support can buffer some negative effects.[27] Moreover, sensory over-responsivity has been identified as a mediator between childhood abuse and maladaptive adult attachment, complicating interpersonal functioning.[28] These findings emphasize the importance of integrating trauma-informed, attachment-based approaches into therapeutic care to support relational healing.

Cumulative Effects and Complex Trauma

The cumulative impact of prolonged or repeated childhood adversity—referred to as complex trauma—profoundly alters developmental trajectories, affecting emotional regulation, self-concept, and relational functioning across the lifespan. Unlike single-incident trauma, complex trauma stems from chronic exposure to stressors such as repeated abuse, emotional neglect, or familial dysfunction, particularly during sensitive developmental periods and in the absence of protective relationships.[29]

Neurobiological research indicates that complex trauma disrupts the brain's stress-response systems, notably the amygdala, hippocampus, and prefrontal cortex, leading to dysregulation of the HPA axis. This dysregulation is associated with persistent anxiety, emotional numbing, identity instability, and vulnerability to disorders such as C-PTSD, depression, and borderline personality disorder.[30]

A 2023 study by Hoeboer et al. in the *European Journal of Psychtraumatology* found that individuals with high ACE scores were significantly more likely to meet diagnostic criteria for C-PTSD, characterized by chronic shame, dissociation, and interpersonal difficulties. These effects extend into adulthood, contributing to social and occupational impairments, substance misuse, and poor mental health outcomes. The compounding nature of ACEs underscores the urgency for early identification, trauma-informed care, and targeted interventions to mitigate long-term harm.[29,30]

Moderating Factors: Resilience, Coping, and Social Support

Despite the well-documented risks associated with ACEs, not all individuals with trauma histories develop chronic psychological disorders. Emerging evidence highlights resilience, adaptive coping, and social

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support as critical protective factors that can moderate the long-term mental health consequences of ACEs.

Resilience—the capacity to maintain or regain psychological well-being despite adversity—plays a key role in trauma recovery. A longitudinal study by Fritz et al.[31] found that higher resilience significantly buffered the impact of multiple ACE exposures on adult psychological distress. Traits such as emotional regulation, optimism, and cognitive flexibility are associated with improved post-trauma outcomes.

Coping strategies also shape psychological trajectories. Adaptive strategies (e.g., cognitive reappraisal, mindfulness, help-seeking) are linked to reduced symptoms of depression and PTSD, while maladaptive strategies (e.g., avoidance, substance use, suppression) are associated with poorer outcomes. Interventions that promote adaptive coping can mitigate long-term psychological harm.[32]

Social support networks—comprised of family, peers, mentors, and community resources—consistently moderate the relationship between ACEs and adult mental health. A 2022 meta-analysis by Riedl et al. emphasized that perceived social support reduces symptoms of anxiety, depression, and stress among trauma survivors. Similarly, supportive relationships across the life course enhance emotional regulation, foster secure attachments, and facilitate post-traumatic growth.[33]

Notably, the presence of at least one nurturing, responsive adult during childhood has been shown to buffer the effects of toxic stress on brain development and emotional stability.[32] Intergenerational caregiving relationships and relational health also serve as powerful mechanisms for healing and resilience.

Promoting these protective factors through early interventions, trauma-informed care, and community-based programs is essential for reducing the long-term burden of childhood trauma.[34]

Interventions and Early Trauma Recovery

Effective interventions can significantly mitigate the long-term psychological effects of ACEs. Trauma-informed therapy, cognitive behavioral therapy (CBT), and eye movement desensitization and reprocessing (EMDR) are among the most evidence-based approaches for promoting recovery.[35]

Trauma-informed therapy is a foundational framework that emphasizes safety, empowerment, and cultural sensitivity. It recognizes trauma as a central factor in emotional and behavioral challenges and has shown particular efficacy in high ACE settings such as schools, correctional institutions, and foster care systems.[19]

CBT is widely used to address depression, anxiety, and PTSD associated with ACEs. Trauma-focused CBT, in particular, helps individuals reframe maladaptive thought patterns and build effective coping skills. Meta-analyses confirm its strong efficacy in reducing trauma symptoms and improving daily functioning.

EMDR is a structured, trauma-specific therapy that uses bilateral stimulation to process distressing memories. Research supports its effectiveness in reducing emotional intensity, physiological arousal, and reexperiencing symptoms in trauma-exposed individuals. It is endorsed by the World Health Organization as a frontline treatment for trauma.[36]

Emerging integrative approaches—including mindfulness-based interventions, somatic therapies, and expressive arts—further support recovery, particularly in cases of complex trauma. These interventions address the physiological imprint of trauma, offering a holistic path to healing beyond traditional talk therapy.[37]

The Role of Positive Childhood Experiences (PCEs)

PCEs—including supportive caregivers, stable environments, and meaningful community engagement—play a critical role in buffering the long-term psychological effects of ACEs.[38] Research consistently shows that secure, nurturing relationships with caregivers foster emotional regulation, self-esteem, and resilience, even in the presence of trauma. Community involvement and strong social networks further enhance protective outcomes by providing children with a sense of belonging, purpose, and emotional safety.[39] Educational systems also serve as vital sources of support; schools that implement social-emotional learning (SEL) programs help children develop emotional intelligence, empathy, and coping skills. A stable and safe physical and emotional environment is foundational, as it allows children to develop trust, autonomy, and adaptive functioning.[40] Interventions that enhance PCEs—such as mentorship programs, early childhood education, SEL curricula, community-based youth initiatives, and trauma-informed care—have demonstrated significant success in reducing mental health vulnerabilities.[41] These approaches collectively build resilience, promote positive development, and help counterbalance the risks posed by early adversity.[19]

Societal and Cultural Considerations in the Impact of ACEs

ACEs have varying impacts across different cultural contexts due to the complex interplay between individual experiences and broader societal, cultural, and historical influences. Although the biological mechanisms underlying ACEs—such as toxic stress and emotional dysregulation—are universally present, cultural norms and beliefs significantly influence how these experiences are perceived, addressed, and mitigated.[42] Cultural values shape how trauma is internalized or expressed; for instance, in many Asian societies, where family honor is prioritized, discussions around emotional neglect or parental substance misuse may be suppressed, exacerbating unaddressed trauma. In contrast, Western cultures may encourage individual emotional expression, though stigma around mental health issues still persists.[43] Social support systems also differ across cultures; communities with strong extended family ties, such as many African or Hispanic cultures, often provide protective buffers that mitigate the mental health impacts of ACEs. On the other hand, individualistic cultures that emphasize nuclear families may inadvertently contribute to social isolation

and diminished support systems.[44] Economic and structural disparities further compound these effects, especially for children in low-income or marginalized communities, where access to mental health resources is limited and systemic inequalities persist.[45] Historical and political contexts, such as colonialism, war, and genocide, also play a role in the intergenerational transmission of trauma, particularly among Indigenous and postconflict populations where cultural disruption and identity loss are common.[46] Gender roles and intersectionality add additional layers, as girls in certain cultures may be more vulnerable to abuse, while boys are often socialized to suppress emotions, increasing their risk of behavioral issues. Marginalized groups—based on race, ethnicity, sexual orientation, or socioeconomic status—experience compounded adversity due to these intersecting identities. Finally, culturally adapted interventions are critical; therapies like CBT or EMDR may require modification to align with cultural norms. Family-based approaches tend to be more effective in collectivist societies, whereas individual therapy may suit individualistic cultures better. Incorporating local traditions and community-based models enhances the cultural competence of mental health care, making interventions more effective and accessible.[47]

Public Health Implications and Policy Recommendations for ACEs

Addressing ACEs necessitates a comprehensive public health approach that emphasizes prevention, early intervention, and systemic reform. Public awareness campaigns and community-based programs, such as the Strengthening Families Program, are instrumental in educating caregivers and promoting protective factors like emotional support and resilience. Evidence-based home visiting initiatives, including the Nurse-Family Partnership, provide critical support during early childhood, while universal ACE screening in pediatric settings facilitates early identification and intervention. Expanding access to high-quality early education further mitigates developmental risks. Policy reforms that bolster social safety nets—through improved housing, food security, paid family leave, and accessible childcare—are vital in preventing ACEs. Strengthening child welfare systems to prioritize family preservation, coupled with expanded access to mental health and substance use treatment, addresses intergenerational trauma. Promoting PCEs, such as strong caregiver bonds and inclusive educational environments, enhances resilience and counteracts the long-term effects of adversity. Implementing trauma-informed systems across healthcare, education, and social services fosters trust, safety, and empowerment, thereby increasing engagement and improving health outcomes. Culturally sensitive care is crucial in addressing disparities, especially among marginalized communities. Coordinated cross-sector responses and universal trauma screening ensure holistic, person-centered care. Moreover, robust data collection systems and longitudinal research are essential for tracking ACE prevalence, evaluating interventions, and informing policy decisions.[47] Ultimately, trauma-informed public health systems not only prevent the recurrence of trauma across generations but also lay the foundation for healthier, more resilient communities.

Conclusion

ACEs have lasting impacts on mental health through interconnected neurobiological, psychosocial, and epigenetic pathways, elevating the risk of mood disorders, substance use, and complex trauma. However, these trajectories are not fixed. Resilience, social support, and culturally grounded protective factors can buffer these effects and support recovery.

This manuscript offers a multidisciplinary synthesis of how ACEs shape mental health outcomes across the lifespan, integrating perspectives from neuroscience, psychology, cultural frameworks, and public health. Unlike studies that treat ACEs in isolation, this review highlights cumulative and systematic impact—linking early adversities to complex trauma, relational disruption, and broader societal disparities. Central to this analysis is the role of PCEs and trauma-informed, culturally responsive intervention as vital counterbalances that promote healing and post-traumatic growth.

Key takeaways underscore the need for early, sustained, and culturally attuned interventions; policies that advance social equity and intergenerational healing; and systematic approaches that prioritize both scientific evidence and cultural humility. Ultimately, addressing ACEs is not solely a clinical concern—it is a public health mandate and a social justice imperative. By embracing a comprehensive, equity-driven approach, individuals and communities can transform adversity into resilience and build a foundation for lifelong mental wellness.

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