Understanding Children with Attention Deficit Hyperactivity Disorder: A Neurocognitive Perspective

OPEN ACCESS

Manuscript ID: EDU-2025-14019545

Volume: 14

Issue: 1

Month: December

Year: 2025

P-ISSN: 2320-2653

E-ISSN: 2582-1334

Received: 01.10.2025

Accepted: 11.11.2025

Published Online: 01.12.2025

Citation:
Ananda Kumar, A. (2025). Understanding Children with Attention Deficit Hyperactivity Disorder: A Neurocognitive Perspective. *Shanlax International Journal of Education, 14*(1), 1–10.

DOI:
https://doi.org/10.34293/education.v14i1.9545

A. Ananda Kumar
Institute of Advanced Study in Education (IASE), India
https://orcid.org/0000-0002-0849-3570

Abstract
Attention is the process of receiving and responding to specific information. Various brain regions are involved in the development of attentional networks. Posner's model of attentional networks explains that attention involves different mechanisms sub-served by separate brain networks (Posner & Petersen, 1990). In this model, attention contains three subsystems: alerting, orienting, and executive control. Some children have hyperactivity or inattention and a combination of hyperactive-impulsive and inattentive activities and behaviours; such children are considered to have attention-deficit hyperactivity disorder (ADHD). ADHD symptoms involve dysfunction of the prefrontal cortex (PFC) and its cortical and subcortical connections. Identifying this disorder in early childhood helps parents, family members, teachers, and peers to monitor, adjust, and handle these children with appropriate care. Knowledge of the neurocognitive process of attention formation and its functions helps us understand the attention process in the brain. The attention process is understood through various neuroimaging techniques, such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and electroencephalography (EEG). These techniques delineate attention networks and detect attention-related dysfunctions in the brain, offering insights into attentional mechanisms. Any dysfunction that occurs during the process of attention creates attention-deficit hyperactivity disorder (ADHD). Understanding ADHD from a neurocognitive perspective can be beneficial because it provides a detailed explanation of the neural processes involved in attention formation and function. Children with ADHD face problems due to dysfunction in specific brain regions involved in attention formation or hyperactive functions. Because of this dysfunction, they face problems in emotional, social, and academic well-being. Understanding children with ADHD from a neurocognitive perspective enables parents, teachers, peers, and educational administrators to support children with ADHD, empowering them to attain academic success and participate effectively in social lives.
Keywords: Attention-Deficit Hyperactivity Disorder, Children with ADHD, Neurocognition, Attention Networks, Dysregulation, Neurocognitive Profile

Introduction

Normal human physiological and psychological behaviour depends on neurocognitive functioning of the brain. Neurocognition is the function of particular areas of neural pathways and cortical networks of the brain during the process of cognition (Bressler & Menon, 2010). Children with proper brain development typically exhibit good cognitive functions, such as attention, perception, learning, memory, and social cognition. Mental disorders in children occur when their brains are affected genetically, through brain diseases and brain injuries, or by exposure to toxins. Attention-deficit hyperactivity disorder (ADHD) is the most prevalent neurobehavioural disorder in childhood. The major components of this disorder are developmentally inappropriate levels of inattention and hyperactivity or impulsivity, which result in functional impairment in one or more areas of academic, social, and emotional function (Rajaprakash & Leppert, 2022). Attention deficit/hyperactivity disorder (ADHD) is a neurobiological problem associated with various brain regions. Understanding children with ADHD from a neurocognitive perspective provides a fundamental concept of attention formation and brain region functions in a neurobiological way. Various neuroimaging techniques can be used to identify attention defects and remedy them, as well as provide support systems for children with ADHD. It explains the mechanism involved in attention formation and how it works in the human brain. Neurocognition of attention formation explains how neurotransmission system dysfunctions in particular or various brain regions develop attention deficit/hyperactive disorder. It clearly explains the minute dysfunctions of brain regions in the attention process and the abnormal neurophysiological and psychological behavioural outcomes of children with ADHD. Adequate knowledge and neurocognitive awareness help to understand children with attention deficit hyperactivity disorder, which is an important aspect of comprehending the nature of their physiological and psychological behaviour and their associated problems. This knowledge enables parents, teachers, peers, and educational administrators to support children with ADHD, empowering them to attain academic success and participate effectively in social lives.

Attention

Attention is the active process of a limited amount of information from the environment through our senses, stored memories, and other cognitive processes (De Weerd, 2003; Rao, 2003). It includes both conscious and unconscious processes. The conscious processes of attention are comparatively easy to investigate. The unconscious processes of attention are difficult to study. The conscious and unconscious processes of attention are elucidated using neuroimaging techniques, including functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and electroencephalography (EEG). These techniques delineate attention networks and detect attention-related dysfunctions in the brain, offering scientific insights into attentional mechanisms.

The processes of the four main functions of attention were explained by Sternberg, Sternberg, and Mio (2009).

The four main functions of attention are as follows:

- Signal detection and vigilance: This process attempts to detect the appearance of a particular stimulus.
- Search: This process attempts to find a particular object in the external environment or in the internal stored information.
- Selective attention: It chooses to attend to particular stimuli or information and ignore unnecessary stimuli.
- Divided attention: This process prudently allocates available attentional resources to coordinate the performance of more than one task at a time.

Attention is the selection of a particular sensory stimulus or mental process for further analysis (Purves et al., 2008). Attention creates heightened stimulation, which exceeds the normal threshold of neural firing, and therefore incites new teams of neurones to unite (Dispenza, 2007).

Attention Networks in Human Brain

The human brain has two cerebral hemispheres. These hemispheres are further subdivided into four separate regions, known as lobes. Thus,the cerebral hemispheres have two frontal lobes, two temporal lobes, two parietal lobes, and two occipital lobes. Each of these areas processes different sensory information, motor abilities, and mental functions and is assigned to perform different tasks (Dispenza, 2007).

In general, the frontal lobes are responsible for intentional action and for focusing attention, and they coordinate nearly all the functions in the rest of the brain. The parietal lobes deal with sensations related to touch and feeling, visual-spatial tasks, and body orientations, and they also coordinate some language functions. The temporal lobes process sounds, perception, learning, language, memory, and smell. The occipital lobes manage visual information (Dispenza 2007). The frontal lobe allows individuals to place sustained attention on any one thing. It turns off other unnecessary information in the brain circuits.

This is a dysfunction of the self-regulation mechanism. Self-regulation refers to the generation and control of one's thoughts, feelings, and actions in the internal state of the mind to attain personal goals (Zimmerman, 1995). Children with ADHD have difficulties, dysfunctions, and dys regulation in controlling their thoughts, feelings, and actions in the internal state of the mind to regulate and control their attention. It is important to understand the self-regulatory mechanisms of the attention process in the human brain.

The term attention refers to the mechanisms that enable adaptive behaviour by selecting, integrating, and prioritising competing demands on our cognitive and emotional systems from the outside world as well as from internally generated goals (Berger, 2011). Posner's model of attentional networks explains that attention involves different mechanisms that are subserved by separate brain networks (Posner & Petersen, 1990). In this model, attention contains three subsystems: alerting, orienting, and executive control (Figure 1). These attentional networks are separable, functionally integrated, and interact with one another (Fan et al., 2009). Attention networks in the brain are affected by different emotional states. Emotions strengthen or weaken attention networks based on the nature of the information, situation, and physical, mental, and psychological conditions of the individual.

Alerting

Alerting refers to achieving and maintaining a state of high sensitivity to incoming stimuli. It is related to both psychology and physiology. Alertness is an important precondition for other attention processes. This network is involved in establishing an attentive state of mind and maintaining readiness to respond. The alerting network seems to involve areas in the right frontal lobe (especially the superior region of Brodmann's area 6), right parietal lobe, and locus coeruleus (Posner & Petersen, 1990). Maintaining alertness over time is often referred to as continued attention. However, in many situations, the readiness to react must be maintained at a stimulant level.

When the information is excessively emotional, the brain's alerting networks function quickly to process the information for immediate action. In continuous teaching and learning circumstances, the teacher has to apply some emotional strategies to alert the learner to receive the information constantly without any distraction. This technique influences the brain and brings alertness so that the brain actively receives information for learning.

Orienting

Orienting refers to the selection of information based on sensory input. It involves engagement, movement, and disengagement processes or stages. An orienting system is associated with the superior parietal and frontal regions and the temporoparietal junction, along with the superior colliculus and pulvinar (Posner & Petersen, 1990).

Executive Attention

Executive attention includes mechanisms for monitoring and resolving conflicts among thoughts, feelings, and responses. The formation of each type of attention involves an administrative process in the cerebral cortex of the brain. This network is related to the control of goal-directed behaviour, including selection, target detection, conflict resolution, inhibition of proponent responses, monitoring, and error detection (Berger & Posner, 2000). The executive control network seems to comprise the midline frontal areas, including the anterior cingulate cortex (ACC), supplementary motor area (SMA), and portions of the basal ganglia (Posner & Petersen,1990).

ADHD has deficits in higher-level cognitive functions necessary for mature adult goal-directed behaviours, in so-called ''executive functions'' (EFs), which are mediated by late-developing fronto-striato-parietal and fronto-cerebellar networks (Rubia, 2013).

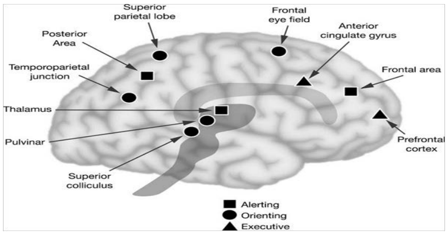

Figure 1 Brain areas involved in the different attentional networks: alerting, orienting, and executive attention [Source: Posner & Rothbart (2007). Educating the Human Brain. American Psychological Association. Washington, DC]

Attention Deficit Hyperactivity Disorder in Children

Attention deficit hyperactivity disorder (ADHD) may be related to dysfunction in the brain's neurotransmission system, which is responsible for making connections between different parts of the brain (Farrell, 2009). According to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), ADHD is a neurodevelopmental disorder characterised by impulsivity, hyperactivity, and/or inattention (American Psychiatric Association, 2013). ADHD is characterised by inattention, hyperactivity/impulsivity, and inappropriate emotional and social behaviours, such as lack of inhibitory control and poor attention to self-monitoring (American Psychiatric Association, 2013). Complex audio-visual, motivational, and emotional dysfunctions have been identified in children with ADHD (Gehricke et al., 2017). Importantly, the frontal and prefrontal regions are responsible for executive functioning, such as planning, motivation, and impulse control (Salomone, Fleming, Bramham, O'Connell, & Robertson, 2015). Reynolds et al. (2017) identified the underlying systems in the frontal cortex that regulate attention and allow distractions to be ignored; they also regulate persistence, precise motor control, and mirroring. Macneil et al. (2011) stated, Unfortunately, children with ADHD exhibit abnormalities in the brain that are likely associated with disconnection from emotion, lack of focus, and difficulty forming attachments with others. In this regard, these children develop problems with emotional and social performance.

Arnsten (2006) explained neurophysiology about Attention Deficit Hyperactivity Disorder. Attention Deficit Hyperactivity Disorder(ADHD) is a disorder seen in children and adults. It is estimated that 3–5% of children have this disorder. Depending on the diagnostic criteria and age group, ADHD affects approximately 5–10% of children and adolescents worldwide (Taylor & Sonuga-Barke, 2008). Children with this disorder are associated with poor academic performance and social outcomes.

The symptoms of ADHD involve dysfunction of the prefrontal cortex (PFC) and its cortical and subcortical connections. ADHD includes symptoms of "inattention" and "hyperactivity/impulsivity." Children can have either the combined type or the predominantly inattentive or hyperactive/impulsive type. The brain region of prefrontal cortex (PFC) plays a vital role in attention. Many of the inattention symptoms of ADHD are related to attentional abilities of the prefrontal cortex (PFC), such as difficulty in sustaining attention or organising, being easily distracted, and being forgetful. Likewise, several symptoms of hyperactivity/impulsivity describe PFC deficits, such as difficulty awaiting the turn. The prefrontal cortex (PFC) controls attention through projections to the parietal and temporal cortices.

ADHD was first described by Dr. Heinrich Hoffman in 1845. This topic has been widely investigated. No one knows for sure. The cause of ADHD is unknown. It may be a partially heritable condition. There is some evidence of a link between maternal smoking and alcohol consumption during pregnancy (Hausknecht et al., 2005; Obel et al., 2009; Rodriguez & Bohlin, 2005). Lead exposure on the part of the child may also be associated with ADHD. Brain injury and food additives, particularly sugar and certain dyes, are other possible causes (Cruz & Bahna, 2006; Nigg et al., 2008). There are noted differences in the frontal-subcortical cerebellar catecholaminergic circuits and dopamine regulation in people with ADHD (Biederman & Faraone, 2005). The three primary symptoms of ADHD are inattention, hyperactivity, and impulsiveness. There are three main types of ADHD, depending on which symptoms are predominant: (a) hyperactive-impulsive, (b) inattentive, and (c) a combination of hyperactive-impulsive and inattentive behaviours.

- Children with the inattentive type of ADHD show several distinctive symptoms.
- They are easily distracted by irrelevant sights and sounds.
- They often fail to pay attention to details.
- They are susceptible to making careless mistakes in their work.
- They often fail to read instructions completely or carefully.
- They are susceptible to forgetting or losing things they need for tasks, such as pencils or books (Sternberg, Sternberg & Mio, 2009).

Neurocognitive Profiles in Children with ADHD

Neuroscientists have conducted various studies related to children with ADHD and have found abnormalities in the neurocognitive functions of children with ADHD brains. Based on these neurocognitive abnormalities, they were explained, characterised, and sub-grouped. It is useful to understand the nature and behaviour of children with ADHD. Soman et al. (2023) examined the development of functional and structural connectivity in children with ADHD compared to controls using graph metrics. They found in functional connectivity, children with ADHD (compared to typically developing children) showed lower degree, local efficiency and betweenness centrality predominantly in parietal, temporal and visual cortices and higher degree, local efficiency and betweenness centrality in frontal, parietal, and temporal cortices. They also found that in terms of structural connectivity, children with ADHD had lower local efficiency in the parietal and temporal cortices and higher degree and betweenness centrality in the frontal, parietal, and temporal cortices. Furthermore, differential developmental trajectories of functional and structural connectivity for graph measures were observed in higher-order cognitive and sensory regions. Their findings showed that the topology of functional and structural connectives matures differently between typically developing controls and children with ADHD during childhood and adolescence. Specifically, functional and structural neural circuits associated with sensory and various higher-order cognitive functions are altered in children with ADHD. Bergwerff, et al (2017) examined neurocognitive profiles in children with ADHD and with this examination they were detected four subgroups in the ADHD group. It is also characterised by (1) poor emotional recognition, (2) poor interference control, (3) slow processing speed, or (4) increased attentional lapses and fast processing speed. Castellanos and Tannock (2002) identified several neurocognitive pathways for ADHD that are well-known in neuroscience. These pathways involve (a) a specific abnormality in reward-related circuitry to abnormalities in (ventral) frontostriatal brain areas, (b) deficits in temporal processing involving the basal ganglia and cerebellum, and (c) deficits in working memory related to abnormalities in (dorsal) frontostriatal areas (Castellanos & Tannock, 2002). Fair et al. (2012) studied subgroups of children with ADHD characterised by either (a) high levels of response variability, (b) reduced working memory, memory span, and processing speed, (c) inaccurate temporal information processing, or (d) suboptimal arousal. Van Hulst et al. (2015) showed that children with ADHD showed subgroups characterised by either (a) fast reaction times and high cognitive control, (b) poor cognitive control, or (c) slow and variable timing. Wolke, Rizzo, and Woods (2002) investigated persistent infant crying and hyperactivity problems in middle childhood and they found correlations between (a) persistent crying at 3 to 4 months of age and hyperactivity, (b) parent-reported conduct problems and negative emotionality, and (c) teachers' reports of lower academic achievements in middle childhood. These different neurocognitive profiles in children with ADHD create awareness and knowledge of understanding the neurocognitive aspects of ADHD children.

Dysregulation in Children with ADHD

Nigg and Casey (2005) described the characteristics of dysregulation in children with ADHD at school age as follows:

- Excessive activity
- Impulsivity and disorganized
- Off-task behaviours

They do not seem to pay attention to what is being said or done and

They exhibit reckless play and are at a higher risk of accidents and physical injuries.

Barkley (2002), explained dysregulation of children with ADHD in the following behaviours:

- These children have trouble coping with the requirements of the school environment
- Tend to go off task
- They have trouble finishing their homework and staying organized
- There is also substantial comorbidity with anxiety problems which seem to reflect poor emotion regulation rather than fear or panic.

Barkley (1997) & Barkley et al., (1990) also explained that ADHD is associated following problems:

- Low academic achievement
- Poor school performance
- Retention in grade

School suspensions and expulsions were also included.

Children with ADHD face various problems and express abnormal behaviours in different situations. Understanding their problems and behaviours helps to support and gradually modify their behaviour through various techniques.

Parenting and Family Environment as Risk Factors for ADHD in Children

Parenting and family environment play significant roles in child development. It also influences the development of executive functioning, attention, and self-regulation, and may affect the risk of developmental disorders, including ADHD. Claussen et al. (2024) examined the relationship of parenting and family environment factors with ADHD. They analysed 52 review of the literature in longitudinal studies and 7 follow-up searches of additional articles. Across all analyses, these parenting factors were significantly associated with ADHD outcomes, including all factors related to parental relationship status, parental incarceration, maltreatment, parenting interactions, and child media exposure. They found that children of divorced parents had a significantly increased risk of ADHD. Parenting interaction quality of sensitivity/warmth, intrusive/reactive interaction behaviour, and negativity/harsh discipline showed an impact on ADHD. Measuring sensitivity/warmth showed a negative correlation with continuous ADHD outcomes, intrusive/reactive interaction behaviour showed a positive correlation with continuous ADHD outcomes, and negativity/harsh discipline showed a positive association with continuous ADHD outcomes. Based on child media exposure, they found that children with more media exposure were more likely to have ADHD. Physical abuse was significantly associated with continuous ADHD symptoms. Finally, they concluded that poorer quality of interaction, maltreatment, divorce and single parenting, and higher child media exposure were statistically significantly associated with an increased possibility of later ADHD symptoms and diagnosis, and thus emerged as potential risk factors. To prevent ADHD formation among children, parents and family members should pay attention to their children's physical, psychological, and social environments and provide support.

Emotional Dysregulation in Children with ADHD

The process of emotional regulation and its effect on attention systematically function in the human brain. Psychologists tend to define emotion in terms of conscious feelings, such as love, jealousy, contempt, anger, and despair (Purves et al. 2008). Emotions are classified in two ways: They are positive emotions, such as enjoyment, love, and surprise. Negative emotions such as anger, sadness, fear, and shame. Children with ADHD have problems with emotional regulation. The limbic system is involved in emotional experience and expression, and the amygdala plays a major role in the experience and expression of emotions (Price, Russchen and Amaral, 1987). Hulvershorn et al. (2014) evaluated children aged 6-13 years with ADHD. They using functional magnetic resonance imaging (fMRI) and found that the amygdala is implicated in the regulation of emotion and the relationship between intrinsic functional connectivity (iFC) of amygdala circuits and emotion regulation deficit in children with ADHD. Children with greater ADHD symptoms have deficits in emotional self-regulation. They express high-intensity and high-level positive and negative emotions. In contrast, those with the inattentive subtype of ADHD displayed impaired social functioning, that is, social passivity and deficits in social knowledge, but did not exhibit problems with emotional regulation (Maedgen and Carlson 2000). Therefore, understanding emotional dysregulation in children with ADHD helps develop stable emotional regulation and expression of emotions in others.

Social Isolation in Children with ADHD

Social isolation in childhood occurs due to physical and mental health conditions. Children with neurodevelopmental disorders, such as attention deficit/hyperactivity disorder, may be particularly at risk of becoming socially isolated (Thompson et al., 2023). Children with ADHD often report difficulties in establishing friendships (Kwan, Gitimoghaddam and Collet, 2020; McQuade, 2020). Children with hyperactive/impulsive and inattentive symptoms influence their socialisation processes. They face difficulties in talking to each other, registering social cues, and cooperating with each other. Socially isolated children face problems in developing interpersonal and intrapersonal skills. Isolated children have limited opportunities to observe, model, and learn age-appropriate interpersonal interactions with other children (Parker 2006).Their parents, family members, friends, peers, and teachers need to understand the social behaviour of children with ADHD to interact with them appropriately for the development of their social skills at home and in school.

Children with Attention Deficit Hyperactivity Disorder (ADHD) often face unique challenges in their daily lives, navigating academic, social, and emotional landscapes that can be particularly demanding. Empathy and support play pivotal roles in helping these children thrive. By understanding the neurodevelopmental nature of ADHD, caregivers, educators, and peers can foster nurturing and accommodating environments. Empathetic approaches include recognising the child's struggles with impulsivity, inattention, and hyperactivity not as behavioural shortcomings but as aspects of their neurological profile. Supportive strategies may encompass tailored educational plans, positive reinforcement, and patience, allowing children with ADHD to build confidence and develop coping mechanisms. Such empathy-driven support can significantly enhance their self-esteem, academic performance, and social interactions, ultimately empowering them to reach their full potential. Creating spaces where children with ADHD feel understood and valued is crucial to their holistic development and well-being.

Conclusion

Children with ADHD are often understood from psychological or behavioural perspectives but rarely from a neurocognitive perspective. Understanding ADHD from a neurocognitive perspective can be beneficial as it provides a detailed explanation of the neural processes involved in attention formation and function. This perspective provides insights into the neurophysiological and neurobiological mechanisms underlying attention, including the interconnectedness of neural networks and the specific brain regions involved. Scientific evidence supports these findings, which have been elucidated through neuroscience. By understanding the normal attention process in the brain and the dysregulation processes that occur in ADHD, we can better comprehend the underlying neural mechanisms that contribute to attention deficits and abnormal behaviour. Understanding the concept of attentional processes from a neurocognitive perspective generates scientific knowledge and awareness of how the human brain develops attention networks. This knowledge contributes to the early identification of children with ADHD. Children with ADHD can be found at home, school, neighbourhoods, or society. It also provides parents, teachers, educators, family members, and peers with a clear understanding of how to handle these children for better attentional behaviour and performance in their daily lives. Since ADHD is a neurobiological mental disorder, examining it from a neurocognitive perspective can help design new therapeutic techniques and maximise therapy outcomes for children with ADHD. Combining psychological interventions and psychiatric treatments can be more effective, which is why this study explored ADHD from a neurocognitive perspective.

References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*. American Psychiatric Publishing.

Arnsten, A. F. (2006). Stimulants: Therapeutic actions in ADHD. *Neuropsychopharmacology, 31*, 2376-2383.

Barkley, R. A. (1997). Behavioral Inhibition, Sustained Attention, and Executive Functions: Constructing a Unifying Theory of ADHD. *Psychological Bulletin, 121*(1), 65-94.

Barkley, R. A. (2002). Major Life Activity and Health Outcomes Associated with Attention-Deficit/Hyperactivity Disorder. *The Journal of Clinical Psychiatry, 63*, 10-15.

Barkley, R. A., Fischer, M., Edelbrock, C. S., & Smallish, L. (1990). The Adolescent Outcome of Hyperactive Children Diagnosed by Research Criteria: I. An 8-year Prospective Follow-up Study. *Journal of the American Academy of Child and Adolescent Psychiatry, 29*(4), 546-557.

Berger, A. (2011). *Self-regulation: Brain, Cognition, and Development*. American Psychological Association.

Berger, A., & Posner, M. I. (2000). Pathologies of Brain Attentional Networks. *Neuroscience and Biobehavioral Reviews, 24*(1), 3-5.

Bergwerff, C. E., Luman, M., Weeda, W. D., & Oosterlaan, J. (2017). Neurocognitive Profiles in Children with ADHD and their Predictive Value for Functional Outcomes. *Journal of Attention Disorders, 23*(13), 1567-1577.

Biederman, J., & Faraone, S. V. (2005). Attention-deficit Hyperactivity Disorder. *The Lancet, 366*(9481), 237-248.

Bressler, S. L., & Menon, V. (2010). Large-scale Brain Networks in Cognition: Emerging Methods and Principles. *Trends in Cognitive Sciences, 14*(6), 277-290.

Castellanos, F. X., & Tannock, R. (2002). Neuroscience of Attention-deficit/hyperactivity Disorder: The Search for Endophenotypes. *Nature Reviews Neuroscience, 3*(8), 617-628.

Claussen, A. H., Holbrook, J. R., Hutchins, H. J., Robinson, L. R., Bloomfield, J., Meng, L., Bitsko, R. H., O'Masta, B., Cerles, A., Maher, B., Rush, M., & Kaminski, J. W. (2024). All in the Family? A Systematic Review and Meta-Analysis of Parenting and Family Environment as Risk Factors for Attention-Deficit/Hyperactivity Disorder (ADHD) in Children. *Prevention Science, 25*, 249-271.

Cruz, N. V., & Bahna, S. L. (2006). Do Food or Additives Cause Behavior Disorders?. *Pediatric Annals, 36*(10), 724-732.

De Weerd, P. (2003). Attention, neural basis of. In L. Nadel (Ed.), *Encyclopedia of cognitive science,* Nature Publishing Group.

Dispenza, J. D. C. (2007). *Evolve your Brain: The Science of Changing Your Mind*. Health Communications.

Fair, D. A., Bathula, D., Nikolas, M. A., & Nigg, J. T. (2012). Distinct Neuropsychological Subgroups in Typically Developing Youth Inform Heterogeneity in Children with ADHD. *Proceedings of the National Academy of Sciences, 109*(17), 6769-6774.

Fan, J., Gu, X., Guise, K. G., Liu, X., Fossella, J., Wang, H., & Posner, M. I. (2009). Testing the Behavioral Interaction and Integration of Attentional Networks. *Brain and Cognition, 70*(2), 209-220.

Farrell, M. (2009). *Foundations of Special Education: An Introduction*. Wiley & Sons.

Gehricke, J. G., Kruggel, F., Thampipop, T., Alejo, S. D., Tatos, E., Fallon, J., & Muftuler, L. T. (2017). The Brain Anatomy of Attention-Deficit/Hyperactivity Disorder in Young Adults: A Magnetic Resonance Imaging Study. *PLOS ONE, 12*(4), 1-21.

Hausknecht, K. A., Acheson, A., Farrar, A. M., Kieres, A. K., Shen, R. Y., Richards, J. B., & Sabol, K. E. (2005). Prenatal Alcohol Exposure Causes Attention Deficits in Male Rats. *Behavioral Neuroscience, 119*(1), 302-310.

Hulvershorn, L. A., Mennes, M., Castellanos, F. X., Di Martino, A., Milham, M. P., Hummer, T. A., & Roy, A. K. (2014). Abnormal Amygdala Functional Connectivity Associated with Emotional Lability in Children with Attention-Deficit/Hyperactivity Disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 53*(3), 351-361.

Kwan, C., Gitimoghaddam, M., & Collet, J. P. (2020). Effects of Social Isolation and Loneliness in Children with Neurodevelopmental Disabilities: A Scoping Review. *Brain Sciences, 10*(11).

Macneil, L. K., Xavier, P., Garvey, M. A., Gilbert, D. L., Ranta, M. E., Denckla, M. B., & Mostofsky, S. H. (2011). Quantifying Excessive Mirror Overflow in Children with Attention-Deficit / Hyperactivity Disorder. *Neurology, 76*(7), 622-628.

Maedgen, J. W., & Carlson, C. L. (2000). Social Functioning and Emotional Regulation in the Attention-Deficit / Hyperactivity

Disorder Subtypes. *Journal of Clinical Child Psychology, 29*(1), 30-42.

McQuade, J. D. (2020). Peer functioning in adolescents with ADHD. In S. P. Becker (Ed.), *ADHD in Adolescents: Development, Assessment, and Treatment.* Guilford Press.

Nigg, J. T., & Casey, B. J. (2005). An Integrative Theory of Attention-Deficit/Hyperactivity Disorder based on the Cognitive and Affective Neurosciences. *Development and Psychopathology, 17*(3), 785-806.

Nigg, J. T., Knottnerus, G. M., Martel, M. M., Nikolas, M., Cavanagh, K., Karmaus, W., & Rappley, M. D. (2008). Low Blood Lead Levels Associated with Clinically Diagnosed Attention-Deficit / Hyperactivity Disorder and Mediated by Weak Cognitive Control. *Biological Psychiatry, 63*(3), 325-331.

Obel, C., Linnet, K. M., Henriksen, T. B., Rodriguez, A., Järvelin, M. R., Kotimaa, A., Moilanen, I., Ebeling, H., Bilenberg, N., Taanila, A., Ye, G., & Olsen, J. (2009). Smoking during Pregnancy and Hyperactivity-Inattention in the Offspring: Comparing Results from Three Nordic Cohorts. *International Journal of Epidemiology, 38*(3), 698-705.

Parker, J. G., Rubin, K. H., Erath, S. A., Wojslawowicz, J. C., & Buskirk, A. A. (2006). Peer relationships, child development, and adjustment: A developmental psychopathology perspective. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology: Theory and method* (pp. 419-493). John Wiley & Sons.

Posner, M. I., & Petersen, S. E. (1990). The Attention System of the Human Brain. *Annual Review of Neuroscience, 13*, 25-42.

Posner, M. I., & Rothbart, M. K. (2007). *Educating the Human Brain*. American Psychological Association.

Price, J. L., Russchen, E. T., & Amaral, D. G. (1987). The limbic region II: The amygdaloid complex. In *Handbook of chemical neuroanatomy*. Elsevier.

Purves, D., Augustine, G. J., Fitzpatrick, D., Hall, W. C., LaMantia, A. S., McNamara, J. O., & Williams, S. M. (Eds.). (2004). *Neuroscience*. Sinauer Associates.

Purves, D., Brannon, E. M., Cabeza, R., Huettel, S. A., LaBar, K. S., Platt, M. L., & Woldorff, M. G. (2008). *Principles of Cognitive Neuroscience*. Sinauer Associates.

Rajaprakash, M., & Leppert, M. L. (2022). Attention-Deficit/Hyperactivity Disorder. *Pediatrics in Review, 43*(3), 135-147.

Rao, R. P. N. (2006). Attention, models of. In L. Nadel (Ed.), *Encyclopedia of cognitive science*. John Wiley & Sons.

Reynolds, J. E., Billington, J., Kerrigan, S., Williams, J., Elliott, C., Winsor, A. M., Codd, L., Bynevelt, M., & Licari, M. K. (2017). Mirror Neuron System Activation in Children with Developmental Coordination Disorder: A Replication fMRI Study. *Research in Developmental Disabilities, 84*, 16-27.

Rodriguez, A., & Bohlin, G. (2005). Are Maternal Smoking and Stress during Pregnancy Related to ADHD Symptoms in Children?. *Journal of Child Psychology and Psychiatry, 46*(3), 246-254.

Rubia, K. (2013). Functional Brain Imaging Across Development: A Review. *European Child and Adolescent Psychiatry, 22*, 719-731.

Salomone, S., Fleming, G. R., Shanahan, J. M., Castorina, M., Bramham, J., O'Connell, R. G., & Robertson, I. H. (2015). The Effects of a Self-alert Training (SAT) Program for Adults with ADHD. *Frontiers in Human Neuroscience*.

Sangal, R. B., & Sangal, J. M. (2015). Use of EEG Beta-1 Power and Theta/Beta Ratio Over Broca's Area to Confirm Diagnosis of Attention-Deficit/Hyperactivity Disorder in Children. *Clinical EEG and Neuroscience, 46*(3), 177-182.

Soman, S. M., Vijayakumar, N., Thomson, P., Ball, G., Hyde, C., & Silk, T. J. (2023). Functional and Structural Brain Network Development in Children with Attention-Deficit/Hyperactivity Disorder. *Human Brain Mapping, 44*(8), 3394-3409.

Sternberg, R. J., Sternberg, K., & Mio, J. (2009). *Cognitive Psychology.* Wadsworth.

Taylor, E. A., & Sonuga-Barke, E. J. S. (2008). Disorders of attention and activity. In *Rutter's*

Child and Adolescent Psychiatry (pp. 521-542). Wiley-Blackwell.

Thompson, K. N., Agnew-Blais, J. C., Allegrini, A. G., Bryan, B. T., Danese, A., Odgers, C. L., Matthews, T., & Arseneault, L. (2023). Do Children with Attention-Deficit / Hyperactivity Disorder Symptoms become Socially Isolated? Longitudinal Within-person Associations in a Nationally Representative Cohort. *JAACAP Open, 1*(1), 12-23.

Van Hulst, B. M., De Zeeuw, P., & Durston, S. (2015). Distinct Neuropsychological Profiles within ADHD: A Latent Class Analysis of Cognitive Control, Reward Sensitivity, and Timing. *Psychological Medicine, 45*(4), 735-745.

Wolke, D., Rizzo, P., & Woods, S. (2002). Persistent Infant Crying and Hyperactivity Problems in Middle Childhood. *Pediatrics, 109*(6), 1054-1060.

Zimmerman, B. J. (1995). Self-regulation involves more than Metacognition: A Social-cognitive Perspective. *Educational Psychologist, 29*, 217-221.

Author Details

A. Ananda Kumar, *Institute of Advanced Study in Education (IASE), Chennai, Tamil Nadu, India,*
Email ID*: kumar0253@gmail.com*