**Childhood Trauma, Brain Development, and the Path to Intervention**

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**Abstract**

This literature review investigates how childhood trauma changes brain development and affects children's emotional regulation, academics, and risk of disorders such as ADHD and PTSD. Existing research has shown that trauma disrupts key brain regions, including the amygdala, hippocampus, and prefrontal cortex, while also changing stress hormones like cortisol. This literature review examines neuroscientific and psychological studies on the biological and behavioral effects of trauma. This paper highlights patterns in existing literature that reshape neural pathways, emotional dysregulation, and overlapping symptoms with disorders like ADHD. Studies show childhood trauma is embedded in the brain, resulting in long-lasting fear responses, which can lead to struggles in academic and social settings. Brain plasticity and the potential of early interventions, such as trauma-focused cognitive behavioral therapy, can prevent long-term harm. Trauma research highlights the importance of early detection and support. Implications will be discussed.

**Lede Summary**

Childhood trauma alters brain development, stress response, and emotional regulation. This research reviews literature to highlight neurobiological impacts and the importance of early intervention for children ages 2-12.

**Introduction**

Childhood trauma is a serious issue that affects children as young as three (De Young, Kenardy, & Cobham, 2011). Childhood trauma has many forms and consists of physical neglect, physical abuse, emotional abuse, and sexual abuse (McKay et al., 2021). Around 25% of American children have experienced trauma by the age of 16 (Peterson, 2018). This early trauma, whether at the hands of families or other prominent figures, affects children biologically and mentally (De Bellis & Zisk, 2014). Childhood trauma is associated with the development of post-traumatic stress disorder (PTSD), marked by anxiety, intense flashbacks, and trauma triggers, which develop after someone witnesses or experiences a traumatic event (van der Kolk, 2000).

PTSD, which results from trauma, causes significant changes in various key brain regions, including the prefrontal cortex, which is responsible for organizing and prioritizing information; the hippocampus, which forms long-term memories; and the amygdala, which adds emotional significance to memories as well as detects threats (Cross, Fani, Powers, & Bradley, 2019). Not only does trauma lead to the formation of triggers, but it also leads to early maturity due to reduced cortical thickness (McLaughlin, 2020). Cortical thickness helps with regulating emotions, and reduced cortical thickness explains how people with PTSD can't regulate emotions. Early puberty is a sign that the child's brain is being forced to mature more quickly, which increases the risk of mental health problems later on (Miller, 2025). Traumatized children are shown to act differently than children who aren't, through high startle responses, hyperarousal, disassociation, and developmental impairments. Many traumatized children develop PTSD, which can lead to a hard time functioning daily (Cruz, Lichten, Berg, & George, 2022). People who have gone through childhood trauma have a higher chance of lower cognitive function in adulthood than those who haven't (Goodman, 2020). In one study, the processing speed of 1,312 adults declined due to childhood trauma (Petkus, Lenze, Butters, Twamley, & Wetherell, 2018). However, the correlation between the trauma-related triggers from PTSD and neurobiological systems and emotional regulation is not fully understood. This paper aims to discover more connections between the developing brain in children and how it affects academic development, emotional regulation, and their tendency to develop Attention Deficit Hyperactivity Disorder (ADHD) and Attention Deficit Disorder (ADD).

Although current research may already display how trauma impacts emotional regulation, memory, and development, and how PTSD causes changes in the brain (Cross, Fani, Powers, & Bradley, 2019). There are some gaps, such as the formation of specific triggers and learning more about how early puberty and trauma can impact behaviors.

**Literature Review**

***The Brain and Trauma: An Overview***

Childhood is a unique period for brain development, characterized by high plasticity. Neuroplasticity is when neural pathways are formed and adapted based on experiences, causing functional changes within the brain (Puderbaugh & Emmady, 2023). During the early years, the brain is more vulnerable to changes impacting the brain structure. This can lead to long-term changes in neural circuits (Auerbach & Delport, 2018).

Children's brains go through synaptogenesis, where the brain creates a huge network of connections, exceeding the number that the adult brain will need (Holt & Mikati, n.d.). Synapses begin early and decline from synaptic pruning as the child goes into adulthood, where the connections are pruned back for a maximized output (Sakai, 2020) (Sakai, 2020). The process makes the brain more receptive to the environment in both positive and negative ways (Mishra, Patni, Hegde, Aleya, & Tewari, 2021). In safe environments, plasticity can promote cognitive growth, healthy social interactions, and emotional regulation. In toxic environments, the pathways strengthened are the more fear-related ones, meaning children will experience more intense stress without support and have trouble in areas involved with emotion and decision making, disturbing the development process (Perella, 2025).

The hypothalamic pituitary adrenal (HPA) axis controls the body's stress response, and when a child goes through trauma, the axis can become overactive. This HPA axis is part of the neuroendocrine system, which releases cortisol to respond to stress, creating a feedback loop of hormones to regulate stress (Cleveland Clinic, 2024). The activation of this axis is repeated and increases cortisol and other hormones, which can alter growth and synaptic connectivity (Sharan & Vellapandian, 2024). Imbalanced cortisol responses are shown in people who have experienced childhood abuse. Cortisol helps the body respond to stress; however, in abused children, their responses are imbalanced and are either too high or too low. Their bodies become more sensitive to stress as they grow into adolescence, which leads to magnified reactions. This process is called sensitization (Brown, Bennet, Rapee, Hirshfeld‐Becker, & Bayer, 2020). This leads to traumatized children feeling more stress, activating the HPA axis in response, causing hyperactivation (Murphy et al., 2022). These shifts affect how the brain processes emotions and memories and can reprogram circuits for fear and emotional regulation, and affective memory. This leads to trauma survivors developing hypervigilance and increased intrusive memories. This also forces them to figure out the distinction between past problems and the present safety (Sherin & Nemeroff, 2022).

***Key Brain Regions Affected by Trauma***

Trauma during early development has long-lasting changes on brain function, especially in three important brain regions: the amygdala, hippocampus, and prefrontal cortex. They are responsible for detecting threats, memory, and emotional regulation, which can become dysregulated in traumatized children (McEwen, Nasca, & Gray, 2015). Brain systems get rewired when repeatedly exposed to trauma, which may lead to children in chronic fear with reactions that are difficult to control. There are studies where physical markers are shown in the brain scans, indicating brain flow. Brain scans from PTSD have more activity within the emotional brain regions, whereas healthy brain scans have blood flow in the bottom of the brain. (PTSD UK, 2009; Cross, Fani, Powers, & Bradley, 2019).

The amygdala, also known as the brain's fear center, has a crucial role in identifying threats and triggering responses. In children who have experienced trauma, this region starts to become hyperactive, making the children more reactive to something non-threatening (Aleksandra Barberini et al., 2024). Studies demonstrate that in children who experience early trauma, the amygdala becomes more active than usual when seeing negative emotional facial expressions or negative emotional scenes (Belleau et al., 2020). Children with PTSD are more sensitive to emotional indicators, even when not in real danger. This can lead to PTSD symptoms such as hypervigilance and outbursts. In another study, researchers established that structural changes in the amygdala occur, where there is more volume in the brains of traumatized children (Davis & Hamner, 2024). This most likely occurs due to heightened activity because of overwhelming fear. When there are interruptions in the amygdala and prefrontal cortex connectivity, the trauma can also lower the brain's ability to regulate proper fear responses (Leite, Esper, Junior, Lara, & Buchweitz, 2022). This is a complex problem as the child grows into adolescence, as this is when emotional control develops (de Voogd et al., 2025). This can lead to the amygdala misinterpreting neutral faces as threatening, which can increase difficulties in trauma-affected children (Samaey et al., 2024).

The hippocampus is another crucial brain region that stores and retrieves memories. Studies have presented that stress from trauma can physically shrink the hippocampus, which leads to the brain having difficulties with properly forming and organizing memories (Jeong et al., 2021). This explains how PTSD affects people as they feel as if they are reliving traumatic events and struggle to separate their current reality from their past trauma. Another study on adolescents with PTSD demonstrates that hippocampal size was notably smaller in the individuals with early trauma (Acheson, Gresack, & Risbrough, 2012). This reduced size correlated with many more severe symptoms, such as stronger flashbacks, emotional distress, confusion, etc. These changes in the hippocampus lead to obstructed learning, more confusion while stressed, and tenacious fear even in safe environments. Research from the University of Michigan elucidates that hippocampal function is correlated with an overgeneralization of fear, which is a symptom of PTSD (Joshi, Duval, Kubat, & Liberzon, 2019). Children with trauma fail to distinguish safe and threatening environments, which results in widespread anxiety (McLaughlin & Lambert, 2017). The subregion, the

posterior hippocampus, supports memory retrieval and processing, while the anterior hippocampus can connect more with the amygdala and the HPA axis (Greicius et al., 2003). Connectivity between the posterior hippocampus and the brain's network, an area to self-reflect and have a level of understanding, is shown to be reduced in children with trauma. The anterior hippocampus has disrupted communication with emotional regions and can lead to a sense of fear (Malivoire, Girard, Patel, & Monson, 2018; Admon, Milad, & Hendler, 2013). Both subregions become disrupted, leading to children also having difficulties academically, as it becomes harder to retain new information as well as to engage and follow instructions.

Finally, the prefrontal cortex is responsible for critical thinking, impulse control, and emotional regulation. This brain region develops more slowly than the other two regions and is more sensitive to stress. When trauma happens early, it can interrupt the development and make the brain less capable of regulating the amygdala and managing emotional responses. This imbalance of the hyperactive amygdala and the underdeveloped prefrontal cortex leads to a disequilibrium of emotions and poor decision-making (Aleksandra Barberini et al., 2024). A second study proclaimed that trauma-exposed children show lower activation in the prefrontal cortex when trying to control emotional responses. This low activity leads to difficulty in calming themselves during struggles and can result in impulse decision-making as well as a will to take risks (Koenigs & Grafman, 2009). More research displays that early trauma reduces gray matter in the prefrontal cortex, which lowers attention and behavioral regulation. The repeated activation leads to high levels of cortisol, which interferes with the growth of neurons, which is what gray matter is made up of. With less gray matter and weaker neural connections, the prefrontal cortex loses its ability to manage impulse control and attention (Gorka, Hanson, Radtke, & Hariri, 2014). This contributes to children exhibiting symptoms similar to ADHD, such as being easily distracted, hyperactive, and impulsive. This weakened control from the region can explain how traumatized individuals are more subject to substance use or self-harm as a coping strategy (Lobo et al., 2011). This is due to it being harder for them to manage emotions in healthy ways and needing something to cope with the overwhelming feelings.

All together, these vital brain regions form a complex network that is responsible for detecting threats, interpreting danger, regulating emotional responses, and forming memories. Trauma during this early development interrupts the system at various levels, such as overactivating threat detection in the amygdala, shrinking memory processing in the hippocampus, as well as delaying regulation and control functions in the prefrontal cortex (Herringa et al., 2013). These regions are not independent, and when they operate in isolation, the communication resulting from trauma leads to the brain becoming hyperreactive, emotionally vulnerable, and overwhelmed (Greene, Black, & Schlaggar, 2016). These prominent changes can explain why children exposed to trauma can be misdiagnosed or develop symptoms of ADHD, anxiety disorders, or PTSD (Shore, Posey, Berkower, Ontjes, & Babik, 2024). As the brain rewires in response to chronic stress, it results in fear responses embedded in the brain as well as emotional instability, reshaping the developing mind (Bick & Nelson, 2015).

***Neurobiological Changes***

Childhood trauma triggers cause neurobiological changes that alter the brain's stress regulation systems, making individuals more vulnerable to disorders such as ADHD, ADD, and anxiety. Repeated trauma affects the HPA axis and the body's core stress response system. Studies signify that chronic exposure to stress can lead to an elevation of cortisol response levels, causing disruptions in the brain's normal stress recovery (Russell & Lightman, 2019; McEwen, 2017). This can promote a more heightened state of emotional dysregulation (Sherin & Nemeroff, 2022). This dysregulation can damage function, attention, and emotional regulation, which are all stereotypical symptoms of ADHD and anxiety disorders. Studies of neuroimaging exhibit that children with PTSD have abnormal activity in the prefrontal cortex and hippocampus (Corominas-Roso et al., 2015). As a result, children with trauma can appear inattentive or hyperactive due to trauma-induced changes in their developing brains (McLean, 2016).

Neurobiological disruptions can extend beyond the brain into the hormonal and immune systems. Children with trauma convey long-term imbalance between cortisol rhythms. These refer to the natural daily fluctuations in the levels of cortisol. Cortisol follows a daily, diurnal cycle where it peaks early in the morning, called the cortisol awakening response, and then gradually declines throughout the day, reaching low levels when going to sleep (Andreadi et al., 2025). Diurnal slopes refer to the normal pattern of cortisol levels rising and falling throughout the day (ZRT Laboratory, 2019). Lower morning levels or flat diurnal slopes are correlated with poor emotional regulation, anxiety, and an interruption in the normal cortisol rhythm (Bowirrat et al., 2010). Research displays that disruptions can explain why traumatized children are more likely to be diagnosed with disorders like generalized anxiety or depression, or misdiagnosed with ADHD (Szymanski, Sapanski, & Conway, 2011). These overlapping symptoms between trauma and neurodevelopmental disorders can make diagnosis difficult. Inflammation markers can be elevated in trauma-exposed children, which indicates a physiological stress response that prepares the body

for hypervigilance (De Bellis & Zisk, 2014). This chronic stress contributes to the cycle of emotional dysregulation and poor attention control.

Research also suggests that trauma-related brain changes lead to structural changes in those with neurodevelopmental disorders, similar to disorders like ADD and ADHD. Children's brains depict reduced volume in the corpus callosum, which is the bridge that connects the left and right sides of the brain (Bowirrat et al., 2010). When the connection between the left and right sides of the brain is reduced, it affects how well the brain integrates thinking and emotions. The connectivity between the prefrontal cortex and the limbic system, which is a system with emotions, especially the amygdala, can lead to impaired decision-making and self-regulation (Bowirrat et al., 2010). Trauma changes the functioning of neurotransmitters like dopamine and norepinephrine, which are also involved in ADHD (Seven, 2022). Therefore, it is essential for doctors to accurately distinguish between neurobiological changes caused by trauma and attention disorders.

Cortisol, dopamine, and norepinephrine are crucial hormones and neurotransmitters. Neurotransmitters carry signals between nerve cells in the brain and nervous system, and hormones travel through the blood to reach organs and tissues all over the body, regulating long-term processes. This can change how trauma can be easily triggered and resurfaced in childhood PTSD. Low cortisol levels can weaken the body's ability to regulate stress responses (Russell & Lightman, 2019). Corticotropin-releasing hormone (CRH) triggers stress hormone release, and noradrenergic circuits, involving norepinephrine, become overactive and intensify fear and arousal. This can cause the alarm systems in the body to be constantly prepared for any threat (Sherin & Nemeroff, 2022). When an individual with PTSD faces a trauma reminder, their body, specifically the HPA axis, does not produce enough cortisol to calm the stress response. This is called cortisol braking, and the lack of it releases the chemical norepinephrine from the locus coeruleus. This chemical makes the body alert and ready to react, and the heightened release of it can fuel hyperarousal, causing attention fixation on assumed threats. This can lead to exaggerated startle responses (McCall, 2024). Dopamine dysfunction, especially in reward or stress-regulating circuits, can weaken emotional control and feed intrusive memories. If dopamine signaling is changed, becoming too high or too low, it locks trauma memories in places that can intensify PTSD triggers (Pan, Kaminga, Wen, & Liu, 2018). Too much catecholamine activity, a group of stress-related chemicals including dopamine and norepinephrine, can make the brain encode certain events as extremely important. This leads to emotional salience, where the event feels more intense, making it harder to forget (Sherin & Nemeroff, 2022). These dysregulated hormones can permanently embed traumatic memories and also lower the threshold for being triggered again, perpetuating the cycle of hypervigilance and emotional reactions.

***Behavioral Impacts***

Emotional dysregulation, the difficulty of returning to an emotional baseline, from childhood trauma, leads to fast mood swings, anxiety, and impulsivity. These symptoms correlate with PTSD and disrupt daily functioning in school and home environments. An analysis of research and diagnostic issues clarifies how emotional dysregulation with childhood trauma and PTSD contributes to long-term development and psychiatric issues (Dvir, Ford, Hill, & Frazier, 2014). Another study highlights how trauma damages emotional, behavioral, or cognitive development, which can include attention or self-regulation (Gregorowski & Seedat, 2013). Trauma may also trigger regressive behaviors, where children may revert to earlier developmental stages, such as bedwetting, clinginess, tantrums, thumb sucking, and baby talk (Oberheim, Barlow, & Nescott, 2024). These behaviors are coping strategies when the stress overtakes the child's ability to regulate their emotions or to process experiences properly. Studies also reveal that chronic trauma changes the brain's stress response, which further damages the regulation of fear (Abbas Alameddine, 2025; Furley et al., 2023). This regression emphasizes the developmental disruption that trauma causes, especially when their sense of safety is threatened.

Trauma-exposed children may struggle in academic settings or relationships, as trauma can impair classroom behavior or learning, which results in a loss of motivation for school, poor grades, discipline, or absenteeism (Miller, 2025). Behaviors like social withdrawal, impulsivity, aggressiveness, and defiance can cause a strain in peer and adult relationships, harming social development (Gregorowski & Seedat, 2013). Regression also has an impact in school, which may lead to academic struggles as children with trauma may struggle with skills they had before, such as reading, math, or basic classroom routines. As children slip back to their younger selves, it reflects trauma's ability to alter attention and memory (Oberheim, Barlow, & Nescott, 2024). They also regress socially by becoming overly clingy to teachers and certain peers, and developing an overly dependent attachment style (Cruz, Lichten, Berg, & George, 2022). Children may also have a response of dissociation, where they freeze and try to separate themselves from the experience. It starts to be used as an automatic defense mechanism. Children may unknowingly exhibit this behavior while learning, in the classroom, or socially, which can impact their brain's ability to fully engage, potentially causing damage in social or school life (The National Child Traumatic Stress

Network, 2018). These academic challenges can increase the risk for becoming school dropouts, losing faith in their future, suicidal thoughts, and a long-term socially challenging experience (Yao et al., 2023).

Trauma also affects attachment and psychosocial development. Studies on attachment disorder, such as Reactive Attachment Disorder (RAD) and Disinhibited Social Engagement Disorder (DSED), prove how early neglect interrupts healthy emotional connections (Zeanah & Gleason, 2015). Developmental trauma affects emotional awareness and communication skills, which makes it difficult for children to build trust and participate in social interactions (Wang et al., 2018). Regression in children can lead to early attachment-seeking behaviors, such as being overly attached, indicating signs of separation anxiety, and wanting constant reassurance. Cruz et al. disclose that disruptions in caregiver and child relationships lead to children distancing themselves completely from other people as a defence against "future stress" or gaining an overly dependent attachment style. In terms of attachment styles specifically, avoidant attachment is when children minimize their emotional expression and try to appear independent as a coping mechanism. PTSD can lead to both extremes of attachment responses (Cruz, Lichten, Berg, & George, 2022). Some children who develop chronic depression due to trauma and academic struggles may become so accustomed to emotional pain that they eventually stop trying to improve.

This is called learned helplessness, or behavioral inertia, where repeating failure to change the conditions leads to a belief that nothing can help (Liu, Kleiman, Nestor, & Cheek, 2015). This helplessness reduces motivation and makes depressing emotions feel safer and familiar, discouraging recovery. This is associated with symptom persistence and suicidal risk (Liu, Kleiman, Nestor, & Cheek, 2015). These behaviors can exemplify the child searching for safety but also their feelings of cautiousness with mistrust and isolation, intensifying PTSD symptoms in adolescence and adulthood (Gregorowski & Seedat, 2013).

***Early Intervention***

The brain is plastic throughout life, especially in childhood and adolescence. This makes early intervention crucial as it can prevent long-term consequences of childhood trauma. Early therapeutic activities reduce the severity of PTSD symptoms and can even change brain structures involved in stress regulation (Garrett et al., 2019). Supportive environments and positive relationships can improve recovery and provide children with the stability needed for healthy developmental growth. Without early intervention, traumatic stress will disrupt normal neurodevelopment and can increase vulnerability to anxiety, depression, or cognitive function (Cisler & Herringa, 2021). Early detection of symptoms is important as well as children may not physically disclose their suffering, but it may be exposed in different changes in behavior or academically. Finding and acknowledging these symptoms early on can help prevent long-term damage and maladaptive coping mechanisms, which become harder to treat in adulthood (Wadsworth, 2015). Early treatment helps stabilize stress hormone regulation and reduces risk of chronic PTSD symptoms. Intervening early manages symptoms, as well as reshaping how the brain processes stress and trauma (Joss, Lazar, & Teicher, 2020).

The most effective early interventions are trauma-focused cognitive behavioral therapy (TF-CBT), which helps children refocus their trauma-related thoughts and emotions. This is a non-traditional modality for ganglion blocks, a cluster of nerve cells. It is a service for children and their safe caregivers to use behavioral principles to address the situation and to reduce post-traumatic stress (de Arellano et al., 2014). Studies demonstrate that TF-CBT reduces PTSD symptoms and strengthens the prefrontal control of the amygdala, regulating emotional regulation. (de Arellano et al., 2014; Cisler et al., 2015; Falconer, 2013). Other approaches, such as mindfulness practices, can support recovery by reducing hyperarousal and intrusive memories as attention control begins to improve (Boyd, Lanius, & McKinnon, 2018). There are various therapeutic methods, including clinical interventions, cognitive rehabilitation, exposure therapy, group therapy, and pharmacotherapy. These approaches demonstrate how targeted interventions leverage the brain's adaptability, fostering flexibility and resilience in the face of change, and can help reverse maladaptive stress responses. Combining therapies is often crucial for achieving stronger outcomes, as it addresses the multiple dimensions of trauma (Theodoratou et al., 2023).

Beyond therapy, early interventions with family support, school programs, or community resources can promote recovery pathways as well. Family support can reduce the child's stress reactions and strengthen the caregiver's role. Psychoeducation and coping skills training normalize children's emotional responses while simultaneously teaching caregivers to stabilize the environment (Goodrum & Prinz, 2022). School programs increase students' accessibility to intervention. Substance Abuse and Mental Health Services Administration, SAMHSA, a program for mental health, provides School-Based Trauma-Informed Support Services (TISS), a grant program that embeds mental health support into the child's daily environment. Teachers and school staff can

recognize trauma symptoms and use trauma-informed approaches to benefit the children. (SAMHSA, 2024; Sonsteng-Person & Loomis, 2021). Community Resources integrates trauma-informed services, such as clinical care, caregiver support, early childcare, etc. Community-based play therapy can help young children to process trauma when access to formal therapy isn't available (Koukourikos et al., 2021). Evidence shows that early psychological and behavioral interventions can reduce the neuropsychological effects of trauma, such as memory disruptions and impaired functioning (Kerbage, Bazzi, El Hage, Corruble, & Purper-Ouakil, 2022). Strengthening safe caregiving relationships can buffer the children from the harmful effects of trauma, improving long-term social and emotional outcomes (Tymofiyeva & Gaschler, 2021). Plasticity explains how interventions can have such a long-lasting impact. The developing brain is malleable, leading children and adolescents to have a greater capacity to rewire circuits involved in emotional regulation (Joss, Lazar, & Teicher, 2020). Therapy and supportive relationships enhance plasticity by reinforcing neural pathways with safety and trust. Studies exhibit that interventions targeting neuroplasticity may prevent trauma from forming into long-term psychiatric disorders, emphasizing the power of early support to promote recovery (Theodoratou et al., 2023; Bailey, Trevillion, & Gilchrist, 2019; Melton et al., 2020). With coordinated care, intervention can become sustainable and impactful, leading to healthy development.

**Discussions/Conclusion**

Ultimately, evidence makes clear that trauma alters the brain in ways that impact behavior and development. The amygdala, hippocampus, and prefrontal cortex do not operate in isolation, and trauma disrupts their connectivity, which explains the difficulties in emotional regulation, memory, and threat detection (Kredlow, Fenster, Laurent, Ressler, & Phelps, 2022). This explains children feeling constant danger in safe environments, struggling academically, and reliving constant trauma (Peterson, 2018). Hormonal dysregulation, especially with cortisol, sets off feedback loops fueling anxiety and hyperarousal. This establishes how these biological changes translate into behavioral struggles. These cycles can be difficult to end unless interrupted by early interventions (Murphy et al., 2022).

Timing is also crucial, as trauma during early childhood is in the sensitive times of brain development. This leads to lasting effects compared to trauma that occurs later in life (Teicher & Samson, 2016). Social and environmental contexts also shape how trauma unfolds. Supportive caregivers and safe school environments can mitigate the neurological impact, while unstable homes, poverty, and abuse can magnify it (Pember & Pettit, 2025). External factors like these actively interact with the brain, either helping recovery or causing more cycles of fear. However, the brain stays plastic throughout life, and treatments with trauma-focused CBT, mindfulness, and safe environments can improve brain function and emotional regulation. Early intervention prevents trauma from becoming long-term and encourages the possibility of healing (Calderone et al., 2024). Future research suggests treatments should be tailored to individual neurobiological profiles, developing strategies that can address symptoms and brain and hormonal changes. Understanding how trauma alters brain systems, hormones, and is shaped by the environment will open pathways for more solutions and actions. Childhood trauma can be redirected to recovery with safe social environments and caring relationships.

**Conflicts of Interest**

There are no identified conflicts of interest.

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