The Tug-of-War of Emotion in Children With AuDHD

BY: GARDENIA CHANG

Imagine having a long-lasting tug-of-war in your brain, where two rival teams intensely vie for control. This competition takes place every day in children with AuDHD, who experience both Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD). In one corner, the ADHD team exerts boundless energy, pulling out all the stops with unbridled fervor and restless vigor. On the other side of the rope, the ASD team tugs repetitively from all different angles and refuses to interact with other team members. Confined in the midst of this relentless tug-of-war, the child struggles to bring these opposing forces into harmony, all the while feeling torn apart by the relentless tussle.

"Having a dual diagnosis is like you are a walking conundrum with the ADHD pulling you in one direction and the ASD in another direction," describes Hari B. Srinivasan, a Ph.D. candidate in Neuroscience with lived

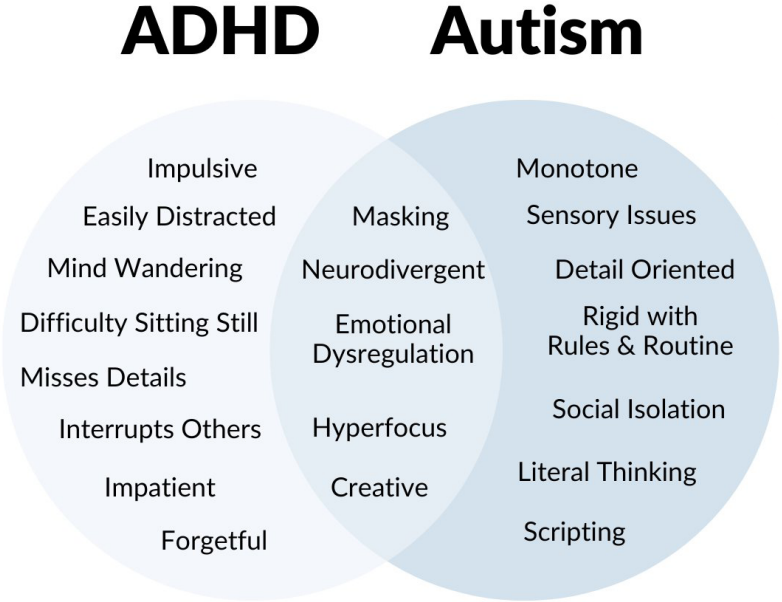

Figure 1: Common features in attention-deficit/hyperactivity disorder (ADHD) and autism spectrum disorder (ASD).

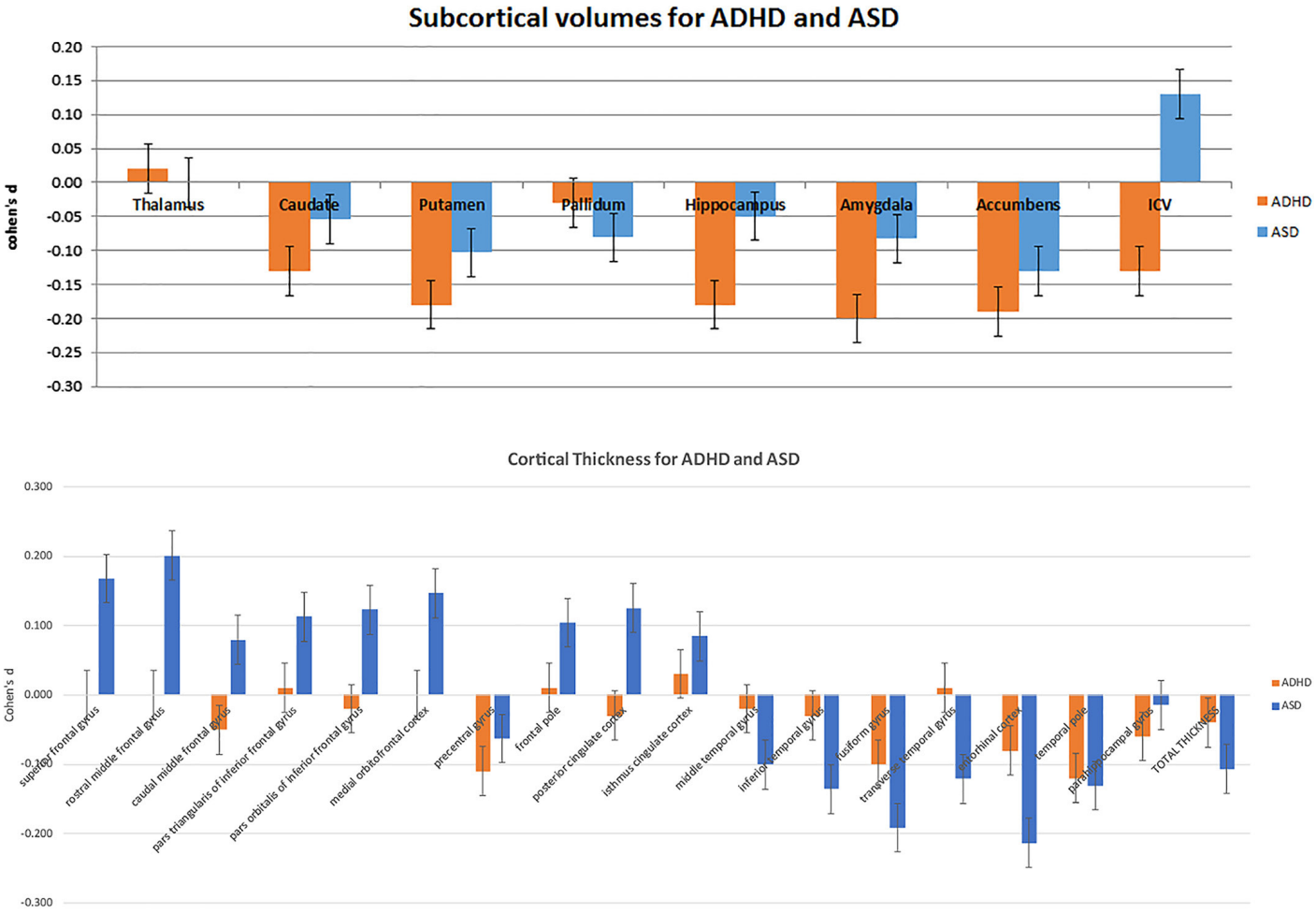

Figure 2: Cohen's d effect sizes for the subcortical measures (up) and cortical measures (down) for both ADHD and ASD cohorts compared to their controls. Figures taken from Hoogman er al., 2022 (adapted from Hoogman et al., 2019 and van Rooij et al., 2018)

experience of AuDHD and a Fellow at the Center for Autism and Innovation.

Unraveling the Paradox of AuDHD

AuDHD is an unofficial term that describes an individual who is diagnosed with both ADHD and ASD.[1] It is estimated that symptoms of ADHD are exhibited in 30-80% of individuals with ASD, while approximately 20-50% of individuals with ADHD may also display symptoms of ASD.[2,3] What causes this high co-occurring rate? What does it mean to have a dual diagnosis of these two disorders? Many children with ADHD appear frequently restless, talkative, and impulsive.[4] Meanwhile, individuals with ASD frequently avoid eye contact and have difficulty communicating and interacting with others, often hyperfocusing on one topic or mechanical objects and sticking to a specific routine.[5] It can be alarming when the opposing symptoms of ADHD and ASD collide in a single child.

The surprisingly high rates of coexistence may be largely due to the shared etiology of the two neurodevelopmental disorders, such as the similar genetic and neurobiological mechanisms by which they develop. ADHD and ASD both involve atypical brain structure and function, particularly in areas related to attention, executive function, social cognition, and emotion. Difficulty in emotion regulation is one of the overlapping features that especially impairs the social skills and interactions of individuals with AuDHD.[6]

Emotion Dysregulation in AuDHD

Studies on children with ADHD and ASD mainly focus on defining emotion regulation from the functional emotion theory. This approach defines *emotion regulation* as how goal-directed behavior is supported by emotional processing.[7] From this standpoint, *emotional dysregulation* is defined as a disruption in any emotional expression or experience that interferes with behavior that works towards attaining a specific goal. For example, emotional dysregulation affects a child's ability to maintain or improve their emotional state in challenging situations, enhance relationships with family and peers, and participate in socially acceptable interactions. Additionally, emerging evidence indicates that emotion regulation might be a mechanism contributing to the high co-occurrence of ADHD and ASD.[7,8] This same difficulty might also be associated with symptom severity in both conditions related to the severity of the symptoms.[9,10] Furthermore, the coexistence of ADHD and ASD leads to an increased risk of anxiety and mood disorders for AuDHD children.11 Numerous studies have shown that there may be an additive effect of AuDHD on the psychiatric coexistence of anxiety mood disorders and other disorders such as schizophrenia and disruptive behavior disorder.[12,13]

The Genetic & Neurobiological Basis of AuDHD

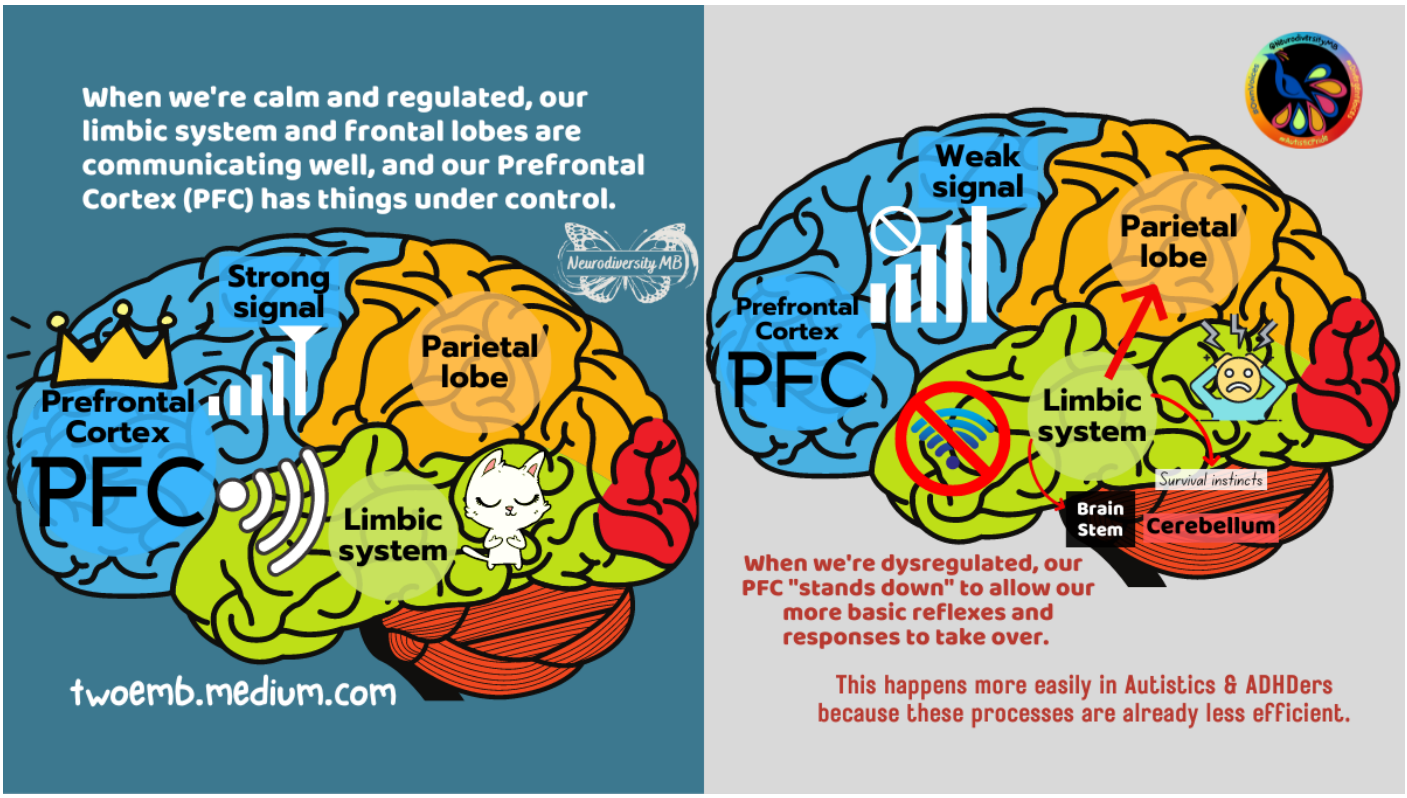

Figure 3: The figure shows the relationship between the prefrontal cortex (PFC) and the limbic system during the regulated stage (left) and dysregulated stage (right).

Genetic factors play a significant role in the emotional development of ADHD and ASD, further contributing to their co-occurrence.[14,15] A meta-analysis on large-scale genome-wide association studies (GWAS) indicates that ADHD and ASD are 37% genetically correlated.[16] The gene for the dopamine receptor DRD4 serves as an example of this. DRD4 regulates the neurotransmitter dopamine, which is involved in attention, executive function, and emotion regulation.[17, 18] Studies found that a rare mutational event of DRD4 gene, called 7-repeat (7R) allele may increase the risk for elevated autism symptoms in children with ADHD.[19,20] Gene-environment interaction studies suggest that abnormal DRD4 function coupled with adverse life events is also associated with poor emotion regulation and a lack of maternal caregiving in mothers, which increases problematic behaviors in early childhood through adolescence.[21,22] Research also indicates that the interaction between DRD4 and early stressful life events in children, such as childhood maltreatment, negative parenting behavior, and sexual or physical abuse, is related to the severity of ADHD during early childhood.[23] These studies highlight the potential for gene-environment interaction in AuDHD. However, studies investigating the role of DRD4 and other gene variants in relation to AuDHD show inconsistencies. Further research is needed to reconcile these discrepancies and identify other potential genetic factors that might contribute to the development of AuDHD.

Advances in neuroimaging techniques also help us understand the neurobiology of psychological disorders. The ENIGMA consortium study is the most extensive analysis of structural brain data to date for individuals with ADHD and ASD.[15] This study used magnetic resonance imaging (MRI) to examine the overlapping results from cortical and subcortical analysis of ADHD and ASD compared to neurotypical groups. They found that both disorders show comparable decreased volumes in areas in the limbic system (e.g., putamen, amygdala, and nucleus accumbens) and are associated with lower cortical thickness in the temporal lobes. These anatomic differences may result in ineffective communication between cortical regions and subcortical regions.

Specifically, the compromised connectivity between the prefrontal cortex (PFC) and the limbic system may make it more difficult for children with ADHD and ASD to regulate their emotions. The limbic system and the PFC collaborate in orchestrating emotional and cognitive behaviors. The limbic system is responsible for processing emotional significance and expressing emotional responses. Meanwhile, the PFC modulates and regulates emotional responses generated by the limbic system and takes control over or calms us down when we feel distressed, sad, or threatened. However, a dysfunction or imbalance in this interaction can lead to difficulties in emotion regulation. Neuroimaging empirical evidence has shown that the altered amygdala-prefrontal circuitry might contribute to emotional dysregulation and social impairment in children with ADHD and ASD.[24,25,26,27] However, there is little research to date that focuses on the population of AuDHD; that is to say, the neurological impact of coexisting ADHD and ASD is still unknown.

Enhancing Emotion Regulation in ADHD and ASD: Present and Future

Children with both ADHD and ASD experience challenges regulating emotions. In ADHD, impulsivity, poor inhibition, and heightened emotional reactivity to stress contribute to emotional dysregulation.28 For ASD, difficulty reading social and emotional cues, communication challenges, cognitive

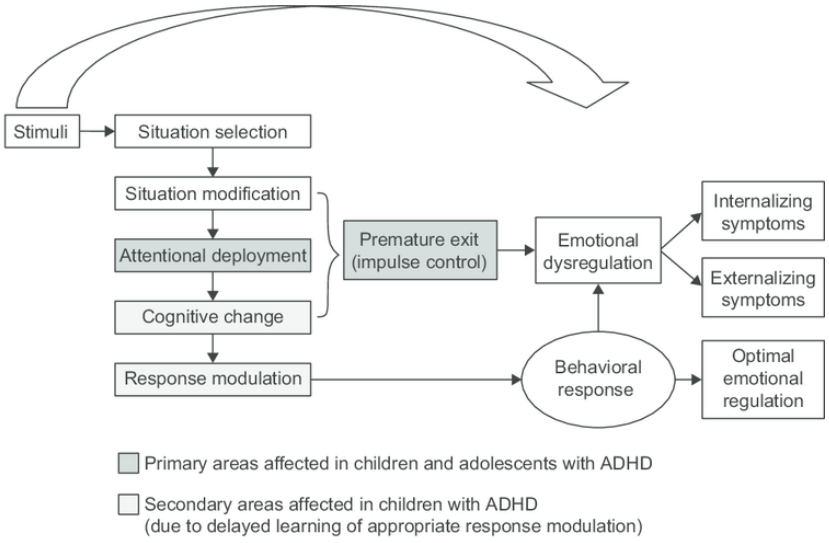

Figure 4: Conceptual model of emotional dysregulation in children with Attention-deficit/ Hyperactivity Disorder (ADHD). Adapted from Gross (1998). Children with ADHD might struggle with the emotional regulatory processes, particularly poor attention deployment and impulse control. This challenge may lead to early withdrawal from cognitive coping strategies and result in emotional dysregulation.

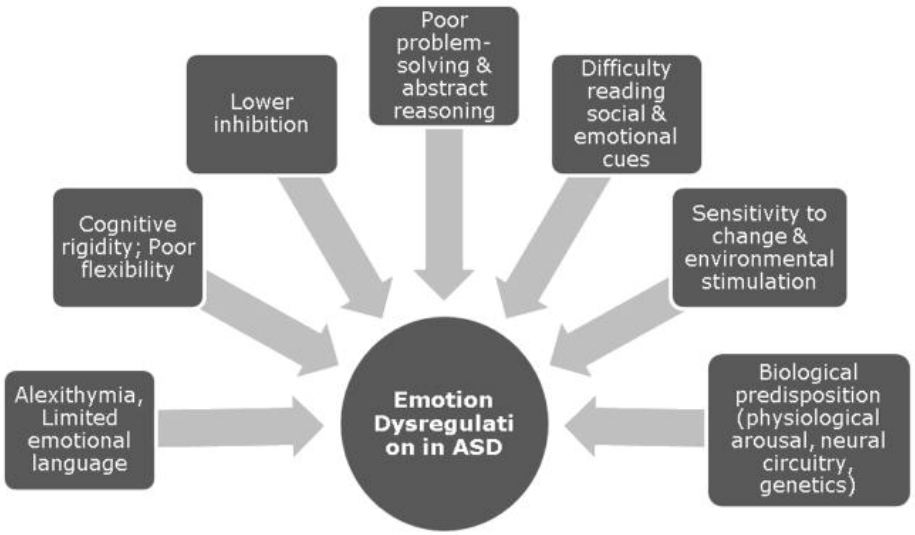

Figure 5: Characteristics of Autism Spectrum Disorder that may contribute to emotional dysregulation.

rigidity, and heightened sensory sensitivity make them more susceptible to emotional overwhelm and less able to manage emotion effectively.[29] For example, children with ASD are suggested to employ fewer adaptive strategies like cognitive reappraisal and more maladaptive ones like suppression compared to neurotypical children.[30,31] These factors, though stemming from different conditions, can lead to similar difficulties in emotion regulation. Multimodal interventions are recommended for both ADHD and ASD, including pharmacological approaches, behavioral and cognitive for children, and cognitive and behavioral therapies (CBT) for adolescents and adults. ADHD medication, such as serotonin-dopamine reuptake inhibitor (SDRI), may help regulate impulsive behaviors and enhance executive functions by enhancing dopamine functioning in the prefrontal cortex, mesolimbic, and mesocortical tracts.[32] Additionally, CBT, such as mindfulness-based approaches and acceptance and commitment therapy, can assist children in slowing down their intense emotions, becoming more aware of their emotions, and understanding their causes.[33,34] Studies also show that CBT can assist children with ASD in mitigating suppression and enhancing adaptive regulatory strategies, such as reappraisal and problem-solving, as well as enhancing their cognitive flexibility.[29,35] However, it is crucial to consider that CBT may have a limited impact on children with ASD who also have intellectual disabilities; more alternative or adapted interventions would be necessary.

Children with either ADHD or ASD confront obstacles associated with their independent symptoms; however, the combined effects of both conditions make it even harder for the AuDHD population to execute effective emotional regulation. Additionally, a recent study suggests that symptoms of hyperactivity/impulsivity in ADHD and restricted/repetitive behaviors in ASD indirectly predict social impairment through their shared association with emotional dysregulation.[36] Despite the existence of numerous evidence-based interventions that have proven effective in training emotion regulation in children with ADHD or ASD, the population of children with AuDHD has been largely neglected. While stimulant medications like methylphenidate and amphetamine — increase dopamine and norepinephrine activity to help executive and attention function — work very effectively for managing core ADHD symptoms in ADHD-only individuals, their effects can be paradoxical in children coexisting with ASD and even cause more side effects such as depression and irritability.[37] Although these children face additional challenges, there are few interventions specifically designed to meet their unique needs, and there is a scarcity of clinical trial research dedicated to addressing this gap.

Bridging the Gap and Building a Future for AuDHD

The unique interplay between ADHD and ASD symptoms presents a distinct challenge for children with AuDHD, especially in the domain of emotion regulation. Despite the high prevalence of coexistence, current research oversees the social and emotional development and remains a large gap in evidence-based intervention targeting this population. This tug-of-war neuropsychological condition is tearing our next generation apart. As we aim to better support children with AuDHD, it is crucial to develop a deeper understanding of their special needs and to create efficient

interventions and proper care that address the complex dynamics of emotion regulation within the context of AuDHD.

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