



How trauma 'gets under the skin': Biological and cognitive processes of child maltreatment

CHILDREN'S MENTAL HEALTH eREVIEW



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The children’s mental health eReview summarizes children’s mental health research and implications for practice and policy.

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RESEARCH SUMMARY

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Introduction

During early childhood, the mind and body undergo a period of rapid growth and change. Consequently, this time of development is particularly sensitive to the effects of stress, as environmental factors can influence internal architecture in many ways. As such, there are numerous ways that stressful, traumatic experiences can “get under the skin” and affect biological functioning and, ultimately, development as a whole.

When the brain detects a threat, a biological stress response is triggered. The *stress response* [words in *italics* are defined on page 10] is a series of coordinated activity within the body that results in physiological changes such as increased heart rate and slower digestion, providing the body a surge of energy and strength. Threats can be subtle or overt and may include loud noises, anticipatory stress due to an upcoming exam, heightened awareness of a dangerous animal in the wild, unexpected assault or robbery by a criminal, or harm or anger by a caregiver. Stress responses are adaptive to threatening situations that a person encounters because they provide the person with the necessary resources to deal with the threat. However, chronic stress can constantly activate the stress response and cause damage. Serious trauma in which a child is exposed to chronic, severe, and prolonged stress constitutes what is referred to as *toxic stress*. Child maltreatment is a form of toxic stress in

which caregivers physically, emotionally or sexually abuse or neglect children. Forms of child maltreatment can vary in severity, frequency, and duration. In the context of trauma



such as child maltreatment, chronic activation of various stress responses can cause the body to continuously produce stress hormones. This prolonged period of stress is toxic to the individual and can be detrimental as it creates “wear and tear” on the body and can seriously impact life and development – a concept known as *allostatic load*. This review will discuss:

- the numerous ways trauma can affect biological and psychological (cognitive and emotional) responses to stress,
- how these alterations can induce behavioral changes that promote the development of mental health problems, and
- how this information can be integrated into intervention strategies to help regulate stress responsivity in children experiencing trauma.

The effect of trauma on biological processes and the impact of biological responses on behavior

Effect of Trauma on Stress Chemicals

Many different chemicals are released in the body when a threat is detected, and the release of these chemicals is part of the body’s biological stress response. Many of these chemicals are part of the body’s major stress regulatory system, called the *hypothalamic-pituitary-adrenal (HPA) axis*. The

main job of the HPA axis is to control reactions to stress and prepare the body for fight or flight. Being able to fight off or flee from attackers effectively helped our ancestors stay safe in different contexts, so this system stems from the evolutionary need for protection. Activation of the stress response system via the HPA axis results in increased heart rate and blood pressure, elevated production of stress hormones, greater energy flow to skeletal muscles, and heightened attention to surroundings. This direct effect of environmental stress is designed to allow the body to quickly and efficiently respond to environmental signals – to allow a person to pay close attention to the threat and respond accordingly. However, those exposed to chronic trauma such as maltreatment have been shown to have difficulty shutting down the stress response system even after the threat is gone, and this is harmful to the child.¹ In fact, much research has shown that many traumatized children have altered levels of the stress hormone *cortisol*, which is a key regulator of the stress response following initial activation. There is evidence of both elevated as well as suppressed cortisol levels in maltreated children.^{2,3} Altered levels of cortisol can place traumatized children in a *stress-reactive state*, a condition in which the body is biologically prepared to respond to threat (e.g., increased heart rate, stress chemicals, etc.). Those who remain in a stress reactive state for long periods of time can damage multiple physiological systems. High levels can be toxic to internal organs, including the brain, whereas low levels can subject the child to immune-related disorders.⁴ Additionally, high concentrations of stress chemicals are related to serious physical health complications such as heart attack, stroke, and cardiac/vascular lesions that include death of cells in the heart and vascular tissue as well as calcification of the heart.⁵

Importantly, it has been found that childhood maltreatment can influence cortisol production by impairing a child’s social relationships. In a study of maltreated and non-maltreated children, maltreated children displayed less prosocial and more disruptive, aggressive, and withdrawn behaviors.⁶ These behaviors, in turn, were related

to altered cortisol levels over time. To demonstrate, we can imagine a young boy, Billy, who is maltreated. The constant experience of maltreatment keeps his heart rate and stress hormones elevated. These physiological reactions affect his developing organs by damaging the tissues and can lead to physical health complications. Further, Billy’s experience of maltreatment affects the way he interacts with his peers at school. He is more aggressive and disruptive, causing his peers to dislike him. The impaired relationships Billy has with his peers are additional stressors beyond the maltreatment he experiences at home, and it further contributes to his stress response (e.g., cortisol production). All of these things keep Billy’s body in a stress-reactive state and leave him susceptible to further physical and mental health problems later in life.

Childhood maltreatment can influence cortisol production by impairing a child’s social relationships

Constantly elevated stress chemicals can also directly lead to behavioral changes. Increased levels of stress chemicals have been shown to facilitate the maintenance of traumatic memories by prompting the individual to re-experience the emotional and physiological state he/she experienced during the traumatic event.⁷ This may happen due to the fact that the experience of a threat increases stress chemicals and an individual’s attention to their surroundings. Heightened attention to surroundings during the experience of trauma combined with recurrent and chronic elevations of stress chemicals maintains traumatic memories, which can impair behavior by causing distress, as reminders of the trauma that previously happened can be very upsetting. Additionally, chronic biological and psychological hyperarousal obstructs overall functioning as it interferes with a child’s ability to pay attention, complete tasks, and learn new skills. Psychiatric illnesses and mental health problems such as depression and post-traumatic

stress disorder (PTSD) can form as a result of ruminative thoughts about traumatic memories and can further impair social and emotional functioning. These types of disorders have been further linked to physical health complications such as heart disease, rheumatoid arthritis, diabetes, and fibromyalgia, demonstrating the cycle of negative effects of chronic trauma.^{4,5} Additionally, biological processes can interact with an individual's underlying genetics as well as the environment producing a propensity toward developing these physical and/or mental health problems. The interconnectedness between biological consequences of stress and behavioral manifestations demonstrates a type of feedback loop among chronic stress, hyperarousal of the stress system, genetic susceptibility, physical complications, behavioral impairments, and mental health outcomes in traumatized children. In particular, chronically traumatized children can remain extremely vulnerable to stress reactivation as a result of a low stress threshold that is highly sensitive to threat and can easily be triggered back into a state of full hyperarousal. Therefore, levels of stress that may be more manageable to non-traumatized children can be overwhelming to traumatized children. This event perpetuates the cycle of reactivity and both direct and indirect damage to mental and physical health in children exposed to trauma

Effect of Trauma on Immune Functioning

Chronic activation of the stress response by trauma has far-reaching effects on related regulatory systems, such as the immune system. The immune system is closely linked to the HPA axis; therefore, when the HPA system is not functioning properly, the immune system is also negatively affected. Studies have examined alterations to the production of immune cells in traumatized individuals. Though most studies have been conducted in adults who recall childhood traumatic events, evidence supports that changes to the production of immune cells appear dependent upon timing and severity of trauma experienced in childhood. Chronic trauma like maltreatment is associated both with excessive immune cell production as well as mental disorders that develop subsequent to

trauma, such as PTSD.⁸ Further, severity of trauma symptoms is related to immune cell production, where more symptoms correspond to higher immune cell counts.⁹ High levels of cells that sustain or initiate inflammation can increase feelings of anxiety. In a study where individuals were given a substance to enhance production of inflammatory cells, those with high levels of cells reported increased feelings and severity of anxiety.¹⁰ Relatedly, high levels of inflammatory cells can damage the brain. Decreased brain growth has been associated with high levels of pro-inflammatory immune cells in traumatized individuals.¹¹ That is, high amounts of inflammatory cells destroy brain tissue, resulting in decreased growth. Thus, chronic stress can affect immune cell production, which can then damage brain development, with consequences for mental health.

It is important to note that brain areas affected by high levels of immune cells are also involved in the mediation of anxiety. These brain areas include the amygdala and hippocampus, which together comprise major networks of the brain that interpret and elicit fear responses and fear memories [Figure 1].

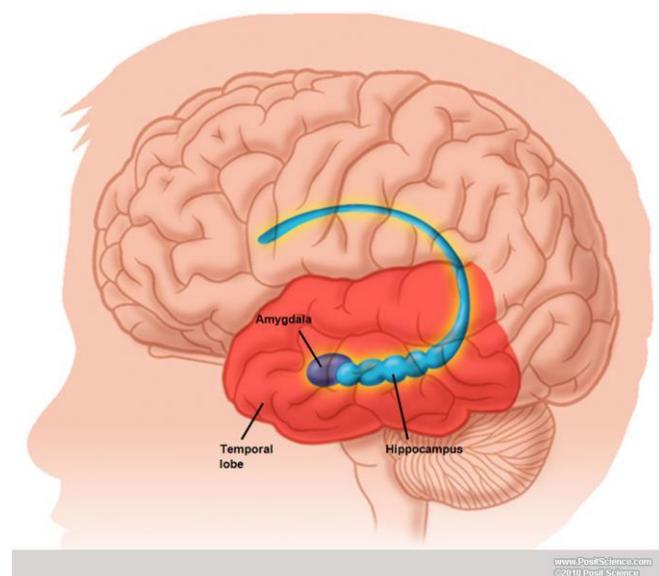


Figure 1.

Neural destruction in the hippocampus and amygdala could contribute to the initiation of fear responses, fear conditioning, and retrieval of

traumatic memories, all of which are symptoms of PTSD.¹² Destruction in these areas could then indirectly keep the stress response activated as fear responses and retrieval of traumatic memories would keep the individual in a state of heightened stress. Further, since increased levels of immune cells can result in impaired development in the hippocampus, brought about by destruction of neurons in the hippocampus by the inflammatory cells, this may relate to the reduced brain size of the hippocampus that has often been documented in individuals with trauma-related mental disorders.¹² It is possible that reduced hippocampal volume occurs subsequent to trauma-induced inflammation, which then disrupts appropriate growth of the hippocampus at critical periods of development. Reduced volume of the hippocampus can then lead to a disrupted fear response in certain situations, and ultimately lead to behavioral dysregulation in traumatized children.



Trauma can similarly affect the process by which cells age. Individuals reporting a history of childhood maltreatment have significantly shorter telomeres, which indicate advanced cellular aging.¹³ *Telomeres* are important “caps” on DNA (similar to the coating on a shoelace that prevents the shoelace from becoming unraveled) that protect DNA as it replicates during cell division. Importantly, shorter telomeres associated with childhood maltreatment are present even after removing the contribution of health-destructive factors like smoking and obesity. Further, advanced cellular age related to shorter telomere length has been implicated in death due to age-related illnesses such as Alzheimer’s, heart disease, and stroke.¹⁴ The shortening of

telomeres, then, has important health implications for children experiencing maltreatment.

Epigenetic Mechanisms of Early Trauma

The evidence above suggests that the effect of trauma on the body is widespread; the breadth of impact is a result of biological systems that are vast interconnected webs of subsystems and processes. A mechanism through which maltreatment can affect this broad range of biological systems involves epigenetics.

Epigenetics refers to changes to the function of genes that ultimately affect whether a gene is or is not expressed. Epigenetic changes involve specific markings added to or removed from the genetic structure which program DNA to express certain genes at certain times and in certain places within the body across time.¹⁵ Gene expression is critical to development depending on regions of the gene expressed and typicality of the expression. One of the best examples of how epigenetic changes can trigger differences comes in considering identical twins. Identical twins share 100% of their genes, yet they can be very different from one another in multiple ways. Sometimes, one twin is a bit taller and looks slightly different. Also, many times identical twins can have very different personalities and behaviors. How could it be that identical twins are never exact clones, yet they share the exact genes? The answer is that epigenetic changes can affect which genes get expressed, and this is what creates differences. Epigenetic changes can be provoked by the environment. Oftentimes, when an epigenetic mark is added to a gene it prevents a gene from becoming expressed. Alterations to already-existing epigenetic marks can promote expression of genes at inappropriate times. Thus, epigenetic alterations are significant in development because they impact gene expression, which, in turn, affects health and behavior.

In the epigenetic model, traumatic environmental exposures modify the function of a gene and subsequently alter an individual’s response to later traumatic experiences.¹⁶ Thus, adverse experiences can become programmed into a

child's biology via epigenetics. Studies demonstrate that maltreated individuals have increased epigenetic markings on genes involved in the stress response - including the glucocorticoid receptor gene.¹⁷ Importantly, the observed increase in epigenetic markings on the glucocorticoid receptor results in less expression of this gene which is responsible for turning off stress responses. A failure of the glucocorticoid receptor gene to be expressed means that stress response activity of the HPA axis cannot be "shut down", resulting in a persistent activation of the stress response, as well as the numerous alterations that result from hyperarousal. As previously discussed, dysregulation of the HPA axis is an important link between childhood maltreatment and later onset of stress-related mental and physical disorders. Most alarmingly, evidence suggests that epigenetic modifications can be inherited by future generations.¹⁸ Heritability of epigenetic modifications adds a new layer to the concept of intergenerational transmission of trauma, where the persistence of stress reactivity among generations of families may be biologically explained by inheritance of epigenetic markings, triggered by the environment to which the parent was exposed.

Traumatic environmental exposures modify the function of a gene and subsequently alter an individual's response to later traumatic experiences.

The effect of trauma on cognitive processes and the impact of cognition on physiological systems

It is clear that the biological response to stress involves closely coordinated activity of several different processes. Trauma can impact each process simultaneously, leading to changes throughout the entire biological system. These facts demonstrate how environmental exposures can internally transform an individual, and reveal just some of the innumerable ways trauma can influence physiological systems, allowing trauma to "get under the skin" and affect the physical

and mental health of children. At another level, trauma, particularly maltreatment, can affect the way children think about and interpret the world around them. As a result, stressors in the environment may become more salient or threatening, perpetuating chronic activation of the stress response.

Early trauma in the form of child maltreatment triggers alterations in neurophysiological reactivity towards threat, subsequently augmenting the experience of stress. Home environment and early parent-child relations serve as social support for the child and a safe haven for acquiring appropriate and flexible emotional processing and regulation. However, maltreating caregivers typically exhibit constrained socioemotional communicative behaviors¹⁹ and emotional expressivity²⁰, thereby limiting children's ability to develop adequate self-regulatory and coping mechanisms. Maltreating mothers' ability to express internal states and emotions has significant effects on their children's ability to communicate and recognize other's emotions.^{20,21} Therefore, those reared in abusive or neglectful homes are placed in a suboptimal environment for adaptive emotional development. As such, maltreated children are bound in their socioemotional growth by interactions at home such that those exposed to chronic abuse become hypervigilant toward threat-relevant stimuli. Anger is especially salient in individuals exposed to child abuse, which is mirrored in their amplified neural reactivity and attention towards negative emotions.^{22,23} Research suggests that greater responsivity to angry expressions permit greater threat recognition at the expense of other emotions.²³ Consequently, the disproportionate allocation of attentional, cognitive, and neural resources expended on threat perception and detection leads maltreated children to suffer from reduced capacity to process and understand other emotional states while hypersensitizing to expressions of anger. Further, trauma-induced alterations to threat perception/detection can both influence as well as be modified by internal biologic hyperarousal, demonstrating the intimate

connection among maltreatment, biological systems, and cognitive systems.



Developmental processes that allow trauma victims to adapt to their volatile environments can evoke adverse effects on neurobiological functioning and emotion regulation. Abused children are more sensitive and biased in their

perception of anger. It is likely that a neutral situation to which a maltreated child is exposed will be interpreted as threatening, thereby increasing feelings and reactions of stress. For example, a situation where a classmate accidentally bumps into a maltreated child in the school hallway may be interpreted as malicious instead of accidental occurrence. As a result, the maltreated child will feel threatened and will have a host of stress reactions to this perceived threat. This over-sensitivity toward threat that maltreated children may have can be adaptive in the context of their violent homes. For example, the ability for a maltreated child to detect that a violent parent is angry will help the child avoid further interaction with the caregiver. Thus, this poses as an adaptive strategy for survival for these children. On the other hand, over-attention and misperception of threat in typical peer situations prompt maltreated children to react with hostility and violence. Consequently, young children from abusive homes overreact emotionally to stress, act more aggressively in challenging situations²⁴, and show difficulties with self-control.²⁵ Emotion dysregulation then predisposes the child victims to dysfunctional social relationships outside of the home (e.g., peer victimization, peer rejection),²⁴ which in turn contribute to additional “acting out” behaviors

otherwise known as externalizing symptoms.²⁵ This vicious cycle of cognitive biases, poor emotional control, and social relational difficulties can impact the biological stress response system by holding the trauma victim in a hyperaroused state. Altogether, early trauma generates a cascade of maladjusted perceptual and cognitive processes, which aids in shaping and is molded by dysregulated neurobiological regulatory networks, such as cortisol production as noted above. In effect, chronic exposure to social and emotionally impoverished families may cause an individual to psychologically and biologically cope with stress in a maladaptive manner, which in turn magnifies the risks of developing psychopathology.

Intervention strategies

Interventions can lessen the intensity and severity of a child’s response to trauma, which in turn can decrease the likelihood of developing sensitized biological and cognitive reactions that lead to the persistence of symptoms. However, to date, investigations on efficacy of interventions or empirically based treatments for maltreated children are lacking. Currently, only a handful of studies have empirically demonstrated successful intervention efforts on biological and psychological health of maltreated children and their relations with their maltreating caregiver. Several of these investigations indicate that the intervention, child-parent psychotherapy, helps foster mutuality and positive emotions between parent and child. The underlying model for this type of intervention emphasizes the parent-child attachment. Early attachment to caregivers permits us to form representations of relationships, which refers to the way we perceive relationships to work. Therefore child-parent psychotherapy targets the maltreating caregiver and child attachment to effectively alter the way mother and child perceive a functional, healthy relationship. Maltreated children who completed an adapted version of child-parent psychotherapy with their mothers increased their expectations of a positive mother-child relationship after the intervention, indicating an evolving anticipation that the caregiver is safe, responsive, and reliable

in times of need.²⁶ These children further demonstrated less maladaptive maternal representations post-intervention, meaning that they perceived mothers to be less negative, controlling, and contradictory in their behavior. Child-parent psychotherapy was further shown to increase the sense of security with the caregiver, otherwise known as attachment security.^{27,28} More recently, the utility of this intervention measure proved to impact biological functioning in maltreated children.²⁹ Maltreated infants who were given the child-parent psychotherapy with their caregivers demonstrated a normalization effect in their stress regulatory control. After the intervention, cortisol regulation of these infants became increasingly similar to their non-maltreated peers such that differences between cortisol levels of the two groups eventually dissipated.²⁹ Altogether, child-parent psychotherapy is a potentially valuable intervening method for victims of childhood trauma such as home violence.

Despite the emerging reports indicating the robust effect of psychotherapy on the relational and physiological outcome of maltreated children, current research severely lacks in-depth knowledge of alternative interventions thereby limiting treatment options. To our knowledge, studies on maltreatment have suggested a multitude of implications for treatment and intervention programs targeted toward children from violent home environments; however, few have conducted empirical work to offer evidence to attest these postulations. Future directions in developmental psychopathology research and the treatment of early trauma should integrate both empirical findings and practitioners' observations to form appropriate therapeutic measures founded on scientific evidence. Through such collaboration between both academic and applied fields of psychology, significant strides in prevention of dysregulated behavioral and physical health can be made.

Glossary of terms

Allostatic load - wear and tear on the body caused from frequent activation of the stress response as a result of repeated or chronic stressful experiences

Cortisol - one of the major stress hormones produced by the HPA axis. Too much or too little of this hormone is harmful as it is also a key regulator of the stress response - where certain levels of cortisol serve as a signal to either shut down or turn on stress response activity

Epigenetics - literally means "above" or "on top of" genetics; includes changes to the structure of DNA in the form of specific markings which ultimately affect whether a gene is expressed

Hypothalamic-pituitary-adrenal (HPA) axis - the body's major stress regulatory system; produces stress hormones that contribute to the stress response

Stress-reactive state - a period in which the body's stress response is turned on

Stress response - coordinated activity within the body resulting in physiological changes such as increased heart rate, slower digestion, heightened attention to surroundings, and a release of particular hormones; provides the body a surge of energy and strength to deal with threatening situations

Telomeres - important "caps" on DNA (like the coating on the tip of a shoelace) that protect DNA from "breaking" during cell division

Toxic stress - chronic, severe, and prolonged stress that is more than an individual can deal with and is detrimental to well-being

IMPLICATIONS FOR PRACTICE AND POLICY

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This review of recent research increases our understanding of the impact of toxic stress on the biological and psychological systems of the human body. It provides evidence that prolonged periods of stress are toxic to the individual and can be detrimental to development. Greater Minneapolis Crisis Nursery provides support for highly stressed families living in Hennepin County. The Crisis Nursery offers voluntary family support services to families who have experienced crisis directly related to the effects of extreme generational poverty such as trauma, maternal depression, domestic violence, homelessness, isolation and lack of education. Families who access Crisis Nursery services are primarily young, single mothers with children under the age of six. They are women who are motivated to create a better environment for their children. The Crisis Nursery offers a continuum of care including a 24-hour crisis line, provision of resources, voluntary overnight childcare, parent support groups and an intensive home visiting service.

Children and families who use Crisis Nursery services have experienced some form of trauma. As a result, they experience many of the effects described in this review (altered cortisol levels, high arousal and anxiety, dysregulation, immune reactions such as asthma and skin conditions, etc.). High states of arousal compromise a child's perception of the world, ability to learn and relationships with others. This affects their development, reactions, behavior, and what is needed from the Crisis Nursery. Thus, staff and volunteers need additional skills and support to do this work. Based on the research in this review and from many other sources, the Crisis

Nursery has modified its care protocols to meet the needs of the families it serves. These protocols are called The Nursery Way. In short, The Nursery Way protocols were developed to implement care practices that support resilience and promote coping skills for both parent and child.



One of the founding tenets of the culture of Greater Minneapolis Crisis Nursery is to ensure that all parents/guardians and their children believe they can expect help and feel safe, nurtured and supported by all staff and volunteers. Part of The Nursery Way has been to train staff and volunteers to work in this way with children. Children need the same caring, consistent, supportive interactions with all adults with whom they come in contact. Specifically, children with high anxiety and/or arousal have difficulty with change and transition, so we establish clear routines, create picture schedules of the daily activities, and remind the children regularly of what is happening during their stay. We make our work as transparent as possible. Also, children in crisis can feel as if everything happening to them is out of their control, so we teach children that they can expect help, especially help to cope with the stress of being away from home. We do this by providing children with predictability, controllability and social supports. By providing such an environment, children feel a sense of security and responsibility and they learn that they can trust all staff at the Nursery. It is important for us to explain that “this is how we do it at the Nursery”. We are not here to make judgments about what the child experiences elsewhere; we want to deliver care that fits the

child's needs at this time of high stress and crisis. Children who are stressed may act out toward the people around them or completely shut down and remove themselves from everything. Both show us that the child needs help, so we talk with parents about how the child might be feeling when they act this way. We don't need to know all the details about what caused the child's stress to provide good care – children in crisis need this type of responsive, predictable care regardless of their individual experience.

This research review defines toxic stress as “serious trauma in which a child is exposed to chronic, severe, and prolonged stress”. Much of the review focuses on child maltreatment as a form of toxic stress. However, we know from previous research that isolation, poverty and parental mental health disorders can also create stress reactive states in children. These factors together with a host of additional environmental factors increase the risk of child abuse and neglect. Although these factors may not reach the threshold of maltreatment, they certainly contribute to toxic stress and must not be overlooked when creating strategies to address the impact of toxic stress. The research on the impact of toxic stress together with the research on the protective factors compels professionals to continue to work toward prevention. At the Crisis Nursery, we do this work by helping parents manage these high stress situations in order to prevent maltreatment. The protective factors help to inform our work with parents. Staff members work with the parents to increase their coping skills, identify their needs and connect them with resources to help alleviate their current crisis. In addition, staff members provide parents with an opportunity to talk about the parent/child relationship and increase their knowledge of child development.

This research review introduces the idea of epigenetics, which relates to our work with parents. An individual's environment can affect how a parent's genes function, and therefore how she responds to trauma. Parents in crisis are affected not only by what is happening today but also what has happened to them in the past. In

an effort to empower parents around issues related to parenting, we offer them a safe place to talk about their lives and struggles, discuss what it's like to parent their child, and learn about developmental milestones in childhood. We honor the fact that they do the best they can given their circumstances. All of the work we do with children we also do with parents because they have the same experiences and needs. Parents have experienced violence, poverty, depression, isolation, etc. and they also need predictability and control in their lives and supportive relationships. Our work with them helps them understand the experiences of their child. Our interactions with parents are informed by research related to resilience and protective factors – parents help identify the resources they can build on as well as where they need help. With these in mind, parents set goals for themselves during each intake session. We recognize that asking for help in managing this stress takes a tremendous amount of courage. We understand that families who voluntarily choose to access services are vulnerable and want to keep their children safe.



The research in this article may indicate that families in a heightened state of arousal may be less receptive to receiving help, but research tells us that this stress actually makes them open to new experiences and learning; an opportunity for growth and change. The Crisis Nursery acknowledges that such families need different kinds of support and strategies because of these stresses. We believe that parents/guardians who access Crisis Nursery Services want what is best for their children and will do whatever it takes to

make that happen. No parent/guardian sets out to put their child in harm's way. Yet whether due to mental illness such as depression, stress caused by poverty, or the inherent challenges of parenting, any parent can reach a breaking point. We as a society need to work toward decreasing the risk factors associated with maltreatment and work toward increasing protective factors in all families. No one agency or person can end child abuse and neglect. Many are a part of the formula- parents who have the courage to ask for help, agencies that respond with trauma informed care protocols and professionals who counsel and follow up with parents and children. We all must be part of the solution by encouraging people to ask for help and responding when they do.

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This eReview about how trauma “gets under the skin” is particularly relevant to clinicians working with chronically stressed and traumatized populations from a mind-body medicine perspective. It highlights that a mind-body approach, which addresses the interconnected psychological and biological consequences of trauma, needs to be at the forefront of services rendered along with other psychological interventions. These other psychological services include parent child psychotherapy (addressed in this eReview) and other evidence-based trauma interventions, such as eye movement desensitization and reprocessing (EMDR) and trauma-focused cognitive-behavioral therapy (TF-CBT). From a clinical perspective, it is important to consider early intervention and a varied, multi-modality approach for treatment of post-traumatic stress disorder (PTSD).

There is a growing body of empirical evidence for the efficacy of mind-body skills (MBS), including meditation, guided imagery, hypnosis, biofeedback, and yoga, lowering anxiety, improving mood, and treating the symptoms of PTSD¹⁻⁶. In addition, clinical experience tells us that children learn these self-regulation skills

quickly and enjoy learning how to be the “boss of their bodies.” Family-focused interventions are also important, as parents’ need these skills too! Parent child psychotherapy is enhanced when we include information on the stress response and help parents manage their own emotions and stress. We must help parents understand that often what has been labeled as “bad” or maladaptive behavior (or has been diagnosed as a clinical disorder) in their children is triggered by stress (in both mind and body), epigenetics and a child’s ineffective way of coping with this stress. In children, trauma shows up in their behavior, manifesting as emotional irritability, anger and aggression, social withdrawal, inattention, anxiety and/or depression, and impacts their perceptions and beliefs of self, other and world.

During early childhood, the body and brain are vulnerable to the effects of stress. As mentioned in this eReview, chronic stress and trauma result in changes to brain development, immune functioning, cellular performance and aging (telomeres), the chronic release of stress chemicals and the function of our genes (epigenetics). These changes increase the risk for psychological, behavioral, and academic problems, as well as chronic illnesses. However, it is not just the presence of chronic stress/trauma, but how one copes with that stress/trauma that determines the ultimate impact it will have on an individual’s life. Teaching children and parents self-regulation skills changes their responsivity to stress. This is vitally important, especially for chronically maltreated children who are vulnerable to stress reactivation as a result of a low stress threshold, dysregulation of the HPA axis and epigenetics.

Fundamentally, pediatricians, parents and policy-makers agree that young children who become *more involved* in their own physical and mental health become healthier, happier and more productive adults. However, there is significant debate about the most effective interventions that contribute to health and wellness. From an Integrative Medicine perspective, key factors include good nutrition, regular exercise and learning self-regulation skills. Childhood is the

ideal time to develop these healthy habits. Clinically, we see that with as little as two 10-minute mind-body practice sessions per day, children experience less behavioral problems, better attention, more positive mood and anxiety reduction. Although these skills can be learned individually with a trained mental health and/or health provider, teaching these skills in groups through schools and/or community programs is ideal for maximizing an individual's capacity for self-care and restoring hope for traumatized populations.

1. Enhancing emotional regulation skills, stress management and social connection for traumatized youth has the potential to facilitate the full range of positive psychological, behavioral, academic and health outcomes. However, in order to fully address how stressful and traumatic experiences can “get under the skin” we need to: Educate the public on how chronic stress and trauma impacts biological functioning and subsequent physical, emotional and behavioral health, and how mind-body skills increase a child's ability to cope following acute or chronic trauma. The pertinent research included in this eReview should also be incorporated into professional training programs for mental health providers, teachers and other professionals who work with children and families.
2. Provide comprehensive and innovative school wellness programs which include mind body skills, nutrition, exercise and group support for *all* children. When we include these easy-to-learn, practical “life skills” into the regular curriculum we help all kids grow healthy brains and we have the added potential of reaching traumatized children who never have the opportunity to receive mental health services. These mind-body skills are easily adapted to all varieties of school settings and are accepted by many with diverse ethnic and cultural backgrounds. Although some children will need specialized mental health referrals and intensive individual treatment, providing educational MBS groups as a first tier approach, or in collaboration with other treatments, is more than reasonable. Research indicates that mind-body skills groups are very attractive to children,

parents, teachers and school administrators and have a positive impact on problematic responses to stress and trauma¹⁻³.

3. Provide services and treatment models that care for the child, family and community. Childhood trauma occurs within a relational context. We must provide parents, teachers and the community with skills so they can support their children.
4. Increase access to services by making group therapy the standard for learning self-regulation skills. Mind-body skills groups are cost-effective and provide a sense of connection and support.
5. Begin teaching mind-body skills as soon as possible after a traumatic event, because fixed patterns (sleeplessness, nightmares, aggression, anxiety and fear) are harder to change. Focus on building strengths and positive coping skills in our interventions.
6. Work with the mind *and* the body. Including active meditations, yoga and exercise in all approaches should be the rule, not the exception. Children who have been traumatized are agitated and hyper-aroused in both mind and body. Movement will help break up these fixed physical and emotional patterns.



Around the world, including the United States, trauma is complicated by having limited access to skilled mental health providers. This is certainly true in Haiti, where I have worked with The Center for Mind-Body Medicine (CMBM) since the 2010 earthquake. In Haiti we first worked with the leaders of the community (educators, doctors, nurses, and religious leaders), teaching them

mind-body skills to reduce their stress symptoms, improve their mood and increase their sense of hope. We have trained and supervised over 200 Haitians who are leading MBSG in hospitals, schools, churches and communities. These caring and skilled facilitators, many who endured their own trauma and have no previous mental health training, are helping to heal the chronic trauma and stress experienced by children and adults in their communities. It is encouraging to witness children participating in MBSG experience fewer behavior problems, focus better in school, sleep better with fewer nightmares, and less anxiety. This approach has been fundamental to the healing of Haitians and I believe will improve the future for generations to come.

Mind-body approaches have grown in popularity and are widely implemented in many settings. Multiple studies have investigated the feasibility, acceptability, and potential short-term efficacy of mind-body approaches. Future research is needed to identify the mechanisms by which these approaches are effective, namely how they change brain functioning and development, and their effectiveness for long-term health outcomes. Clinical practice would also benefit from research studies that integrate the separate fields of study on attachment, trauma-focused psychological interventions and mind body medicine.

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This research on the effects of chronic stress/trauma on the human body, in particular children, has begun to illuminate how detrimental the experiences of chronic stress are and how an impact in one system affects all the other systems (e.g., physiological, neurological, and mental). American Indians have always held the belief that everything is interconnected, including the body. The research supports this belief.

Historically, American Indians promoted the concept of "living in balance" with the world around them. When a stressor is introduced, it could create imbalance. Traditionally, strong systems of support (i.e., family, tribe) assisted in creating balance after a stressor. However, with the introduction of historical trauma in the forms of forced removal from traditional lands, removal of food sources, biological warfare and genocide, American Indians have been exposed to long term chronic stress. Traditional ways of healing through spiritual practices were outlawed, limiting and sometimes preventing the ability to begin the healing process for many American Indians. This historical trauma response is passed through the generations affecting contemporary American Indians on a daily basis. American Indians experience the highest rates of health disparity in comparison to the general population. They also experience being victims of

crime and poverty in higher rates than the overall population, putting them at higher risk for future stressors. The research in this article related to epigenetics is one way of explaining how trauma can be held personally within the genes and makeup of a person, modifying and being passed on to future generations, thus setting the stage for an increased sensitivity to stress with the proper environment.



I do not believe that chronic stress or trauma is unique to the American Indian population. History tells us that many different cultures have experienced chronic stress and trauma. What we hold in common is that the response to it appears to be very similar affecting all areas of development. As a provider of mental health services I believe that the overall answer to the treatment of trauma is the same for all populations - healing and love. However, the way that each culture, family, and individual heals from trauma has to be unique to that culture, family or individual. In working with American Indians, it is imperative that you view the person holistically, ensuring that you look at all aspects of a person (physical, spiritual, intellectual, mental) and develop a treatment model that incorporates all aspects to help them “live in balance” with the world that they are living in today. In working with American Indians who are dealing with chronic stress and trauma, it is important to assess levels of cultural identity to work on providing support through cultural traditions. It is important to provide connections to spiritual and/or religious leaders to provide guidance and develop a strong support network

in the community. This helps provide support and guidance on a daily basis.

Therapeutic interventions need to focus on reducing the effects of future stressors and reprogramming the brain’s stress response system, working on de-activating it and learning how to regulate emotional responses. This is supported by the research in this article related to the activation of the stress response by trauma. Interventions in therapy should focus on teaching the individual and family emotional regulation techniques such as deep breathing, relaxation and positive imagery so they can learn that through practice they can self-regulate reactions to stress. It is important that more than just the individual in therapy learn these techniques so that behavior can be encouraged in the environment and the family can also learn the benefit of regulating themselves, thus resulting in a more adaptive environment and reducing future stressors. This process needs to occur early on before processing of trauma can occur. If there are no adaptive ways to respond to stress and trauma a person will utilize non-adaptive ways of responding to stress that increase future stressors or traumas. Without an adaptive way to respond it is difficult for an individual to manage the difficult emotions that will arise during the processing of past traumas.

Interventions or therapeutic techniques that utilize “talk therapy” can be ineffective and even damaging to healing from trauma if they leave the person with no way to manage the anxiety. This intervention can continue to activate the stress response system and keep the person at an activated level. The treatment modalities that have been more helpful in working through trauma in the American Indian population is a form of trauma focused cognitive behavioral therapy that has been culturally adapted for the population and involves the utilization of traditional stories and practices to assist the person through a rewriting their trauma narrative. I have also found Eye Movement and Desensitization and Reprocessing (EMDR) Therapy to be helpful in moving people through healing their trauma in a more non-threatening

manner, providing ways to manage difficult emotions without having to relive every traumatic memory. However, research on therapeutic practices should focus on developing a cultural adaptation of this treatment modality that reflects culture practices.

In addition, we have discovered that culturally-based groups that focus on traditional practices while learning about the effects of trauma with the whole family can be successful in American Indian populations. Within the group, they learn about traditional practices, ways of self-soothing and healing as a family with others with similar histories and beliefs. Bonds and connections are developed in a supportive manner, building a stronger connection to the community and belief structures, increasing positive connections and building a larger and stronger support network.

Interventions need to focus on the family and the community as a whole. Efforts to help the community heal through traditional practices and community events that focus on support will create strong connections, which ensures more support for all people. Spiritual and traditional practices need to be supported on a macro level, including within schools, larger institutions and through support on a legislative level. Advocacy also needs to occur within the health care industry with health dollars put towards traditional practices as a way to provide healing and reduce mental health issues. Given the wide-ranging effects of stress and trauma described in this review, these types of activities should be viewed as a preventative mental health strategy to reduce the probability of mental and physical health issues in the community. The research indicates that individuals who have a strong and healthy support network through family and community have lower rates of mental and physical health problems.

Regarding service delivery to this population, providers who are not familiar with American Indians need to be educated on the history and effects of trauma. In addition to education they need to become involved in the American Indian community as a whole, attending and participating in cultural events, pow-wows and

spiritual events when appropriate or asked by members. This participation and involvement in the community builds connections and trust with the very people you are invested in helping to heal. It also helps to inform and improve the services you are providing to this resilient people. It takes trust in a provider to begin the healing process and helps to build future avenues of trust with other cultures.

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