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Supporting the Mental Health Needs of Youth Through Neurobiologically-Informed Approaches

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A research project submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

for the degree of

Educational Specialist

Department of Graduate Psychology

May 2023

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Dedication

This project is dedicated, with tremendous gratitude, to the many folks who have shown me the importance of curiosity, compassion, connection, and play.

“Safety is the treatment”

-Stephen Porges

“Relationships are the agents of change, and the most powerful therapy is human love.”

-Bruce Perry

“One gift of nonjudgmental, agendaless presence is that a wide road of acceptance opens, so that the inner world of our people gradually begins to sense, experience and trust that every part is equally valued and equally welcome.”

-Bonnie Badenoch

Acknowledgements

Thank you to my family for always being in my heart and reminding me that I am held securely in yours. Thank you to my incredible spouse, Harrison, for helping me remember to cherish each moment, interaction, and opportunity. Thank you to my brilliant cohort for adventuring alongside me. Thank you to my committee chair, Dr. Amanda Evans, for singing my song back to me and believing in me. Thank you to my committee members for generously sharing your time, energy, and expertise with me. I hold deep appreciation and gratitude for those who walked with me through this journey.

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Abstract

Many children and adolescents are experiencing increased mental health challenges, resulting in a serious public health crisis. Mental health providers must apply innovative, research-based, and developmentally responsive intervention to meet the current mental health needs of youth. Neurobiologically-informed approaches, such as Polyvagal Theory, the Neurosequential Model of Therapeutics, and Interpersonal Neurobiology, could be used to support children and adolescents appropriately and effectively across a variety of settings. These approaches apply principles of neuroscience, acknowledge developmental considerations, and attend to the impact of trauma. This project reviews mental health trends in children and adolescents, provides a brief overview of these approaches, and applies these approaches to clinical intervention through a case example.

Introduction

Children and adolescents are presenting with social, emotional, and behavioral difficulties at increasing rates (American Academy of Pediatrics, 2021; Bitsko et al., 2022). The numbers and severity of mental health challenges that youth are experiencing indicate a public health crisis, and the need for accessible and effective therapeutic resources is paramount (American Academy of Pediatrics, 2021). Steadily increasing mental health concerns in children and adolescents have been exacerbated and intensified by the COVID-19 pandemic, and the number of youths in need of counseling services now exceeds the number of available helping professionals (Abramson, 2022). Given the scarcity of therapeutic resources, many children are spending months on waiting lists or making numerous trips to the hospital to stabilize crises (Abrams, 2023). Now more than ever, counseling professionals must be adequately trained to provide therapeutic support that is developmentally and culturally responsive, evidenced-based, and innovative.

One way to address the current mental health needs and potential dysregulation in children and adolescents is through neurobiologically-informed approaches. These approaches use foundational principles of brain development and functioning to inform conceptualization and clinical intervention (Prendiville & Howard, 2016). Advances in neuroscience have generated knowledge of how the brain grows and functions, changes, interacts in relationship, and responds to environment (Badenoch, 2008; Perry, 2009; Siegel, 2012). These principles of neural development and functioning have been innovatively translated to therapeutic intervention, and several clinical approaches have emerged.

Polyvagal Theory, the Neurosequential Model of Therapeutics, and Interpersonal Neurobiology, are three neurobiologically-informed approaches that could be used to address the

current youth mental health crisis. Each of these approaches uniquely applies principles of neuroscience to clinical intervention in developmentally sensitive and trauma-informed ways. The purpose of this paper is to describe three neurobiologically-informed approaches that offer compelling frameworks for conceptualization and intervention that could be used to respond to the current youth mental health crisis and to provide specific applications of these approaches through a case example.

Mental Health Trends in Children and Adolescents

Childhood and adolescence are critical periods of life that can have an enduring impact on development, mental wellness, and overall health (Bitsko et al., 2022). Rapid brain growth occurs during these periods, and with each interaction, relationship, and experience, developing brains establish neural circuits and patterns for engaging with the world (Perry, 2009). By interacting with others and their environment, children and adolescents learn physical, emotional, relational, and cognitive skills that inform overall wellbeing and mental health (Perry & Hambrick, 2008). Mentally healthy children and adolescents meet developmental and emotional milestones, cope with stressors effectively, maintain satisfying relationships, and function well across multiple settings and environments (Bitsko et al., 2022). Children and adolescents may experience mental health challenges when they have difficulty learning, interacting, or regulating emotions to a degree that causes distress or negatively effects daily functioning (Bitsko et al., 2022). Research has shown an inextricable link between mental and physical health, and the fact that experiencing poor mental health can negatively impact physical health throughout life (Bitsko et al., 2022). While compelling evidence exists to support the brain-body connection, therapeutic support for children often overlooks this relationship in counseling interventions.

Concern regarding the number of young people experiencing mental health challenges and distress has steadily increased over the last decade. A comprehensive report from the Centers for Disease Control and Prevention examined mental health trends in youth between 2013 and 2019. According to this report, children and adolescents were diagnosed with variety of mental health disorders at increasing rates (Bitsko et al., 2022). The most common concerns included attention-deficit/ hyperactivity disorder (ADHD), anxiety, depression, and suicidality (Bitsko et al., 2022). Notably, suicide was the second leading cause of death for people between 10 and 24 years old, and enduring feelings of hopelessness increased by 40% in young people (Bitsko et al., 2022). At the time of the report, one in five children met criteria for a mental health diagnosis, yet only 20% of young people received necessary care from a mental health provider (Bitsko et al., 2022). Since the completion of this report, the mental health needs of children and adolescents have continued to intensify.

The Impact of COVID-19

The onset of the COVID-19 pandemic in 2020 considerably impacted the mental health and wellbeing of young people, compounding the already increasing distress among this population (Shivaram, 2021). This global crisis isolated children from peers and supports, disrupted familiar routines, generated educational challenges, and created an atmosphere of collective uncertainty and fear (Abrams, 2023). In 2020, emergency room visits related to mental health crises increased by 24% for children 5-11 years old and 31% for children 12-17 years old (Leeb et al., 2020) A survey completed by the Children's Hospital of Chicago found that 71% of caregivers believed the pandemic negatively impacted their child's mental health and 69% of caregivers indicated the pandemic was the worst thing that ever happened to their child (Abramson, 2022). Additionally, the pandemic claimed the lives of many, and over 204,000

children in the United States lost a primary caregiver (DeAngelis, 2022). The significant distress and loss brought on by the pandemic exacerbated existing mental health concerns, generated new challenges, and resulted in an influx of young people seeking counseling services (Abrams, 2023). Available research examining the current mental health trends in children, families, and communities, suggest that many may be experiencing significant levels of dysregulation as a result of the collective trauma and uncertainty regarding safety brought on by the pandemic.

Youth were not impacted equally by the extreme disruptions and loss of the pandemic (Shivaram, 2021). Children and adolescents who are marginalized, including lesbian, gay, bisexual, trans, queer, intersex, asexual, and gender expansive (LGBTQIA+) youth and youth who experience racism, were disproportionately exposed to adverse events and mental health challenges during the pandemic (Abrams, 2023; Eugene et al., 2022; Webb Hooper et al., 2020). The pandemic illuminated the insidious impact of systemic racism and oppression as families and communities of color faced an increased risk for negative outcomes (Eugene et al., 2022; Webb Hooper et al., 2020). School closures, remote learning adaptations, and decreased access to school-based supports disproportionately impacted youth who are Black, Indigenous, or People of Color (Eugene et al., 2022). Furthermore, the majority of children who lost a caregiver to COVID-19 were Children of Color (Shivaram, 2021). These devastating trends highlight the necessity for helping professionals to provide affirming and culturally responsive therapeutic support, acknowledge intersectionality, and actively engage in advocacy efforts.

Rates of mental distress in children and adolescents have gained national attention since the onset of the pandemic. In 2021, these concerns were punctuated when the American Academy of Pediatrics, the Children's Hospital Association, and the American Academy of Child and Adolescent Psychiatry declared a National State of Emergency in Child and

Adolescent Mental Health (American Academy of Pediatrics, 2021). These professional organizations acknowledged that children and adolescents have faced the difficulties associated with COVID-19 and racial inequity while also navigating existing concerns related to social media, community violence, climate change, and political division (American Academy of Pediatrics, 2021; Shivaram, 2021). The declaration of a National State of Emergency in Child and Adolescent Mental Health highlighted the widespread distress many young people are experiencing and called for action from policymakers. Notably, the declaration specifically called for innovative clinical intervention and promoted trauma-informed services that support the relational health of children and families (American Academy of Pediatrics, 2021).

Neurobiologically informed approaches, such as Polyvagal Theory, the Neurosequential Model of Therapeutics, and Interpersonal Neurobiology, are examples of innovative clinical intervention that sensitively consider trauma and support relational health in children and families. These approaches align with the counseling profession in that they are strengths-based, wellness approaches that reduce distress, increase connection, and improve overall health. To comprehensively describe these theories, it is first important to understand general information related to the nervous system and brain as it relates to children and adolescents.

Nervous System and Brain Development

An understanding of how the nervous system and brain develop and core principles of neural functioning serve as the foundation for neurobiologically-informed approaches (Badenoch, 2008). This section provides a brief overview of the nervous system, regions in the brain, and neural development and functioning.

The nervous system, which is composed of the brain, spinal cord, and pathways of nerves throughout the body, is a broad term used to describe the system that connects the brain and body.

This system allows messages to be transmitted back and forth between the brain and different areas of the body. Part of the nervous system includes the autonomic nervous system, which is responsible for sensing and responding to cues of safety and danger (Dana, 2018). If cues of danger are detected, the brain sends signals to the body to adapt functioning and reallocate energy sources for survival, activating stress response systems (Dana, 2018; Perry & Winfrey, 2021). If cues of safety are sensed, the brain and body remain open to connection and social engagement (Dana, 2018). While the autonomic nervous system plays a vital role in survival, chronic stress and unpredictable, prolonged activation of the stress response system can shape neural development and negatively impact emotional, physical, and relational health (Dana, 2018; Perry & Winfrey 2021). When individuals experience unpredictable, prolonged, or extreme activation of their stress response system, their nervous system becomes dysregulate, and healing involves finding ways to regulate the nervous system and promote feelings of safety.

The brain is complex an intricately formed organ that can be divided into four primary regions (Perry, 2009). These interconnected regions include the brainstem, the diencephalon, the limbic system, and the cortex, and each is responsible for mediating specific functions (Perry, 2009; Prendiville & Howard, 2016). These regions organize in a hierarchical manner, developing from least to most complex (Perry, 2009). Each of these regions forms and matures at different stages in development (Perry, 2009). The brainstem, which must be completely formed and functional at birth, is responsible for regulating body temperature, respiration, blood pressure, and heart rate (Perry, 2009; Perry & Winfrey, 2021). The diencephalon fully develops between 1-2 years of age, and it mediates arousal, sleep, appetite, and movement (Perry & Winfrey, 2021). The limbic system, which includes reward centers, memory, bonding and relational health, and emotions, develops between 1-4 years of age (Perry, 2009; Perry & Winfrey, 2021).

The most complex region, the cortex, becomes fully formed in late teen/early adult years, and it is responsible for creativity, abstract thought, language, values, time, and hope (Perry, 2009; Perry & Winfrey, 2021). Notably, the development of each region can be impacted by the type of experiences and environment an individual is exposed to. The relationship between these regions will be explored in more detail in the section titled Neurosequential Model of Therapeutics.

Each distinct region of the brain is composed of billions of specialized cells called neurons (Badenoch, 2008). These neurons connect throughout the brain to create intricate neural pathways that carry messages in the form of electrical signals (Badenoch, 2008). The interaction between environment, experience, and genes informs the connections that neurons make and shape the neural pathways that form (Badenoch, 2008; Perry, 2009). Early childhood is considered a critical period of brain development, during which, the brain is especially sensitive and malleable (Badenoch, 2008; Perry, 2009). Dr. Perry (2009) describes the importance of this critical period:

In healthy development, that sensitivity allows the brain to rapidly and efficiently organize in response to the unique demands of a given environment to express from its broad genetic potential those characteristics that best fit the child's world; different genes can be expressed, and different neural networks can be organized from the child's potential to best fit that family, culture, and environment. (p. 245)

While this sensitivity can support the process of healthy development, it also makes children particularly vulnerable to the impact of adverse experiences (Perry, 2009; Perry & Winfrey, 2021). Consequently, the type of experiences, relationships, and interactions in early life can significantly inform health and development.

While the brain is most malleable and sensitive during the early years of life, it maintains the ability to rewire and form new neural pathways throughout life (Badenoch, 2008). This capacity is called neuroplasticity, and it has compelling implications for the mental health professions (Badenoch, 2008). Neural pathways are formed, maintained, and strengthened through repeated activation and use (Badenoch, 2008). Changes in the brain occur in response to patterned, repetitive activity, often within the context of a meaningful relationship (Badenoch, 2008; Perry & Hambrick, 2008). Acknowledging the brain's capacity to create new neural pathways and understanding the type of experiences and interactions that can promote rewiring offers mental health professionals a roadmap for conceptualization and clinical intervention.

Neurobiologically-Informed Approaches

As briefly described in the previous section, neuroscience research continues to increase understanding of the structures, development, and function of the brain. Increasing knowledge of neural growth and processes is becoming widely accessible and has significant implications for the counseling profession (Prendiville & Howard, 2016). The advances in neuroscience offer meaningful frameworks that can be used to inform case conceptualization, mental health interventions, and therapeutic approaches. Unlike other therapeutic methods, brain-based approaches are inherently trauma-informed, developmentally responsive, and culturally sensitive (Perry & Winfrey, 2021; Porges, 2022; Prendiville & Howard, 2016). Polyvagal Theory, the Neurosequential Model of Therapeutics, and Interpersonal Neurobiology are three brain-based philosophies that can be applied to a variety of clinical settings, populations, and presenting challenges. These approaches have the potential to effectively address the complex mental health concerns that many youth may be experiencing.

Polyvagal Theory

Polyvagal Theory offers a scientific perspective to understand how neurophysiological systems respond to external cues, eliciting feelings of safety or vulnerability, and how this impacts individual functioning (Porges, 2022). This theory was developed by Dr. Stephen Porges in 1990 after years of researching and measuring activation of the vagus nerve, which is part of the autonomic nervous system (Porges, 2022). Central to Polyvagal Theory is an understanding of three pathways within the autonomic nervous system and how activation of these pathways impacts emotional and interpersonal functioning (Dana, 2018). These pathways include the dorsal vagal pathway, the sympathetic pathway, and the ventral vagal pathway (Porges, 2022). Outside of individual awareness, the autonomic nervous system continually scans the environment and others for cues of safety or danger¹, and information detected determines what pathway becomes activated (Dana, 2018). Each pathway is associated with automatic neural and physiological responses that impact an individual's state of regulation and functional capacity (Dana, 2018). Through a polyvagal lens, activation of these pathways and the associated states serve as a protective adaptation. Applying Polyvagal Theory to clinical intervention involves understanding the function and relationship between these neurophysiological pathways and the characteristics and role of the associated states.

Knowledge of the development, components, and function of the autonomic nervous system serve as the foundation for Polyvagal Theory. The autonomic nervous system regulates neurophysiological functions in response to signals and sensations from the environment through three distinct pathways that activate to promote survival (Dana, 2018). This system is composed

¹ Dr. Porges coined the term “neuroception” to describe the way in which the autonomic nervous system detects safety, danger, and threat and initiates a response from within the body. Uniquely different from perception, “neuroception” happens outside of an individual's consciousness and awareness (Dana, 2018).

of two branches: sympathetic and parasympathetic (Dana, 2018). The sympathetic branch, located in the middle of the spinal cord, includes the pathway responsible for preparing the body and mind for action, reacting to cues of danger by releasing adrenalin and activating the fight or flight response (Dana, 2018). The parasympathetic branch includes two pathways within a large cranial nerve, called the vagus nerve, that extends from the skull throughout the torso and abdomen (Porges, 2022). The vagus nerve is divided into two pathways: the ventral vagal pathway and the dorsal vagal pathway (Porges, 2022). The ventral vagal pathway detects cues of safety, preparing the body and mind to foster connection with others and the environment (Dana, 2018). Conversely, the dorsal vagal pathway activates when cues of extreme danger are present, initiating a "protective state of collapse" where the body and mind shut down and become immobilized (Dana, 2018). While each of these states activates to promote survival and serves an important adaptive purpose, increasing activation of the ventral vagal pathway is associated with feelings of safety, relational connection, and physical health benefits (Dana, 2018). Increasing understanding of the different pathways and states of activation is a central aspect of applying Polyvagal Theory to clinical practice.

From an evolutionary perspective, the pathways in the autonomic nervous system developed over time based on adaptive need and activate in predictable ways (Porges, 2022). The pathways in sequence from oldest to newest are dorsal vagal, sympathetic, and ventral vagal (Porges, 2022). Deb Dana, author of *The Polyvagal Theory in Therapy: Engaging the Rhythm of Regulation*, suggests that the pathways in the autonomic nervous system and their associated states can be understood in their evolutionary sequence and function using the analogy of a ladder. The ventral vagal pathway, the most recently developed pathway, is at the top of the ladder. This pathway activates when cues of safety are detected, and the associated state is one of

connection, engagement, and physical regulation (Dana, 2018). Moving down the ladder, when cues of danger are sensed, the sympathetic pathway activates; preparing the body to move into action through fight or flight (Dana, 2018). In this state, the heart rate elevates, breath becomes shallow, and adrenaline is released (Dana, 2018). The dorsal vagal pathway, the oldest pathway, is at the bottom of the ladder. It activates in life-threatening situations when cues of extreme danger are sensed. The associated state is one of numbness and immobilization, and the body shuts down to conserve energy (Dana, 2018). It is natural for individuals to move up and down this ladder of regulation; however, distress can be experienced when individuals encounter prolonged activation of the dorsal vagal pathway or the sympathetic pathway. Promoting activation of the ventral vagal pathway and increasing flexibility in transitions between states can help decrease distress and improve mental wellbeing (Dana, 2018). The table below, informed by the work of Deb Dana in her book, *The Polyvagal Theory in Therapy: Engaging the Rhythm of Regulation*, briefly describes the states associated with each pathway, activated attitudes or beliefs in each state, and actions or interventions that promote regulation and feelings of safety.

Table 1: Polyvagal States of Regulation & Interventions

Pathway	Description	Actions & Interventions
Ventral Vagal	<i>I am:</i> Safe, social, connected, engaged, attuned <i>The world is:</i> welcoming and trustworthy	<i>Maintain activation</i> Express gratitude, engage in mindfulness, connect with others
Sympathetic	<i>I am:</i> Mobilized, anxious, angry, or in fight or flight <i>The world is:</i> chaotic and scary	<i>Regulate to ventral state</i> Deep breathing, slow movement, activities to promote relaxation, seek support from trusted relationship
Dorsal Vagal	<i>I am:</i> Immobilized, collapsed, numb, shut down, depressed <i>The world is:</i> empty and hopeless	<i>Regulate to ventral state</i> Walking or other movement, stimulate sensory engagement, seek support from trusted relationship

Using Polyvagal Theory in clinical practice can involve increasing client awareness of their different regulatory states, exploring the adaptive function these states serve, or facilitating an environment and relationship where the client experiences a felt sense of safety (Porges & Dana, 2018). In the therapeutic setting and within therapeutic relationship, opportunities for activation of the ventral vagal pathway and promoting feelings of safety and connection are prioritized (Porges & Dana, 2018). The application of Polyvagal Theory to clinical practice can be summarized using the 4 R's: recognize the state, respect the adaptive response, regulate or co-regulate, and re-story (Dana, 2018). When working with children, these steps are presenting or applied in developmentally responsive ways. Rather than using the anatomical terminology, the three states might be described as engaged (ventral vagal), mobilized (sympathetic), and immobilized (dorsal vagal). Recognizing the state might involve helping the child to notice or identify sensations in their body, feelings, or actions connected with each state. Respecting the adaptive response could include normalizing and validating that people experience a wide range of emotions and sensations, some of which keep them safe. This step could also include supporting caregivers or adults in the child's life to accept that confusing, big, or difficult behavior and reactions might in fact be adaptive activation the child's nervous system. Regulating and co-regulating can include fostering internal abilities and calming skills, creating an environment of safety, and connecting to trusted relationships. Re-storying with a child might involve facilitating exploration of specific experiences or events while the child is in an engaged, ventral vagal state.

Neurosequential Model of Therapeutics

The Neurosequential Model of Therapeutics (NMT) is a developmentally responsive, neurobiologically informed clinical approach (Perry & Hambrick, 2008). Created by child

psychiatrist Dr. Bruce Perry, the NMT was developed in response to years of clinical intervention and research investigating trauma and maltreatment of children (Perry & Hambrick, 2008). Dr. Perry recognized the need for an innovative framework to effectively understand and respond to the impact of trauma and maltreatment on children in a developmentally sensitive way (Perry & Hambrick, 2008). The NMT process includes a developmental history, an assessment of current functioning, and recommendations for intervention (Perry, 2009). These elements are used to generate a comprehensive understanding of a child's past experiences, current functioning, and opportunities for support and intervention (Perry & Hambrick, 2008). Ultimately, this approach attempts to rewire and heal early trauma and activating experiences by intentionally engaging the brain in its sequence of development (Perry, 2009). Below, the elements of the official NMT process are briefly described and foundational neuroscience principles of this approach are presented along with broader clinical applications.

The NMT process begins by gathering a thorough developmental history of the child. The developmental history includes the NMT Core Assessment and the NMT Relational Health History (Perry & Hambrick, 2008). The NMT Core Assessment catalogs significant events, stressors, and challenges in the child's life and identifies the timing, severity, and quality of these experiences (Perry & Hambrick, 2008). The NMT Relational Health History gathers information regarding relationships, attachment, and resiliency or vulnerability factors in the child's life (Perry & Hambrick, 2008). A developmental "load" is determined by scoring these events and estimating which neural pathways and functions could be impacted by the experiences in the child's developmental history (Perry & Hambrick, 2008). Once the child's developmental history has been examined, the child's current level of functioning is assessed, and estimates are generated of which neural systems and brain regions are contributing to the child's level of

functioning and psychiatric symptoms (Perry, 2009). An interdisciplinary team collaborates to create a functional brain map that visually illustrates developmental status in regions of the child's brain (Perry, 2009). Finally, the developmental history and current level of functioning are used to determine specific therapeutic recommendations and opportunities for enrichment (Perry, 2009). This innovative approach is being used across a variety of settings to effectively identify the mental health and developmental needs of children and inform clinical treatment.

While the official NMT process requires specific training and education through the *Neurosequential Network*, the foundational principles of this approach can be readily applied to clinical work and intervention with individuals across the lifespan. This approach acknowledges that neural development is an intricate and dynamic process. Constructs of neuroscience that inform this approach include: the brain develops in a predictable and ordered sequence, experience and genes interact and influence neural development, and the brain maintains plasticity, the ability for neural pathways to change through repeated experiences, throughout development (Perry, 2009). The foundational principles that inform the NMT process have clinical implications and therapeutic applications.

The brain develops from the bottom-up, in a predictable sequence starting with the least complex region and progressing to the most sophisticated region. As described in a previous section, the brainstem, diencephalon, limbic system, and cortex each have unique functions and timelines of development and maturity. Given that these regions are significantly interconnected, the organization of lower parts of the brain informs the development and organization of higher regions of the brain (Perry, 2009). As the name suggests, the Neurosequential Model of Therapeutics acknowledges the therapeutic benefits of engaging regions of the brain in a sequential manner. Intentionally engaging underdeveloped or abnormally functioning regions in

the brain in the order they develop can promote regulation and integration and improve mental health over time (Perry & Hambrick, 2008). Furthermore, when children are exposed to chronic stress or unpredictable trauma, their neural development can be disrupted leading to emotional, behavioral, and relational difficulties (Perry & Winfrey, 2021). Increasing amounts of evidence indicate that effective therapeutic interventions target the most fundamental levels of dysregulation through sensory, expressive, and experiential engagement (Perry & Winfrey, 2021). The table below briefly describes the function of each region in the brain and presents examples of the type of interventions that engage each region.

Table 2: Neurosequential Development & Interventions

Region & Symptoms	Function	Type of Intervention
Cortex <i>Guilt, shame, sense of worth</i>	Abstract and concrete thinking, executive functioning, affiliation & reward, creativity & flexibility	Meaning making, insight-oriented approaches, use of humor, reasoning, decision making, story telling
Limbic System <i>Relational challenges</i>	Emotional reactivity (feelings of connection & love and fear & anger), attachment, sexual behavior	Experiential interventions (role-play, drama, sand tray, & rituals), relational & social skills, emotion expression & identification (poetry, art, music, movement).
Diencephalon <i>Depressive & emotional difficulties</i>	Motor regulation, movement, arousal levels, attention, and appetite	Sensory & physical engagement, large motor movement activities (walking, yoga), complex fine motor activity (fidgets & art), combined sensory experiences (movement with music)
Brainstem <i>Trauma core symptoms</i>	Blood pressure, respiration, heart rate, and body temperature	Sensory & physical engagement: movement/dance, music, touch, taste, and play

In addition to understanding the sequence in which the brain develops, it is also clinically relevant to consider the sequence that stimuli and information are processed by the brain. Just as the brain develops in a predictable sequence from the bottom up, stimuli and information are

processed in an ordered manner, also from the bottom-up (Perry & Winfrey, 2021). When an individual is dysregulated, experiencing chronic stress, or sensing threat to their safety, the bottom regions of the brain take charge, making it nearly impossible to access the more sophisticated functions of their brain (Perry & Winfrey, 2021). Therefore, trauma experiences and dysregulated states impair an individual's ability to connect with others, think creatively, problem solve, or use logic. Dr. Perry describes a sequence of engagement that can inform interactions to more effectively attend to the neurobiological needs of others and promote feelings of safety: first regulate, then relate, and finally reason. Awareness and application of this sequence of engagement can help counselors more attentively respond to the needs of children and clients.

Another principle of neuroscience central to the application of this approach is neuroplasticity. The brain maintains plasticity, the ability to rewire and change, throughout development, and this remarkable finding can inform clinical practice in significant ways. Neurons and neural pathways are sensitively responsive to activation; pathways form, maintain, and are changed in a use-dependent manner (Perry, 2009). Dr. Perry identified six core elements characterizing positive, therapeutic experiences that can promote healthy neural rewiring. The elements, sometimes called the 6R's, are relational, relevant, repetitive, rewarding, rhythmic, and respectful. The 6 R's can serve as a guide for creating and conducting neurobiologically informed, developmentally responsive, and trauma sensitive interventions.

Interpersonal Neurobiology

Created by Dr. Daniel Siegel, Dr. Allan Schore, and Dr. Louis Cozolino, Interpersonal Neurobiology (IPNB) is a comprehensive, interdisciplinary framework that explains the dynamic interaction between an individual's brain, mind, and relationships (Siegel, 2012). The IPNB

perspective asserts that brain, mind, and relationships create a “triangle of wellbeing” and explores the mutual, reciprocal interaction among these components (Badenoch, 2008; Siegel, 2012). Incorporating research findings from several professional fields, this approach offers a detailed and thorough framework to understand how the brain, mind, and relationships interact and impact individual health and functioning (Badenoch, 2008; Siegel, 2012). Given IPNB’s comprehensive approach to understanding the human experience and mental wellbeing, there are many nuanced concepts and aspects to the framework. For the purpose of this paper, the components of the triangle of wellbeing will be defined, the role and types of integration will be described, and the importance of relationships will be applied to clinical practice.

The IPNB framework uses an expansive definition of the brain. This approach acknowledges the intricate relationship between the skull-based mass of specialized cells typically referred to as the brain and the complex network of physiological systems that interact with this organ (Siegel, 2012). The process of interaction throughout this system is described as energy and information flow (Siegel, 2012). Therefore, IPNB uses the term brain or embodied brain to describe the mechanism, composed of neural networks and physiological systems, that allows the flow of energy and information (Siegel, 2012). The IPNB approach also integrates and applies the principles of neuroscience described in previous sections to understand the development and function of the brain.

Central to IPNB is the distinction between the brain and the mind. If the brain is the mechanism that processes the flow of energy and information, the mind functions as the process that regulates this flow (Siegel, 2019). Dr. Daniel Siegel defines the mind as, “the embodied and relational emergent process that regulate the flow of energy and information.” This definition can be dissected into four significant components. First, the mind is a process that guides and

mediates the flow of energy, a term to describe firing synapses, and information, a term to describe unique mental representations of objects and concepts (Badenoch, 2008). The mind considers internal and external cues in this process of regulating energy and information flow (Badenoch, 2008). Second, the mind is an “emergent process,” meaning that it is continually evolving, shaped by internal processes and interpersonal experiences (Badenoch, 2008). Third, the function and abilities of the mind develop throughout the lifespan (Badenoch, 2008). Finally, the mind has a natural tendency toward integration. This dense definition offers an innovative perspective to understanding the mind and its function.

The final component of the triangle of wellbeing is relationships. From an IPNB perspective, relationships generate and share the flow of energy and information (Siegel, 2019). Humans have developed an impressive adaptive capacity to notice and absorb information within relationships and interactions (Badenoch, 2008; Siegel, 2012). Facial expressions, tone of voice, content of speech, body language, eye contact, and physical presence are continually detected within relationships and interactions (Badenoch, 2008). Furthermore, within relationships individuals engage in a mutual exchange of energy and information that can alter regulatory states, neural development, and overall health (Siegel, 2012). The IPNB approach acknowledges the necessity of relationships, the potential for harm or healing within relationships, and tremendous therapeutic significance of relationships.

The brain, mind, and relationships are uniquely integrated elements that compose the triangle of wellbeing. Each of these elements informs the others in mutually responsive ways. The IPNB approach asserts that triangle of wellbeing is a dynamic system that informs development, functioning, and mental wellness (Siegel, 2019). Relationships create shared energy, which the mind regulates to be integrated and organized into the brain, which is the

mechanism and structure that responds to information and energy (Siegel, 2019). The triangle of wellbeing offers an innovative framework to understand the human experience and comprehensive health and wellness.

Foundational to this approach is the concept of integration. The IPNB perspective asserts that health and human thriving result from integration. This term is used to describe the ongoing, natural tendency to link and make connections between differentiated elements (Siegel, 2019). Integration within the brain, mind, and relationships supports growth, health, and healing (Wheeler & Taylor, 2016). There are several domains of integration, including: consciousness, bilateral, vertical, memory, narrative, state, interpersonal, temporal, and transpirational or identity integration (Siegel, 2019). Mental distress and functional challenges can result from impaired or underdeveloped integration in these domains (Siegel, 2019; Wheeler & Taylor, 2016). Therefore, the nine domains of integration offer a roadmap for intervention and therapeutic treatment.

When applying IPNB to the therapeutic environment, acknowledging the significance of the relationship is paramount. The therapeutic relationship can be used to facilitate integration and ultimately support healthy development and restoration (Badenoch, 2008). Counselors applying interpersonal neurobiology to their clinical practice thoughtfully acknowledge the significance of their presence (Badenoch, 2008; Siegel, 2019). In her 2008 book, *Being a Brain-wise Therapist*, Dr. Bonnie Badenoch describes the importance of the therapeutic relationships in this way:

If our [therapists] internal resources of hope are rich and deep, the resonance circuits that embed our being within our patients' inner worlds will become a secure foundation for

them. However, if we don't have confidence in the potential goodness of life's processes, our patients will feel that, no matter what words of hope we may speak. (p.90)

This approach acknowledges the counseling relationship as a powerful opportunity to share new energy and information with the client, energy and information that is marked by empathy, acceptance, resonance, safety, and hope.

Clinical Application

While each theory described above presents a unique clinical framework, there are several consistent themes related to clinical application across the neurobiologically-grounded approaches. First, neurobiologically informed approaches lend themselves to clinical work with children. These approaches emphasize the necessity of acknowledging the developmental age and stage of clients. These frameworks have successfully been integrated into work with children across a variety of setting and with a variety of child-focused therapeutic approaches, such a play therapy. Second, these frameworks attend to the regulatory state of the child, and therefore, more effectively meet the child where they are. When clinical intervention considers a client's state of regulation, their capacity for specific interventions can be accounted for and therapeutic support can adapt to appropriately and effectively respond. Third, these approaches can be applied to a variety of therapeutic settings, including school-based and community outpatient, and applications from these approaches can be generalized and used across settings. Finally, these frameworks can be woven into a variety of theoretical approaches and orientations effectively. Polyvagal Theory, the Neurosequential Model of Therapeutics, and Interpersonal Neurobiology can be applied independently or collaboratively to effectively address the mental health and wellness of children and adolescents.

Case Example

The following sections present a case example and offer potential considerations and applications of neurobiologically-informed approaches. This case example, informed by the current trends of the youth mental health crisis, describes a child client at various stages of the therapeutic process. Within each section, a brief scenario is presented and potential applications of Polyvagal Theory, the Neurosequential Model of Therapeutics, and Interpersonal Neurobiology are outlined. Clinical applications of these theories include case conceptualization, interventions and activities, and general therapeutic considerations.

Referral and Presenting Concerns

Alexis, an 7-year-old female, is referred to a community outpatient clinic due to concerns in the home and school. Alexis' parents, originally from El Salvador, have lived in the United States with their extended families for many years. Both of Alexis' parents work multiple jobs with inconsistent schedules, so she often stays with her aunt or a family friend after school. At home, it is reported that Alexis is "defiant and irritable" and has destructive outbursts if things don't go her way. The school reports that Alexis has been refusing to complete her assignments and without individual support, she "zones out" and "daydreams." The referral form also mentions that Alexis' grandmother, who she was very close to, died from COVID two years ago.

Consider how a clinician using a neurobiologically-informed approach would conceptualize the information from this referral and what initial steps they might take. From Polyvagal Theory, does the referral include any information about how this child might present when different pathways are activated or what regulatory state this child is often in? Are there any patterns to what pathways are activated in different environments? From a Neurosequential perspective, what additional information needs to be gathered in order to obtain an accurate

developmental history? Does this referral include information that suggests chronic stress, adverse events, or relational ruptures? Who needs to be contacted to gather a comprehensive developmental history (school, primary care physician, adults involved in daily caretaking)? From an Interpersonal Neurobiology approach, what domains of integration might be important for this client? What information and energy are being shared with this client in their daily relationships and interactions?

Initial Intake and Interaction

In the initial intake with Alexis' parents, they express concerns for their daughter's wellbeing and uncertainty of how to help her. They describe the challenging circumstances around her grandmother's death, including having to say final goodbyes over facetime due to safety restrictions in the hospital. Alexis' father lost his job, at the start of the pandemic, creating significant financial stress for the family and leading to numerous transitions in the family's schedule and routine. Alexis completed kindergarten in a virtual format and has struggled to make friends in the school setting ever since.

At the first meeting Alexis is seated close to her father on bench in the waiting room. She is staring at a poster on the wall while her father flips through a magazine. Her eyes widen and her body stiffens slightly as her attention shifts to the new presence of the counselor in the room. After greeting Alexis and her father, facilitating introductions, and describing what to expect out of their time together, the counselor invites Alexis to transition. In this transition, the counselor observes discrepancies in Alexis' affect and content of communication, sees her breathing become shallow and rapid, and notices her begin to fidget with the hair tie around her wrist.

Consider how a clinician using a neurobiologically informed approach might navigate the first session with a child client, acknowledging the complex history and information that has

been shared about the client so far. From a Polyvagal perspective, what pathway (ventral vagal, sympathetic, or dorsal vagal) is currently activated in this client? How can feelings of safety be promoted in this initial interaction? Consider the client's sensory experience: what smells, sounds, images, and feelings is the client absorbing? Consider how rituals, actions, and language can be used to communicate predictability and consistency for the client. From a Neurosequential perspective, prioritize the sequence of engagement: regulate, relate, reason. It is likely that in this initial encounter will mostly involve engagement focused on regulating. Consider what basic regulatory needs the client might have: do they need to use the bathroom, get a drink, or have a snack? From an Interpersonal Neurobiology perspective, what energy and information is Alexis taking in from the counselor and what can the counselor do to communicate their attentive resonance to Alexis' experience? How can the counselor use their facial expression, body language, speech, and proximity to convey curiosity and delight in Alexis?

Treatment Planning

Alexis continues to come to weekly outpatient sessions. In the first four sessions, the counselor continues to strengthen the therapeutic relationship, embed rituals to promote consistency and predictability, and observe Alexis' patterns and presentation. The counselor notices rhythms to Alexis' state of activation, especially related to separating and reunifying with her caregivers. Additionally, the counselor observes some behaviors that suggest dysregulation in specific regions of the brain (difficulty with fine motor skills, balance, impulse control, and problem solving). Caregivers report that Alexis enjoys counseling sessions and is usually in a "good mood" when she leaves, but continues to shut down at school and have outbursts at home.

Consider how a clinician applying neurobiologically-informed approaches would focus Alexis' therapeutic treatment and support. From a Polyvagal perspective, treatment goals could include teaching Alexis and her caregivers about the different states, increasing Alexis' ability to recognize what state she is in, or identifying coping skills to support activation of the ventral vagal pathway. From a Neurosequential perspective, therapeutic interventions could focus on dysregulated or under-developed regions of the brain. This could look like integrating experiential activities that incorporate the 6R's (repetitive, rhythmic, relational, rewarding, relevant, and respectful). From an Interpersonal Neurobiology perspective, the nine domains of integration could be used to inform treatment goals and the importance relational health would be prioritized, especially with Alexis' caregivers.

Additional aspects of treatment planning would include care coordination with Alexis' school, primary care physician, and consistent communication with her caregivers. In coordinating with the school, it might be important to offer resources related to the sequence of engagement and the nervous system or share coping skills that Alexis identifies to help her move to a ventral vagal state. In coordinating with Alexis' primary care physician, it might be important to discuss the loss and chronic stress that she and her family system have experienced, given that these events put her at increased risk for certain health conditions. In coordinating and communicating with Alexis' caregivers, it would be important to help them understand how Alexis' emotional, behavioral, and relational functioning is influenced by her developmental age, stress response system, lived experiences, and interactions with others. Additionally, this collaboration would prioritize discussing what contributes to healing, restoration, and thriving.


Considerations and Limitations


Applying neurobiologically-informed approaches requires that counselors have a comprehensive understanding of child development and brain functioning. Furthermore, counselors using these approaches must be able to effectively translate principles of the nervous system, neuroscience, and development into practice. Systems of care are not currently structured to support the neurodevelopmental needs of children and adolescents, especially those who have been exposed to chronic stress or adverse experiences. In order to comprehensively and effectively support child clients with these approaches, counselors must actively collaborate with the child's family, educational system, medical provider, and additional community supports. These approaches acknowledge that change in the brain occurs in an experiential, use-dependent manner. The traditional format of 50-minute sessions once a week may fail to provide adequate experiences to support change and healing for the child. Therefore, counselors using these approaches must find ways to engage caregivers, teachers, and other individuals in the child's life to support the therapeutic goals and treatment.

Summary

Mental health needs of children and adolescents in the United States have increased in recent years. The current number of youth in need of therapeutic intervention and the paucity of available mental health counselors equipped to support this population appropriately indicate a youth mental health crisis. This paper proposed neurobiologically-informed frameworks, such as Polyvagal Theory, The Neurosequential Model of Therapeutics, and Interpersonal Neurobiology, as potentially effective and accessible approaches to address the mental health crisis in children and adolescents. Used independently or collaboratively, these approaches offer developmentally responsive, trauma-informed support. Case vignettes described considerations and specific applications for these neurobiologically-informed frameworks.

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