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Neurobiology of Trauma and Mindfulness for Children

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ABSTRACT

Adverse child experiences (ACEs) have a significant impact on developing children, both physically and psychologically, with ongoing consequences that may manifest throughout adulthood. These negative health consequences can be mitigated if a child is given a supportive environment in which to develop healthy coping mechanisms. Those who specialize in caring for children with ACEs must understand the neurobiology of trauma to conceptualize how trauma triggers the brain and body when encountering stressful events. Mindfulness is an evidence-based practice that can be used as a healthy coping mechanism to develop self-regulation and resiliency in children. The purpose of this article is to provide evidenced-based research on the neurobiology of trauma and mindfulness intervention as a recommended modality for use in children. Furthermore, the content in this article was utilized in developing a training module for a suburban, youth organization that provides residential housing, basic necessities, education, and therapy for children with ACEs. The training module is intended to assist staff members in understanding the neurobiology of trauma and mindfulness techniques in their interactions with the children, thereby improving child–staff relationships and encouraging the development of self-regulation and healthy coping mechanisms.

Key Words

Children, Mindfulness, Neurobiology of trauma

According to the National Center for Mental Health Promotion and Youth Violence, 60% of adults report experiencing abuse or other difficult family situations during their childhood—also called adverse child experiences (ACEs)—with 26% of children witnessing or experiencing their own traumatic event before the age of 4 years (Negrini, 2016). Traumatic experiences for children may consist of community and personal violence, maltreatment, neglect, natural disasters, accidents, medical illness, and grief (The National Child Traumatic Stress Network, 2017). Furthermore, trauma may be experienced as a single event or on prolonged, multiple occasions, both of which can negatively affect the child in the same way (The National Child Traumatic Stress Network, 2017).

Understanding the neurobiology of youth who have undergone trauma is essential for those individuals providing care and services to this vulnerable and at risk population. When there is a traumatic event or ongoing situation in which the child is in danger, his or her brain initiates neurochemical changes internally that result in external behavior and actions (Leitch, 2017). Consequentially, some of these children have behavioral problems, trouble at school, and difficulty making and maintaining relationships—due in part to maladaptive, neurochemical changes in their brain because of inflicted trauma (Children's Bureau, 2014).

When these children, who may be labeled as "troubled," disobey commands and/or do not follow rules, adults can become very frustrated after their attempts at correcting the situation are unsuccessful. The adult's reaction, fueled by frustration and lack of understanding, may actually trigger the child further. Adults who care for youth who have undergone trauma need education on understanding the internal neurobiology of trauma to comprehend the external actions of the child and care for them appropriately. It is only then that the adult may be able to effectively engage with the child and mitigate the potential for triggering the child into crisis mode (Leitch, 2017).

In addition to understanding the reasoning behind a child's behavior and actions, finding ways to respond to the child who has experienced trauma in a calm, loving, and supportive manner is important for the child's growth. Mindfulness, the human ability to be fully aware of what is going on in the present moment, can be a tool that facilitates maturation in the ability to regulate emotions and actions in an appropriate manner (Bethell, Gombojav, Solloway, & Wissow, 2016). Children and adults can use mindfulness in their daily life to effectively cope when confronted with triggers. Numerous studies have statistically proven the efficacy of mindfulness programs and modalities in the youth population to manage triggers and provide resiliency in emotional regulation (Allen et al., 2012; Frewen, Rogers, Flodrowski, & Lanius, 2015;

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Ortiz & Sibinga, 2017; Sanger & Dorjee, 2015; Sibinga, Webb, Ghazarian, & Ellen, 2016). Mindfulness is a safe, low-cost, and beneficial modality that can be used as an adjunct with therapy and medication management to improve the resiliency and emotional regulation of children who have experienced ACEs or traumatic events (Ortiz & Sibinga, 2017).

PURPOSE

The justification for training on the neurobiology of trauma and mindfulness intervention was identified after conducting a Needs Assessment as part of a master's graduate nursing course in April of 2017 at a suburban, youth organization that provides residential short- and long-term housing, education, basic necessities, and therapy for children who are between household placement and have undergone traumatic situations with evidence of behavioral issues. The authors first observed and informally interviewed both the adults (staff) and children (residents) in the organization in an effort to collect data on perceived areas of improvement within the organization. After this initial interaction, a survey was developed to elicit additional information from the adult staff members regarding the needs of the organization identified during informal conversations. The survey asked the staff to rank the organization's needs in order of importance in five areas and included increase the community's awareness and knowledge of the services provided at the organization; increase the training/education for staff on how to care for children who have experienced trauma; increase training/education opportunities for staff on providing medical care to children with physical health needs; increase training/education opportunities for staff on how to participate in self-care strategies to improve stress management and burnout; and increase training/education for staff on how to engage in collaborative teamwork, effective communication, and positive staff, work relationships. Survey results revealed that the majority of the respondents felt that they needed a deeper understanding on the neurobiology of trauma and how this phenomenon can affect staff-child interactions.

As a result of these findings, an evidence-based practice project was developed to educate staff at this organization on care of youth who have experienced traumatic events or ACEs. The goal of this education is to provide staff with a better understanding regarding the neurobiology of trauma and how it results in the child's behavior and actions. Furthermore, the project will provide staff with mindfulness interventions, tools, and resources that have been proven successful coping mechanisms after trauma. The mindfulness modality was chosen specifically by the authors due to personal interest, feasibility of the intervention, and demonstrated effectiveness in the child population. With the education and intervention, staff will be better equipped to care for the children, thereby improving their mental, emotional, and physical health outcomes.

LITERATURE REVIEW

Neurobiology of Trauma

Understanding the neurobiology of trauma can be helpful for those who care for children who have experienced trauma. Trauma is exceedingly stressful on the mind and body. Although mild or moderate stress can be positive and beneficial to development, severe or chronic stress may be associated with physiological and psychological negative health consequences (Hornor, 2017). ACEs can lead to severe and/or chronic stress and thus the aforementioned negative consequences. With repeated stress, physical changes in the brain and hormonal imbalances throughout the body occur. Those effects and negative consequences are a result of neurobiological changes, including the peritraumatic recruitment of the body's stress system known as the hypothalamic–pituitary–adrenal (HPA) axis (Hornor, 2017).

The HPA axis is responsible for the neuroendocrine adaptation component of the biological stress response (Nungent, Goldberg, and Uddin, 2016). When encountering trauma, the hypothalamus releases corticotropin-releasing hormone (CRH). This hormone then binds with the CRH receptor on the pituitary gland to release adrenocorticotropic hormone (ACTH). ACTH then causes the adrenal cortex to stimulate the adrenal release of cortisol (stress hormone). Cortisol can be released for several hours after the traumatic event and binds to glucocorticoid receptors until a certain blood concentration is reached (Nungent et al., 2016). This receptor serves as an important role in the negative feedback loop of the HPA axis. The negative feedback loop allows for systemic homeostasis by deactivating the release of cortisol once the right blood concentration is reached (Nungent et al., 2016).

With frequent exposure to trauma, the HPA axis will have repeated and sustained activation resulting in consistently high levels of stress hormones, thus chronically affecting the immune and inflammatory processes (Nungent et al., 2016). The repeated activation of the HPA axis during critical periods of brain development in early childhood can lead to changes in gene expression that alter the function of distinct parts of the brain that underlie adult emotional and cognitive behavior and functioning (Hornor, 2017).

Studies have shown that chronic activation of the HPA axis and an elevated level of cortisol can lead to heightened reactivity to new stressors (Danese & Baldwin, 2017). Consequently, after enduring ACEs, children are more likely to have triggers. A trigger is a stimulus that causes the child to relive some aspect of

a traumatic experience. Although the reaction is to a completely different situation, it reminds the child of the original traumatic event (Children's Bureau, 2014). This can cause children to react similarly to their previous ACEs, activating their HPA axis once again. Their response to the trigger reflects a reflex that may have been an important reaction for survival and what kept them alive in their past unsafe situation. Triggers may include smells, sounds, tastes, visual, physical, significant dates, stressful events, thoughts, behaviors, and emotions (Children's Bureau, 2014).

Facing these triggers, youth struggle with self-regulation and impulse control, oftentimes engaging in risky behavior not considering the consequences of their actions (The National Child Traumatic Stress Network, 2017). They may behave in ways that are unpredictable, oppositional, and volatile. Furthermore, feelings of powerlessness or fearing an abusive adult figure may cause the child to respond defensively and aggressively, or alternately be rigid or unusually compliant, in response to perceived blame or attack (The National Child Traumatic Stress Network, 2017). Although children may not have control over their emotions and reactions when confronted with their triggers, there are ways to help them regain control. Children are resilient and their brains are pliable at a young age. Supportive relationships, responses of adults, and building a sense of hope and control over their life through means such as mindfulness can facilitate physical and psychological growth in children who have been through ACEs (Hornor, 2017).

Mindfulness for Children

Mindfulness is not a new concept and has been practiced in some form since the beginning of human existence. It is a purposeful awareness of one's presence through breathing, thoughts, emotions, and sensations without judgment (Bethell et al., 2016). Mindfulness is commonly practiced and studied in the form of yoga, deep breathing, meditation, biofeedback, guided imagery, and hypnosis, but can be applied in almost every activity, whether in a structured or unstructured method (Bethell et al., 2016). The key to mindfulness is an unbiased awareness that allows the individual to consciously choose to respond to the situation or environment, instead of automatically reacting in a programed approach. It is well studied and applied as a successful and effective intervention in the adult population; however, it is understudied and underutilized in the youth population and only considered after complete failure of conventional modalities (Bethell et. al, 2016).

Mindfulness has been studied diagnostically on magnetic resonance imaging to evaluate concrete proof for changes in the brain with implementation and practice (Allen et al., 2012; Leitch, 2017; Sanger & Dorjee, 2015). Mindfulness has been well hypothesized to regulate changes in the brain through heightened self-awareness (Allen et al., 2012). In doing so, the brain generates new neurons (neurogenesis) that are reinforced (neuroplasticity) during learning and practice, developing resiliency and prosocial behaviors (Leitch, 2017). Specifically in the youth population, connections are made between relevant prefrontal structures that stabilize arousal and reduce harmful risk-taking (Sanger & Dorjee, 2015). The changes in the brain impact top-down processing in early cognition control and bottom-up processing in more extensive application to increase affective sensitivity (Allen et al., 2012). Changes on a neurobiological level negate the acute response to trauma or ACEs and also inhibit the underlying consequences (Ortiz & Sibinga, 2017). This permits a well-rounded approach as both a preventive and therapeutic modality in ongoing, healthy brain development.

In evaluating high-quality, structured, mindfulness programs implemented with youth, multiple positive outcomes have emerged to encourage the application of mindfulness (Ortiz & Sibinga, 2017). These outcomes analyzed by Ortiz and Sibinga (2017) are compiled from 11 studies conducted in the youth population from 2007 to 2016. Outcomes include decreased anxiety, rumination, stress, somatization, depressive symptoms, suicidal ideation, conflict avoidance, posttraumatic stress disorder severity, and hostility. In addition, prosocial behaviors such as effectiveness in social gains, improved attention, and greater well-being have been identified. These studies validate a reduction in negative effect symptoms, with improved adaptation, attention, and self-regulation in the youth population (Ortiz & Sibinga, 2017).

Mindfulness is a practical way to self-regulate and build resiliency in the youth population (Leitch, 2017). Through structured methods, there is a better capacity for problem-solving and strategic thinking (Ortiz & Sibinga, 2017). This allows youth to choose responses instead of automatically reacting (Ortiz & Sibinga, 2017). This change in the neurobiology and neuroplasticity develops an enhanced mind–body connection in managing emotional regulation from acute and chronic stressors stemming from ACEs and trauma in children (Ortiz & Sibinga, 2017).

Evidence-Based Project

An evidence-based project was developed in response to the results of the aforementioned Needs Assessment conducted at the suburban, youth organization. The project was a PowerPoint presentation training module composed of 33 slides with supplemental information in the notes section. This was the chosen format, as it allowed for both visual aids and written content to be presented in a practical, manageable way to staff.

The first half of the module focuses on understanding the neurobiology of trauma, whereas the second

half explains the mindfulness modality concept and implementation. The science of childhood trauma is explained through a video courtesy of the Office of Justice Programs (2016), through the definition supplied by The National Child Traumatic Stress Network (2017), through the neurobiology of trauma mechanism explained by Nungent et al. (2016), and through a video on toxic stress courtesy of the Center on the Developing Child at Harvard University (2011). Thereafter, the physiological and psychological effects during childhood as described by the Children's Bureau (2014) and those manifested in adulthood described by the Centers for Disease Control and Prevention (2016) are illustrated. Next, content is presented that focuses on understanding triggers identified by the Children's Bureau (2014), Trauma Informed Care as explained by Leitch (2017), and Trauma-Based Cognitive Behavioral Therapy explained by the National Therapist Certification Program (2017). The first half of the module ends with a summation of the information presented to bridge to the next section on mindfulness modality as a successful intervention.

The second half of the module explores the mindfulness definition, the mindfulness impact on trauma and ACEs, research studies on mindfulness in the youth population, structured and unstructured methods, recommended techniques for staff, and additional resources. First, the mindfulness definition as adopted by Bethell et al. (2016) is utilized to lay the foundation. Next, the impact of mindfulness on trauma and ACEs is illustrated in a flow chart by Ortiz and Sibinga (2017). Thereafter, concepts are introduced by Leitch (2017) such as self-regulation and resiliency with image illustrations to examine the effect of mindfulness on the parasympathetic and sympathetic system. Then, evidence-based research studies are presented by Ortiz and Sibinga (2017) to demonstrate the efficacy of the mindfulness intervention. Once this link is established and validated, various structured mindfulness programs are introduced such as Jon Kabat-Zinn's mindfulness-based stress reduction (Sibinga et al., 2016), mindfulness and metta-based trauma therapy (Frewen et al., 2015), and mindfulness-based cognitive therapy and mindfulness-based relapse prevention (Ortiz & Sibinga, 2017). In addition, mindful-based, mind–body methods as described by Bethell et al. (2016) are described. The authors chose recommendation of four mindful-based, mind–body methods because of ease and practicality of the modality. The four methods chosen include the 4-7-8 breathing technique (Gozenonline, 2012a), 3-minute meditation (Gozenonline, 2012b), I am meditation (Gozenonline, 2017), and body scanning (Gozenonline, 2016). The training module ends with the author's recommendations for future direction and desired outcomes, list of additional references, and all resources utilized.

DISCUSSION

The training module was given to the organization's directors to e-mail staff members for viewing on their own time. This indirect approach was convenient to the agency and will allow for a potential greater amount of staff to view the presentation. In addition, staff will be able to save the presentation on their computers and rereview at a later time. The additional material provided in the notes section of the presentation, videos, and resources will assist staff in furthering their own personal research from a basic foundation provided in the module.

Although an indirect method of presenting allowed for convenience of the organization and ability for all staff members to review the training on their own time, it did pose limitations in analysis of functional benefit. It is unknown whether or not staff will actually receive and review the training module; however, the organization's directors have reviewed the module themselves and are able to send to staff through a mass e-mail. The authors did not have access to the organization's employee e-mails to e-mail themselves. Ideally, it would have been optimal to present the content in person to staff and be able to answer questions and comments regarding the material. However, the authors added explanation of content in the notes section of the training module on all slides. This allows staff to review the training presentation and all notes the authors would have presented if the module was delivered in person. Nonetheless, because of the results of the Needs Assessment findings, staff showed genuine interest in learning about the neurobiology of trauma from the demanding and stressful interactions in their daily job. This training module offers staff an opportunity to review content that is research based, clear, and concise as a supplement to developing healthy, staff-child interactions.

Clinical Implications

Working with children who have encountered trauma and ACEs is an arduous job. Although the majority of staff held master's degrees, most lacked a concrete understanding of the neurobiology of trauma as applied in their youth population. With a better understanding of how the brain processes and responds to trauma and triggers, staff can better engage with the children in assisting them to develop healthy, mindfulness techniques to mitigate the effects of induced trauma. This will then ease the demands on staff while engaging with the children and promote a better atmosphere for both children and staff. This module can also serve as a mandatory training for newly-hired staff in addition to current staff to ensure proper education and training is implemented across the board.

In summation, the developed training module was created for utilization among adult staff members with an end goal of improved child–staff interactions. Providing staff a basic foundation of the neurobiology of trauma will educate them of the neurochemical response automatically occurring when a child is being triggered. This will help explain the behavioral issues they may be witnessing and offer a successful, immediate intervention (mindfulness modality) they can teach children to promote self-regulation and resiliency. This self-regulation and resiliency will improve the overall health and well-being of the children from an enhanced mind–body connection that is able to mitigate the acute response to trauma or ACEs and also inhibit underlying consequences of chronic stressors both physically and psychologically.

KEY POINTS

- Understanding the neurobiology of youth who have undergone trauma is essential for those individuals providing care and services to this vulnerable, at-risk population.
- Mindfulness is a practical way to self-regulate and build resiliency in the youth population.
- With a better understanding of how the brain processes and responds to trauma and triggers, staff can better engage with the children in assisting them to develop healthy, mindfulness techniques to mitigate the effects of induced trauma.
- A developed training module on the neurobiology of trauma and mindfulness-based modality for utilization in children will assist both current and prospective staff in optimal child–staff interactions.

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