The Language of Bengali Children with Neurodevelopmental Disorders: A Neurolinguistic Study

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The Language of Bengali Children with Neurodevelopmental Disorders: A Neurolinguistic Study

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DECLARATION

I hereby certify that the content of this thesis, "Language of Bengali Children with Neurodevelopmental Disorders: A Neurolinguistic Study," is original to me and has not been previously presented for a higher degree.

This research work is done under direct supervision and guidance of Professor Dr. Jinat Imtiaz Ali, Department of Linguistics, University of Dhaka, Bangladesh, Professor Dr. Syed Shahrier Rahman, Department of Linguistics, University of Dhaka, and Dr. Md. Faruq Alam, Professor & Head, Adolescent & Family Psychiatry, National Institute of Mental Health & Hospital Sher-E-Bangla, Dhaka.

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This is to certify that **Fahmida Ferdous** has completed this PhD research entitled **"Language of Bengali Children with Neurodevelopmental Disorders: A Neurolinguistic Study"** in the Department of Linguistics, University of Dhaka, Dhaka, Bangladesh under our supervision and guidance as fulfillment of the criteria required for the Doctoral (PhD) degree.

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DEDICATION

To all children who face difficulties after birth as a result of Neurodevelopmental Disorders

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LIST OF ABBREVIATIONS

AAC	:	Alternative and Augmentative Communication
ADHD	:	Attention Deficit Hyperactivity Disorder
APA	:	American Psychiatric Association
ASD	:	Autism Spectrum Disorder
CP	:	Cerebral palsy
DSM-5	:	Diagnostic and Statistical Manual – 5
FOXP2 gene	:	Forkhead boxP2 gene
HIE	:	Hypoxic- Ischemic Encephalopathy
ID	:	Intellectual Disability
IDD	:	Intellectual Development Disorder
IUGR	:	Intra Uterine Growth Retardation
MRI	:	Magnetic Resonance Imaging
MR	:	Mental Retardation
NDD	:	Neurodevelopmental disorders
TORCH	:	Toxoplasmosis, Rubella, Cytomegalovirus, Herpes simplex and HIV

ABSTRACT

NEURO LINGUISTIC

The Language of Bengali Children with Neurodevelopmental Disorders: A Neurolinguistic Study

Fahmida Ferdous

Dissertation under the direction of Professor Dr. Jinat Imtiaz Ali, Professor Dr. Syed Shahrier Rahman, and Professor Dr. Faruq Alam

Linguistic understanding, verbal expression of language, meaning inference, and perception are all hampered by Neuro-developmental Disorders (NDD). Individual processes are greatly impacted by defects in nervous system development; illustrated by this descriptive cross-sectional doctoral research on children with neurodevelopmental disorders has been carried out in tertiary-level hospitals from January 2017 to December 2022 in Bangladesh. The various NDDs (Autism Spectrum Disorder -ASD, Attention Deficit Hyperactivity Disorder - ADHD, Intellectual Development Disorder - IDD, and Cerebral Palsy -CP) have been observed in children. Face-to-face interviews and semi-structured questionnaires have been used to collect data.

In all children having ASD, ADHD, IDD, and CP, all of them have found different levels of receptive/perceptive language development disorder (50.7%, 97.0%, 65.3%, and 84.0%), expressive language disorder (64.0%, 98.7%, 81.3%, and 98.7%), social / sociolinguistic development disorder (88.0%, 100.0%, 89.3%, and 78.7%), and behavioral disorder (80.0%, 97.0%, 64.0%, and 62.7%) respectively. Children with IDD and ADHD have phonemic awareness disorder (77.3%, and 85.1%). Metalinguistic competence disorder

was observed in all children. For children with CP, the radiological finding of anatomical location was a hyperintense or hypointense area found in the frontal lobe (Broca's area) and basal ganglia (56%), temporal lobe (Wernicke's area) and basal ganglia (20%), and frontal, temporal and basal ganglia. A pathological finding was detected in the MRI report that had a noticeable relation ($p<0.05$) with the language area of the brain. However, children with IDD and ADHD have no organic abnormality detected pathologically in MRI of the brain.

According to research, children with CP have significantly higher rates of both receptive language developmental disorder and expressive language development disorder than children with ASD. The receptive, expressive, and sociolinguistic developmental disorder was noticeable higher in children with ADHD than in children with ASD. Receptive language development disorder and sociolinguistic development disorder were observed to be significantly higher in children with ADHD than in children with CP. However, it was found similar in children with CP, ADHD, and IDD. As for the sociolinguistic development disorder, it has been found common in children with CP and ASD but has been found more frequent in children with IDD than in children with CP.

It discovers that children with NDD frequently have language development disorders, demonstrating the interrelationship between the brain, body, and mind in the neurolinguistic process. The research proposes insightful strategies aimed at reducing the deleterious effects of language disorders and suggests early diagnosis and intervention with linguistic assessment and speech therapy. This is the first clinical doctoral research on this topic in Bangladesh.

CHAPTER 1
INTRODUCTION

1.1 Overview:

In this research, human language is identified as a dynamic aspect in preference of traditional concepts, (Monte-Serrat & Cattani, 2021). This perspective associated language with cognition, a continuous process essential in neurolinguistics. The cerebrospinal nervous system receives stimuli from the peripheral sensory organs such as tactile, visual, auditory, olfactory, etc. Where they are organized into information understandable to the human mind (Monte-Serrat & Cattani, 2021; Perlovsky & Kozma, 2007; Terlow, 2020). However, if there are any obstacles during the transmission of these stimuli, the linguistic process will be distorted, and there will be interference in the interpretive activity. We begin our observation of language development from the intrauterine environment to understand how physical and mental conditions can significantly affect fetal brain development. We also observed the intercurrences in the child's brain and body and their effects on language acquisition and progress.

1.2 Objectives:

Thus the objectives of this reaserch are:

a) to assess the linguistic difficulties that Bengali children with neuro-developmental disorders from a neurolinguistic' perspective;
b) to investigate into various neurolinguistic disorders among these children with neuro-developmental disorders; and
c) to characterize the socio-demographic traits among these children with neuro-developmental disorders.

1.3 Clarification of the objectives:

Fetal distress may develop during pregnancy because of acute (e.g., TORCH) and chronic maternal infections, and chronic maternal medical conditions (e.g., diabetes mellitus, hypertension, hypothyroidism, hyperthyroidism, etc). Neuropathological studies suggest that uteroplacental insufficiency may cause brain damage in preterm, term, and post-term fetuses because of fetal asphyxia. The prevalence of biochemically determined antenatal and intrapartum fetal asphyxia is within 2% (Kliegman & Nelson, 2004). If hypoxia because of uteroplacental insufficiency persists, it will lead to neuropathological deficits (Low, 1993), depending on the degree of brain damage (Collucci, 2016). The prevalence of birth complications in Bangladesh is 82.6% and birth asphyxia is 61.7% (Zohra et al., 2018).

Head size is an important measurement for monitoring a child's brain development (Low, 1993). It can be considered that if the fetus head is smaller compared to age and sex, the child may have developed intellectual development disorder and speech disorders and thus the child cannot express their emotions according to situation and context (pragmatic disorder) (Ramos et al., 2018). It is reported that the current number of intellectually disabled children in Bangladesh is 4.6 million. (Disabilities Screening Bulletin, 2016). Another neurodevelopmental disorder that impairs language development is cerebral palsy (CP). Some acute and chronic infections in mothers are risk factors for cerebral palsy (Kliegman & Nelson, 2004). Dysarthria because of cerebral palsy impedes to productive conversation for neurodevelopmental disorders children and over 50% of children suffer from dysarthria (Nordberg et al., 2013). Bangladesh has a CP occurrence of 3.4 per 1000 children. (Al-Imam et al., 2021). Pediatric dysarthria negatively impacts the functional context in all facial expressions of speech motor control framework including verbalization, breathing control, vocalization, sonority, and prosody. Speech characteristics are the early indicators of

pediatric dysarthria because children develop a sequential language phonetic disorder, phonological disorder, pragmatic and sociolinguistic disorders. The correct use of an affix reflects the morphological process, however it could also be affected by the child's syntactic, semantic, phonological abilities, etc. Both production and comprehension are influenced by the phonological characteristics.. The morpheme is governed by the complexity of pronunciation as well as comprehension. Hence the effect is not only articulatory but also morphophonology disorder. Dysarthria is the indicator for advanced identification and outcome of the condition of cerebral palsy in children (Allison & Hustad, 2018).

Maternal non-infectious diseases such as diabetes mellitus increase the possibility of neonatal low blood sugar and blood calcium level, acute respiratory distress syndrome, and other respiratory-related complications due to uteroplacental insufficiency, chronic hypertension, eclampsia, pre-eclampsia, diabetes mellitus, hypo and hyperthyroidism that affect uteroplacental perfusion resulting in Intra-Uterine-Growth-Retardation of a fetus (IUGR) (Kliegman & Nelson, 2004). Long-term intrauterine fetal growth restriction affects the domains of cognitive linguistics in children. The mother's hypothyroidism may adversely affect the child's neurodevelopment (Kliegman & Nelson, 2004). Inadequate ante-natal care, illiteracy, poverty, and awareness are also associated with fetal distress (Olumuyiwa & Idowu, 2017). In Bangladesh, antepartum and intrapartum morbidity are strictly reffering to the standard of living, wellbeing, and financial situation of low- and middle-income families. CP is more commonly associated with homebirth, being the consequence of childhood physical handicap, having a frequency of 3.4 per 1000 children in Bangladesh (Al-Imam et al., 2021). It is commonly observed socio-demographically in low-and middle-income countries (Olumuyiwa & Idowu, 2017; Khanam et al., 2017). Human genetic makeup is an intrinsic core component of the human natural experience, which suggesting that we are

birthed with a gene that recognized our need for language accuisition. It is proposed that the brain is responsible for learning a language. So, language acquisition is neuro-biological and can be delayed development if certain parts of the brain are impaired during vital phases of language development (Goldstein et al., 2010). In neurodevelopment molecular network analysis of the Forkhead boxP2 (FOXP2), the gene provides important opportunities. Language acquisition may very well be influenced by FOXP2 gene-related molecular processes, namely those that affect the development of the striatal, cerebral, and cerebellar portions in the brain's neural network. Understanding these genes and the FOXP2 gene's controlled pathways is necessary to identify language impairment. The FOXP2 gene is responsible for extensive brain progression and processing, language, and neuronal plasticity. However, a mutation was not invented as the cause, but most research shows that deficiency is correlated to Autism and ADHD (Gauthier et al., 2003; Newbury, et al., 2002; Bähner & Meyer-Lindenberg, 2017; Liégeois et al., 2003; Evangelou et al., 2018; Demontis et al., 2019; Fisher, 2019). It is crucial to note that the heterogeneous groups of genetic mutation and neurodevelopmental phenomena that result from FOXP2 mutations (Demontis et al., 2019) cause linguistic disorders. Similar to the FOXP2 gene mutation, there are a variety of issues that go beyond the motor arrangement in addition to the basic lack of motor control apparatus. (Liégeois et al., 2003).

An abnormal genetic mutation of FOXP2 represents a neurodevelopmental phenomenon that may result in neuropathology (Demontis et al.,2019) in functional deviations in linguistic-related cortical and basal ganglia regions, according to brain imaging of the affected area. (Fisher, 2019). The caudate nucleus, the inferior frontal gyrus (Broca's region), the precentral gyrus, the temporal pole, and the cerebellum were the impacted areas of the brain defined by the morphometric methods of MRI analysis. (Belton et al., 2003;

Watkins et al., 2002). Furthermore, a strong correlation between the performance of various linguistic activities and the reduction in brain capacity is present. Last but not least, advances in the "neurobiology of language" suggest that pharmacological tools have emerged to cure speech and language impairments in addition to improve. (Takahashi et al., 2009). Human physical and mental health is controlled by the brain. In mental health, all positive and negative emotions are subsistent and expressed through language and behavior. Early childhood counted as a vital time for making synaptic associations. One million new neural synaptic linkages are constructed every second, compared to any other time in life. The newborn's brain is around 25% of the typical adult brain at birth. The brain growths fast and reach nearly doubles within a year (0-1 year), reaching around eighty percent (80%) of adult size in next 2 years (1-3 year) and ninety percent (90%) by the age of 5 respectively. A newborn child’s brain cell connections make the cerebration. hildren’s everyday experiences help to develop brain connections meaning the environment in which they are nurtured, language expression through positive and negative interaction with their mother, father and caregivers, and the use of their understanding to interact with people in their environment, in society, in their state, and in the world. Daily experiences of the children discover which nervous system connections will exist and which will last forever. The quantity of quality of time and looking after, reciprocity with the parents are the primarily significant effect on their nervous system development. A child's positive emotional attachment to their parents and companionship with them are essential for a child's healthy brain growth. Along with mother, father, sister, brother, close relatives, daycare providers, educators, and other societal members are also a part of the interrelations that develop at home.

After birth, a neonate infant performs his/her reciprocity by crying, cooing, and smiling to attach to their parents and other caregivers. Younger children directly express their

needs and interests with their caregivers and parents acquire the semiotics of a word from various sources by coordinating the linguistic and observational information surrounding them. These manifestations are strong indicators that the child's interest or emotion is being responded to by the parents or caregiver. The foundational stage of the brain's linguistic process is this emotional reciprocity in response to situation and context. The child's brain is literally being built by parents and other caregivers when they pay attention to, interact with, and respond to their children. Therefore, it is crucial to engage in conversation, play, intonation, reading, and play with newborns and young children from birth by giving them a secure and sound surroundings where they can discover their physical and substantial circumstances. The encouragement and interplay they perceive in their developing period make all the differentiation because individual lobes of the brain are responsible for individual competencies such as motor movement, perceptive and expressive language, emotion, and behavior. So, the nervous system connection develops according to the appraisal of values.

The brain develops on its own, as connections in the end loop with one and all other neurons in the most complicated ways. The child empowers in a complex way by thinking, moving, and conversing (United Way of Treasure Valley, 2022). Interaction with the environment language acquisition emphasizes the capacity of the language input (Vulchanet al.,2017). Two different classic hypotheses for how the human brain processes language have been put forth in the field of linguistics. It's crucial to understand that learning a language is indeed a skill that is inbuilt to the human brain is significant. (Chomsky, 1965; Lee & Pinker, 2010). Language development is entirely activated by linguistic input. Another view is the acquisition of language after birth surroundings of the child's linguistic habitat, and the inputs to which they are exposed, which are crucial factors in introducing language to the child

through interaction and communication with the adult (Tomasello, 2005). Therefore, children acquire language with interaction in the sociolinguistic context (Grohmann et al., 2017). In the sociolinguistic approach, language does not stem from innate knowledge, not from the progeny of the environment of the child, but from the interaction between the social context and their cognitive development (Mooney, 2020). Sociolinguistics studies the semiotic form of useing symbols or icons and visuals for linguistic expression. In this case, children interact and exchange emotions according to the situation and context, and the language they express is successively generated, decoded, transmitted, and encoded in various contexts (Zamani,2016). When it comes to studying the interpretation of language, It is not sufficient to focus only on language use; one must also consider how the body and brain are functioning as well as a number of other semiotic cues (such as gestures, images, and physical layout) that make up the information making the message understandable. Semiotic resources provide numerous interpretive clues about the surroundings in which the linguistic process happens. The information results from the combination of visual and auditory stimuli, for example, within a varied context, allied to the phonological and morphological perception, necessary for the processing of language by the central nervous system. Thus, a child's effective communication depends, in addition to a healthy body and mind, on attention, interaction, the transmission of information, and collaborative dialogic forms. Concluding, our studies on the link between brain, language, and context show that language learning goes beyond these two traditional theories, showing that the process of language and cognition is the same and therefore, confirming it as father of Linguistics, that language is a formation/process and not material (Anderson & Saussure, 2018).

CHAPTER 2
STATEMENT OF THE PROBLEM

2.1 Overview:

The interdisciplinary field of neurolinguistic studies the neural, neuro-biological, and physiological processes of language processing in the human neuro cells that regulate language learning, comprehension, and production. Neurolinguistic explores methods and learnings from psycholinguistic, cognitive-linguistic, sociolinguistic, theoretical linguistic, and neurolinguistics disorders (Nakai et al., 2017). So, neurolinguistic focuses on how the brain play role in the processing of language both in healthy and pathological condition concerning its connections to the brain during the course of development by listening, speaking, reading, and writing in our daily living activities. Language is not a material (Saussure, 1916), but a process (Monte-Serrat & Cattani, 2021, 2021a) in which adaptive and environmental factors interact in the development of human cognition. Besides these, neurolinguistics also deals with language acquisition, comprehension, retrieval, and its abnormality (Bambini, 2012).

2.2 Physiology of Neurolinguistics:

Neurodevelopment involves information processing (Copstead & Banasik, 2013; Monte-Serrat, 2018; Livingstone, 1988). Natural language and cognition form an interdependent complex process (Monte-Serrat & Cattani, 2021). Language is uncluttered by using symbols because it is subject to the impacts of perception (Monte-Serrat & Cattani, 2021). Semantic properties of language are related to states of cognition in progressive and mutually beneficial steps of transformation and storage of structures that transport information. Information, in turn, to be produced and transmitted, requires the human

linguistic apparatus (Copstead & Banasik, 2013; Monte-Serrat & Cattani, 2021). Problem detection in the latter can lead to adverse consequences in human development (Monte-Serrat, 2018; Monte-Serrat & Cattani, 2021a). Some of these consequences are covered in this chapter. In the brain, there are two primary centers devoted to the neural base language acquisition, comprehension, and production (Bambini, 2012).

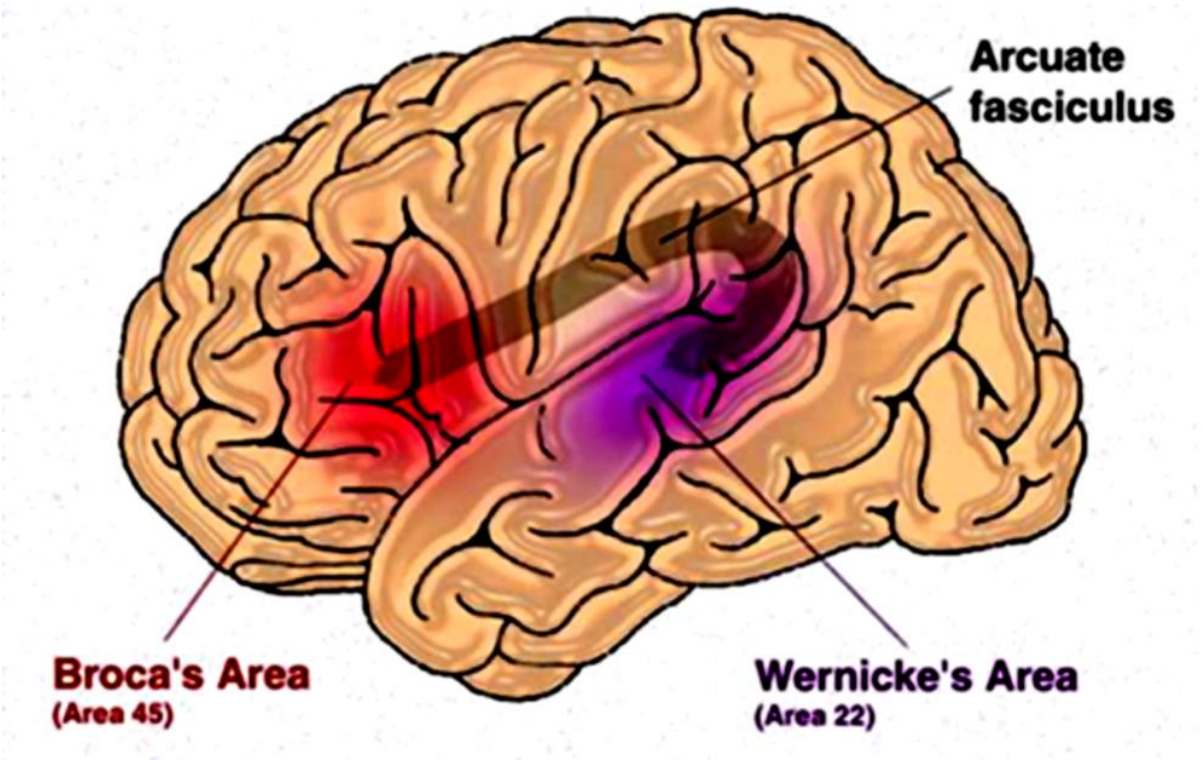

Figure 1 The brain's primary language area[1]

2.3 Lobes:

The cerebral hemisphere of the brain has four distinct lobes. The frontal lobe is located in (a Sylvian fissure) superior to the lateral sulcus and anterior to the central sulcus. The parietal lobe is located posterior to the frontal lobe and reaches to the parieto-occipital sulcus. The lateral sulcus is below the temporal lobe. The occipital lobe is located above the temporal lobe and beneath the parietal lobe.

[1] Source: https://www.flexword.de/en/primary-languages-area-of-the-brain/

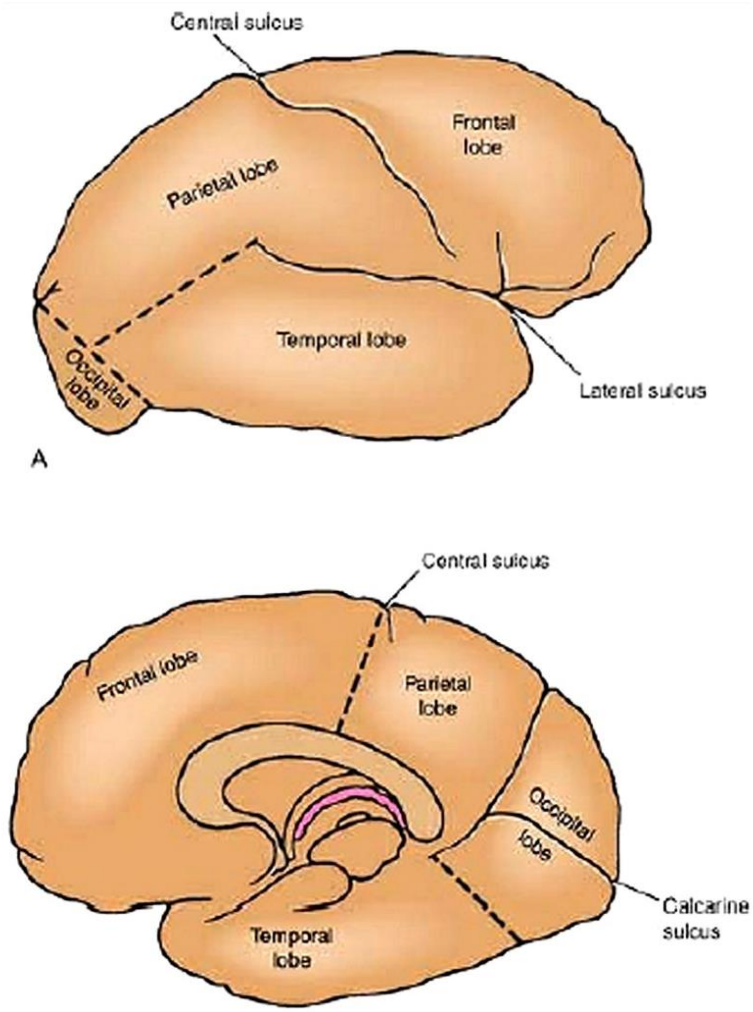

Figure 2 This lateral view of the cerebral hemisphere reveals the brain's lobes[2]

2.4 Broca's or the Broca area

It is connecting with the premotor and primary motor area through the nerve fibers, this motor area is connected with the co-ordinate movement of linguistic apparatus (Copstead & Banasik, 2013; Monte-Serrat & Cattani, 2021), such as diaphragm, larynx, oral cavity, lips, jaw, tongue, teeth, soft palate and the respiratory or lung muscles for the articulation of speech (Datta, 2017; Snell's, 2017)**.** Decoded speech sound enters our ears within (20hz to 20000hz) (Glesson & Clarke, 2015), projection fibers from the 8th cranial nerves to the auditory area, initially the cochlea encoded the acoustic sound by categorization of speech

[2] Source: http://med-mu.com/wp-content/uploads/2018/06/Snell-Neuroanatomy-7th-Edition.pdf

signals and non-verbal cues. By numerous computations, the parallel acoustic patterns are transformed into digital codes at diverse levels of language-specific structure, including particular properties, phonemes, syllables, and words. They pass through three brainstems reaching the cortex, then through the deceptively cognitive psycholinguistic capacity, the sound immediately enters the phonological network of the auditory area to the temporal lobe (Kemmerer, 2014).

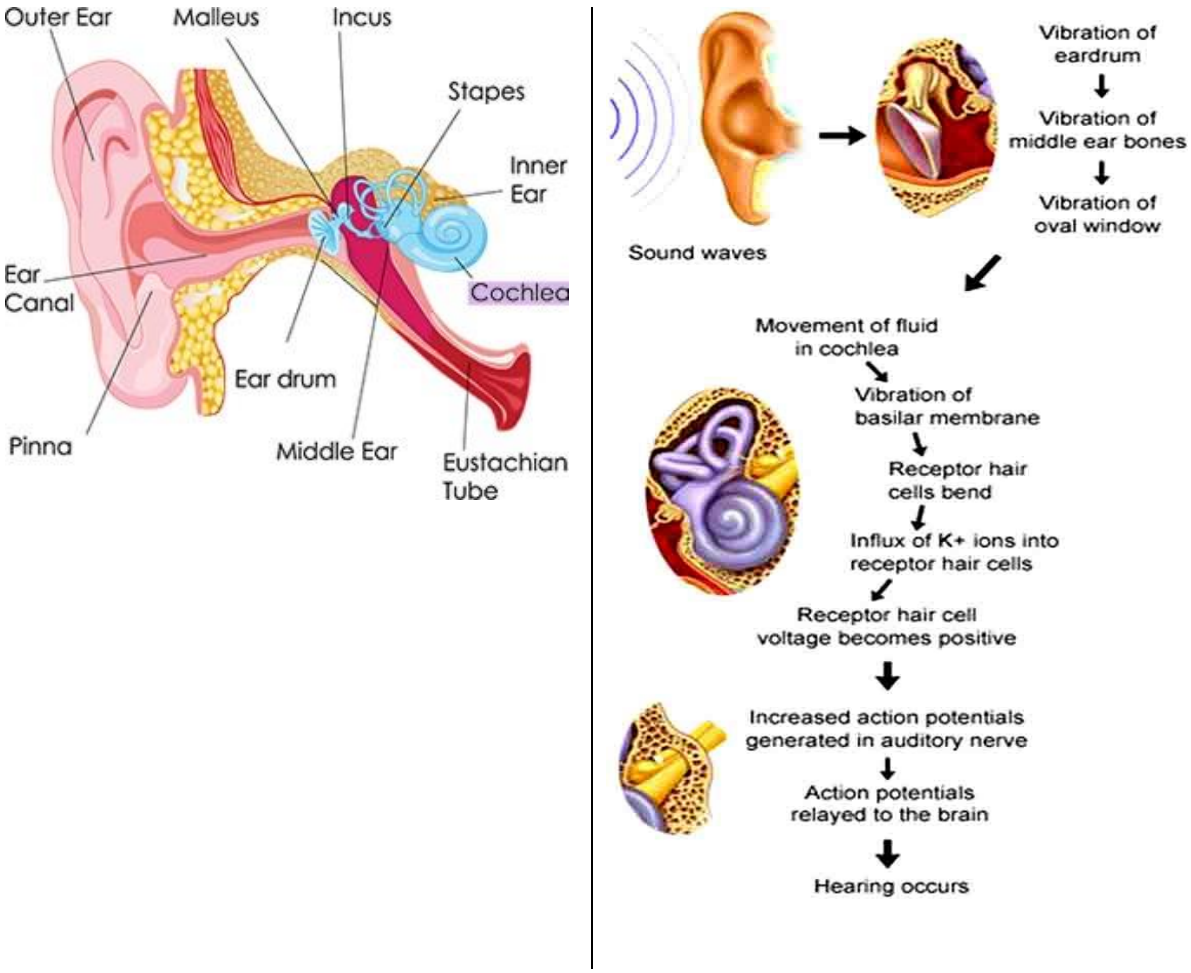

Figure 3 (Step 1) The parts of the ear and physiology of speech sound processing in the ear[3]

[3] Source: https://entforchildren.com/hearing-speech-language/anatomy/

2.5 Wernicke's area

It is in the temporal lobe, also known as the sensory processing area, is positioned in the lateral sulcus of the temporal lobe (Hershel's Gyrus) and in the superior temporal gyrus (known as front part of the primary auditory area). The secondary auditory area (the auditory association cortex), is situated next to the primary auditory area and is responsible for processing high-frequency sounds stimulation from the main auditory area and the thalamus perceives within the secondary auditory area.

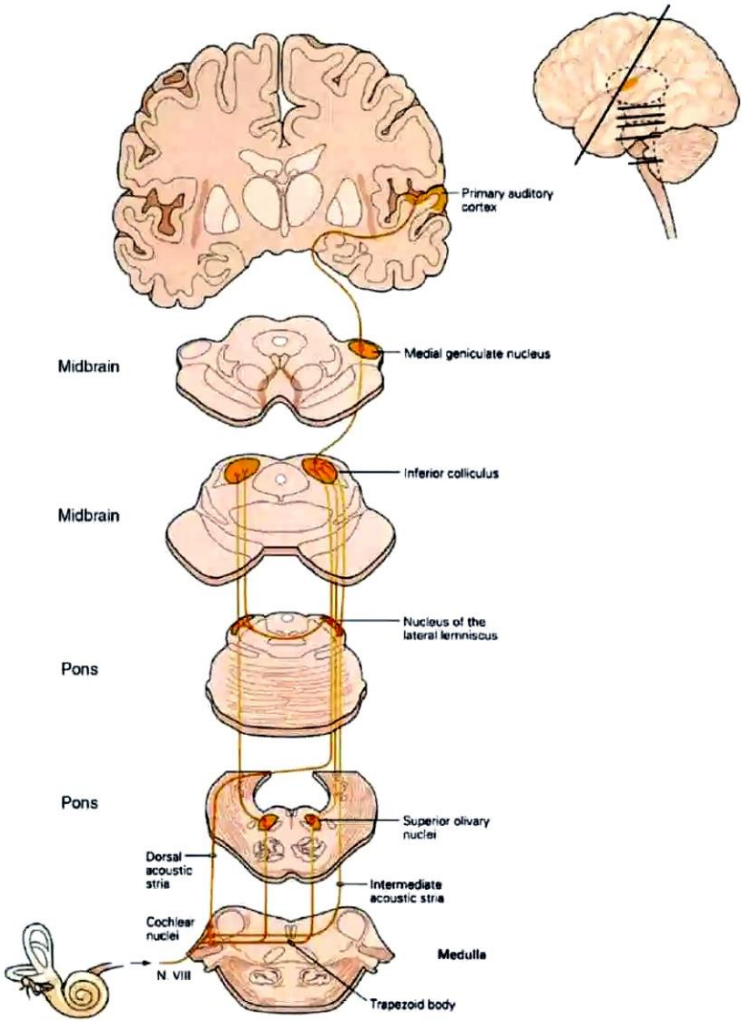

Figure 4 (Step 2) Physiology of speech sound process in the auditory area of the temporal lobe[4]

[4] Source: https://medicoapps.org/auditary-pathway/

The secondary auditory area is responsible for the association and interpretation of auditory input and conveys to the sensory processing area of speech (Wernicke's) from perception, i.e., auditory sensory stimuli are organized into semantic patterns.

2.6 The sensory processing area of written language:

Wernicke's area also allows for the comprehension of the morphosyntactic part of language and it enables human to read a sentence by visual processing when the direct light reflex is in a phoneme, then rods and cones cells of the eye stimulated for reading. Rod cells in the eye help with reading in dim light vision, and cone cells in the eyes help in bright light vision.

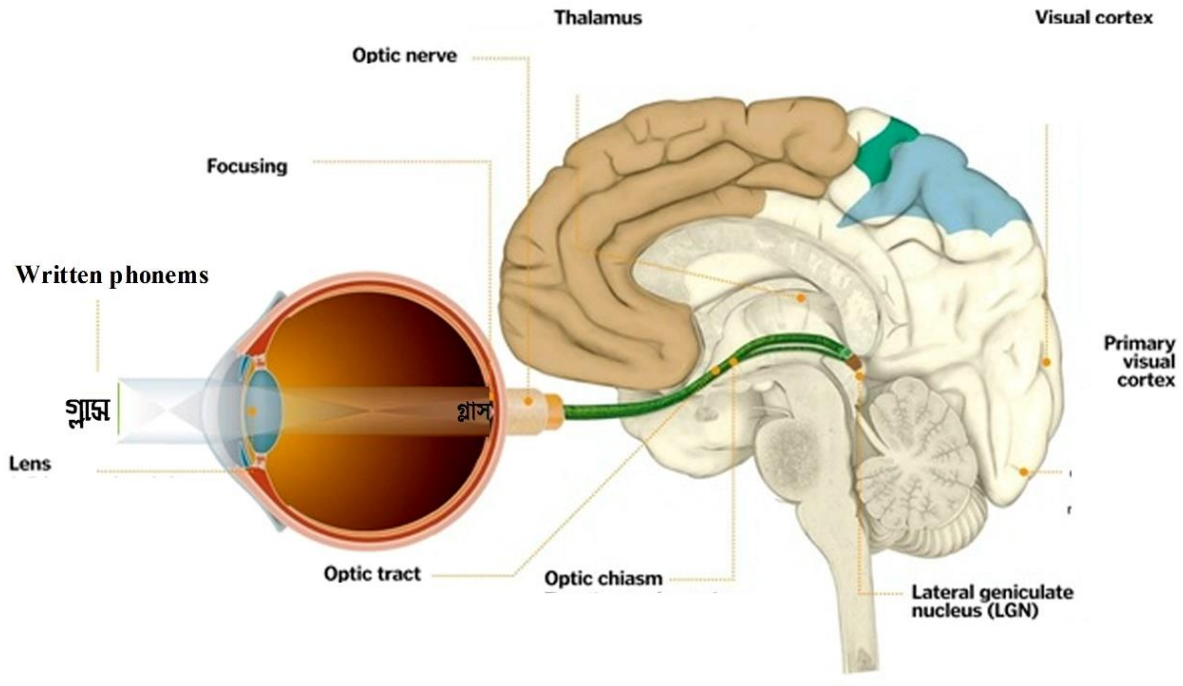

Figure 5 (Step 3) The parts of the Eyes and physiology of written phonemes process in the eyes[5]

[5] Source: https://www.quora.com/How-does-the-human-eye-work

The stimulation for words is through the optic nerve to optic chiasm, then the optic tract, and finally to visual cortex and visual association cortex, the visual association area is responsible for the selection and identification of phonemes **(Occipital lobe).**

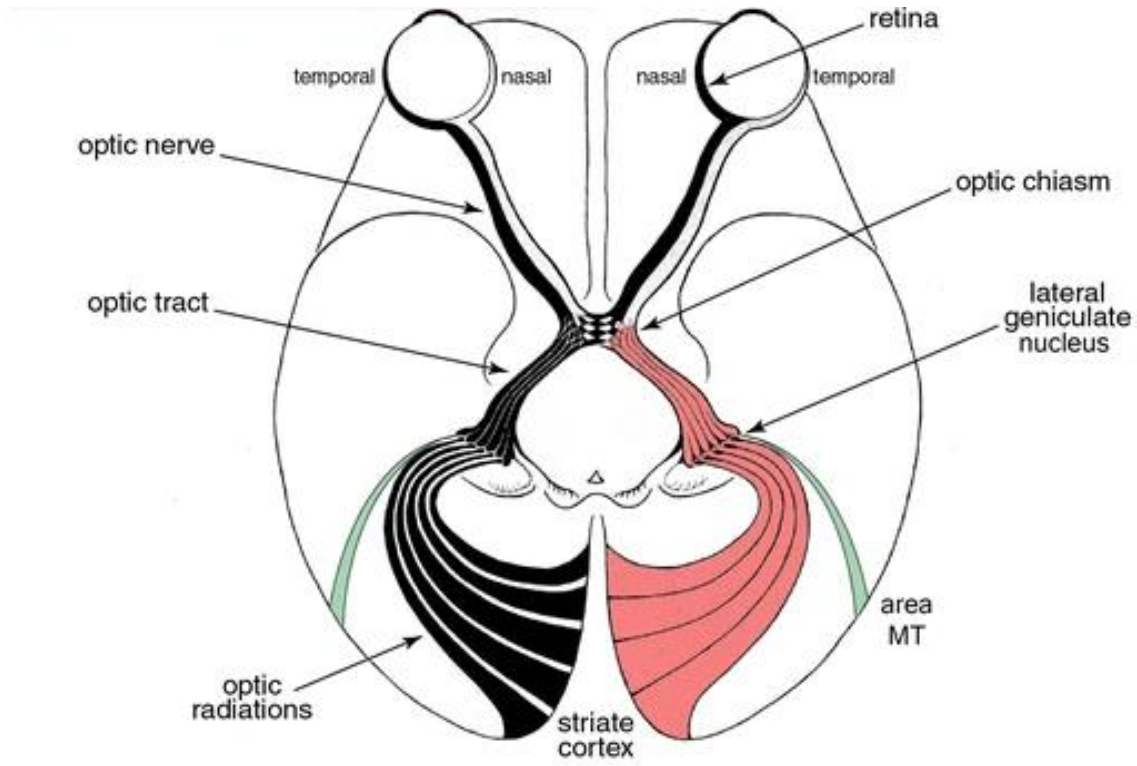

Figure 6 (Step 4) Written phonemes process in the occipital lobe of the brain's visual area[6]

The visual system processes information and not image transmission, making neurons fire or not when extracting information from the environment (Livingstone, 1988). Visual stimuli enter into the angular gyrus, considered as a part of Wernick's area, from perception, i.e., visual sensory stimuli are organized into semantic patterns. Wernick's area in the dominant hemisphere decodes visual & auditory linguistic information, forming the **"Mental lexicon"** (Jarema & Libben, 2007).

[6] Source: https://link.springer.com/article/10.1007/s00417-016-3580-y/figures/2

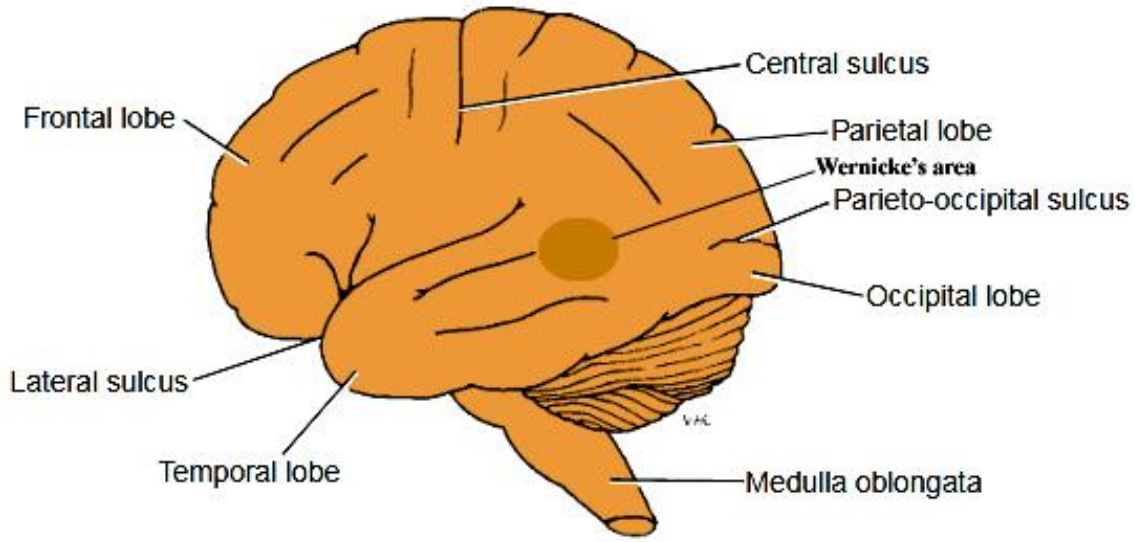

Figure 7 (Step 5) Written phonemes perceive in semantic patterns of Wernick's area[7]

The Wernicke's area and the Broca's area are connected by a group of nerve fibers known as the arcuate fasciculus.

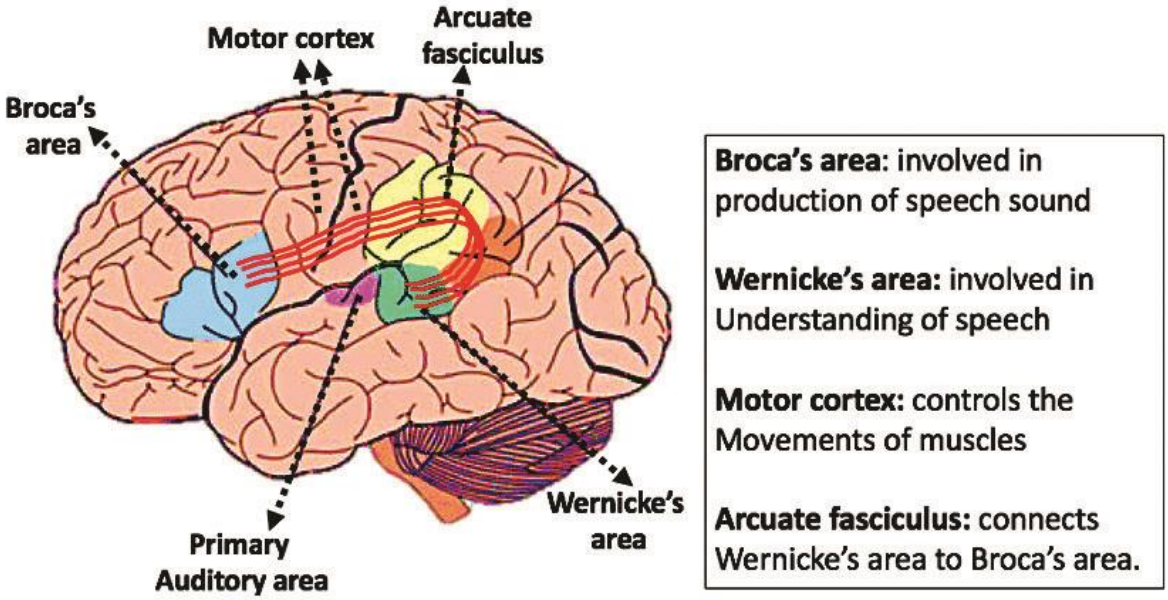

Figure 8 (Step 6) Parts of the brain and their connection with associated areas for language production[8]

[7] Source:http://med-mu.com/wp-content/uploads/2018/06/Snell-Neuroanatomy-7th-Edition.pdf

[8] Source: https://www.researchgate.net/figure/Language-specific-areas-in-the-brain_fig1_317356553

2.7 Connection of motor speech area with muscle fibers:

The motor speech area is responsible for speech production with its connection with the muscle fibers of the motor area by stimulating the linguistic apparatus such as laryngeal muscles, oral cavity, tongue, teeth, palate, and muscles of respiration, diaphragm, also writing by stimulating muscles of the thumb, hand, wrist, elbow, shoulder (Datta, 2017; Snell's, 2017; Crider, 2015).

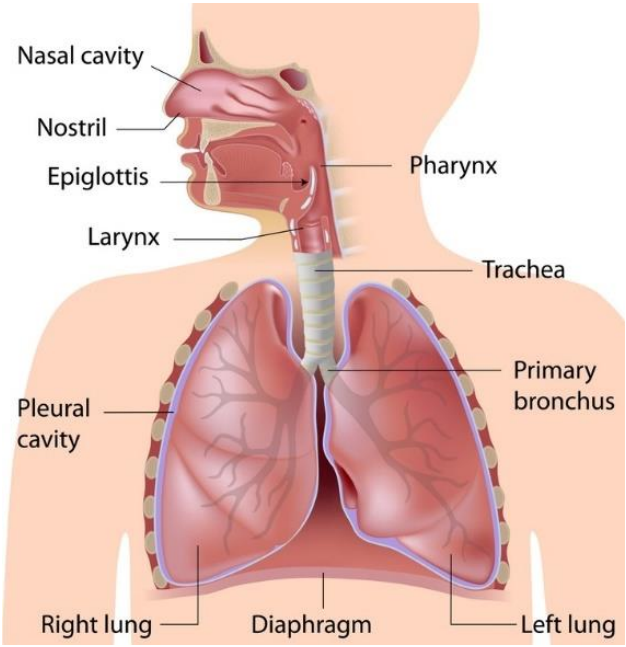

Figure 9 Figure: (Step 7) Parts of the organ that is associated with language production[9][10]

This neurolinguistics procedure of language processing starts from intrauterine life and completes after birth within 3-5years (ICMH, 2009). Avram Noam Chomsky (Chomsky, 2015), an American theoretical linguist said that every human child is birthed with an inherent knowledge of grammar that performs as the foundation for all language acquisition helped to initiate and sustain circumvolution ideas about the cognitive, psycholinguistic, and the philosophies of mind. While every child is birthed with the primary process needed to do so, the skill will never reveal without proper monitoring and guidance

[9] Source: https://quizlet.com/170916946/block-ii-week-vii-flash-cards/

[10] Source: https://www.scholastic.com/parents/books-and-reading/raise-a-reader-blog/sharpen-your-childs-spelling-these-5-activities.html

(Chomsky, 2015) because the ectoderm's neural plate is liable for principal acts in the development of the central nervous system is the aspect of, during the second and the third weeks of pregnancy, followed by expeditious cell generation to develop the neural tube as the plate folds (Ladher et al. 2005). The cells that grow during this massive generation phase are referred to as neuro blasts, which multiply in the ventricular zone before migrating from this region with the assistance of radial glial cells depending on the presence of various molecular gradients in their current location and in the direction of their final landing place. (Bystron et al., 2008). In the human, during cell division 80,000 different genes are present. Among them, half are included in forming and continuing the central nervous system development. The cell numbers increase during intra-uterine life while genes are pre-ordered for the sequence of normal brain development (ICMH, 2009). By the sixth month of pregnancy, in the neuro cortex cell migration is nearly complete among the majority area of the brain (Gupta et al., 2005).

Although neural connections start in the womb of a mother, most of the connections are complete after birth of the influence of environmental factors where the human being survives (ICMH, 2009). The modern linguist Michael Tomasello (Tomasello, 2005) gave an innovative idea that out of a desire, children acquire language to interact with the environment around them. This view of usage-based approach language has been challenged, by general cognitive processes language used in which grammar is used by the motives connected to a dynamic system where emergent symbolic elements and adaptable restrictions influence and create language. Research has progresses towards the usage-based approach in cognitive and practical linguistics, which is combined with psycholinguistics and language acquisition. The primary objective of this view is to establish a link between the analysis of

linguistic structure and the complex cognitive processes that underlie language acquisition as well as many other cognitive phenomena.

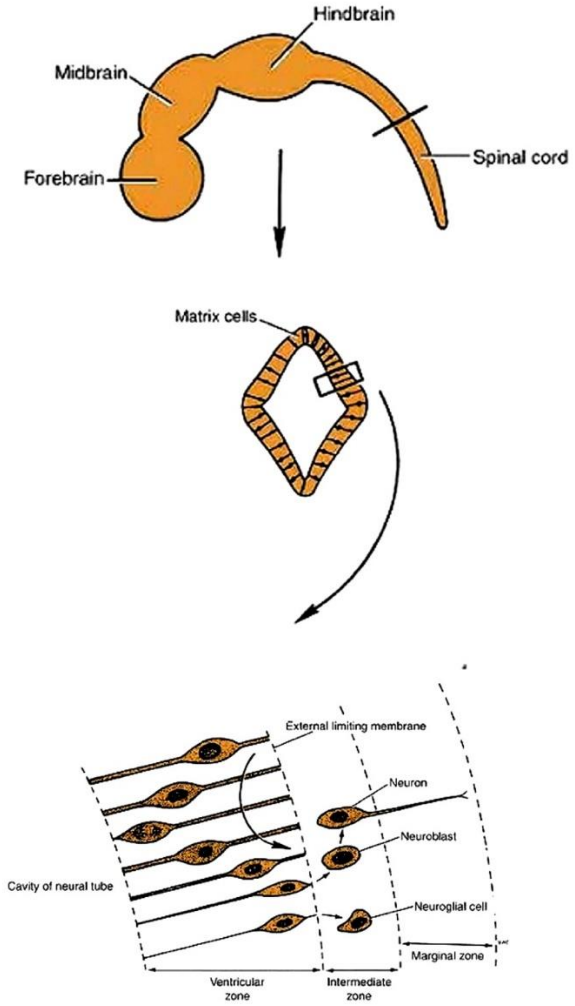

Figure 10 (Step 8) Developing nervous system in intra-uterine life which is associated with Noam Chomsky's theory (Chomsky, 2015)[11]

The primary event of language acquisition or formation initiates in the neural nervous system in intrauterine life. We need to understand that linguistic structure is a process (Monte-Serrat & Cattani, 2021, 2021a) and not a material (Saussure, 1916), which suffers interference from interaction with other human beings and the context during the way, and language development and acquisition are approached by usage-based linguists. Based on

[11] Source: http://med-mu.com/wp-content/uploads/2018/06/Snell-Neuroanatomy-7th-Edition.pdf

the premise that usage-based theories have an impact on language development, language users' experience with specific linguistic components, and the frequency of conversation have an impact on grammar. The frequency of language usage appears to have a significant influence on language users' behavior and communication, information processing, linguistic structure development, and language learning, according to recent research. Development during the intrauterine period differentiates and associates neurons connecting together, and these two processes such as differentiation and synaptic connection resume for respective years after birth. The establishment of CNS network synapse development and the connection is the vital step: significantly additional connections are established than those that are eventually maintained (Colón-Ramos, 2009).

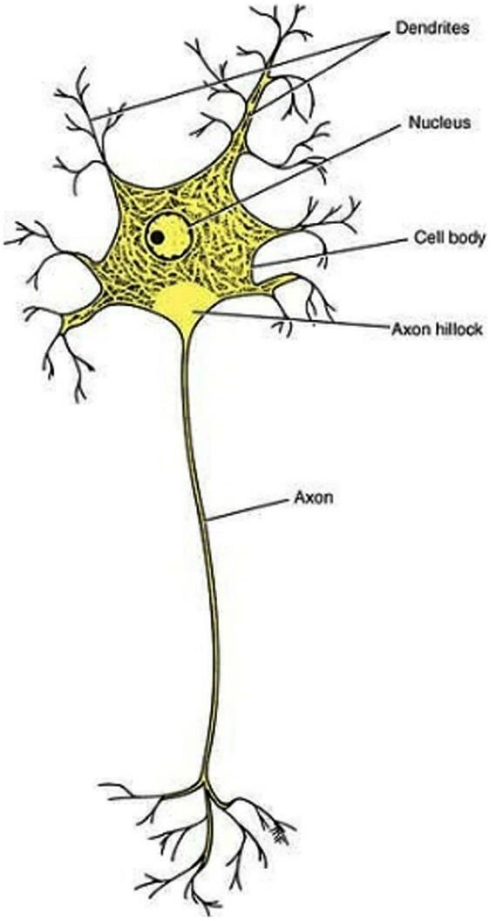

Figure 11 Structure of the neuron (Snell, 2010)[12]

[12] http://med-mu.com/wp-content/uploads/2018/06/Snell-Neuroanatomy-7th-Edition.pdf

During brain development, there is a bundle of disorders in which the growth of the neural nervous system is interrupted. This includes dysfunction of the brain developmental, exhibit as defective motor function, learning language, and verbal and non-verbal communication. Disorders of the brain function happen as the particular grow which affects remembrance, feeling, self-control, and learning ability (Aylward, 2014).

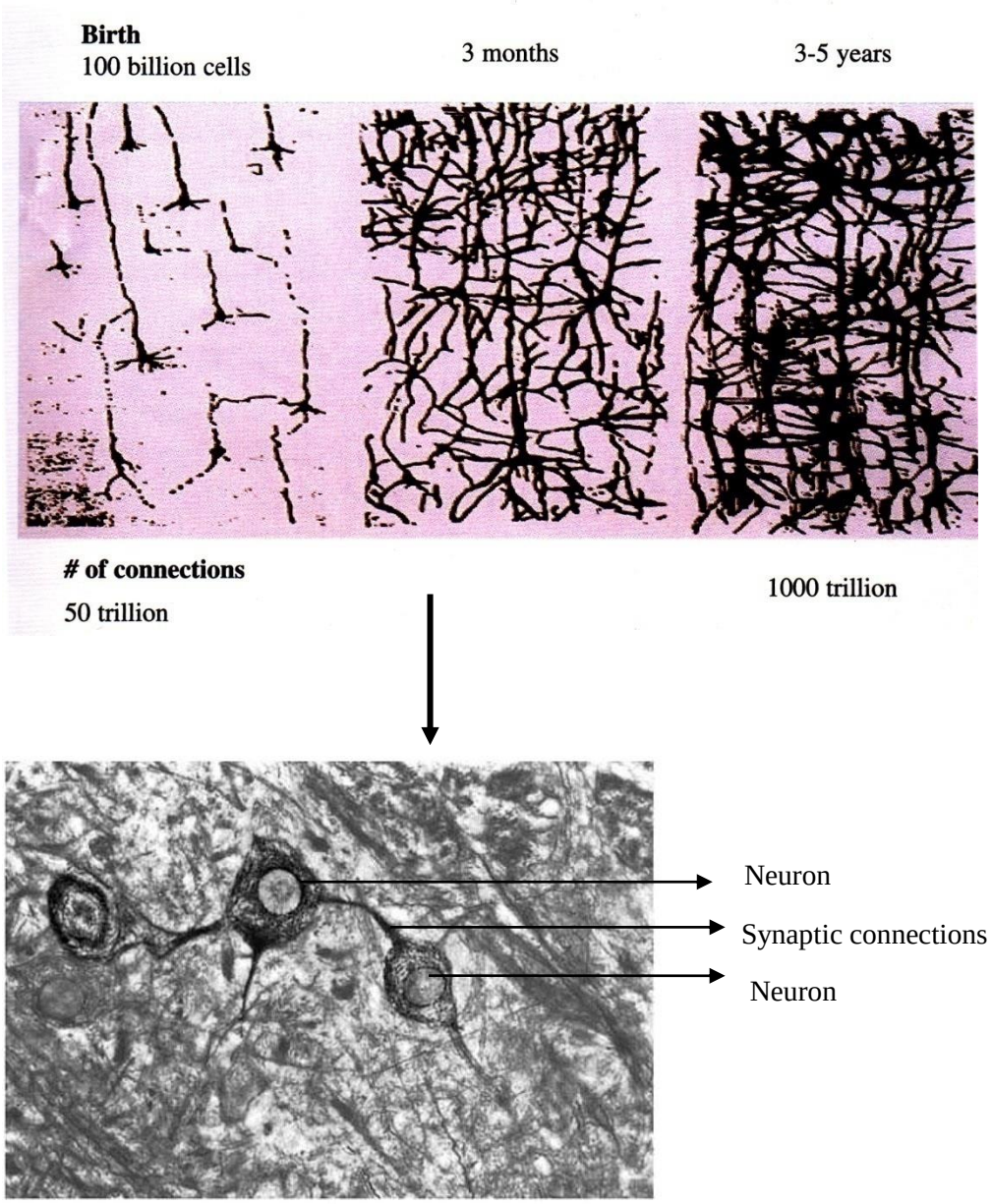

Figure 12 Synaptic connection of the brain after birth (Tomasello, 2005)[13]

[13] Source: http://med-mu.com/wp-content/uploads/2018/06/Snell-Neuroanatomy-7th-Edition.pdf

The term "disorder of neurodevelopment" is relatively new and refers to a group of disorders with severely compromised neurolinguistic processes that are brought on by changes in early brain development. (Amaral, 2002). These disorders often emerge early, frequently before the child starts schooling, and they start throughout the formative period. They are defined by impairments in individual, societal, academic, or occupational functioning. Very specific limitations investigate the developmental deficits that varies from learning and regulating executive functions to global impairments of societal competency and aptitude (Alloway et al., 2009).

The major clinical features are (1) Attention Deficit Hyperactivity Disorder (ADHD), (2) Autism Spectrum Disorder (ASD), (3) Intellectual Developmental Disorders (IDD), (4) verbal/nonverbal communication disorders, and specific learning disorders.

2.8 Attention Deficit Hyperactivity Disorder (ADHD):

Very common problem of ADHD encountered in clinical practice. Inattention and hyperactivity are the two factors that determine whether a child has ADHD. It can be difficult to diagnose because of the complex psychopathologies connected to ADHD and its clinical manifestations. (Graham et al., 2011). Thus, a careful initial evaluation should be made to rule out any possible differential diagnosis.

2.8.1 Linguistic symptoms:

- Language in different contexts and the use of language structure and commonly affected (Gilmour et al., 2004; Geurts & Embrechts, 2008). The application of phonology, semantics, syntax, and morphology are all structural aspects of language. These abilities are critical for the development of literacy as well as for

communicating in spoken language and comprehending it. (Melby-Lervag et al., 2012; Nagy et al., 2014; Monte-Serrat, 2018).

- The two aspects of language impairment are issues with pragmatic language and a lack of language structure. (Bishop, 2000).
- Due to inattention and hyperactivity pragmatic communication disorder are also associated with the severity of symptoms (Norbury et al., 2004).
- Unable to maintain cognitive information such as conversational speech and to produce clear, well-planned, and appropriate (Engelhardt et al., 2009).
- Sensory processing of speech must be required for maintaining conversation (Green et al., 2014), hyperactivity and inattention impair pragmatic conversation and impaired peer relationships and socialization (Leonard et al., 2011).
- Children's executive abilities, which are necessary for use in social situations but are impaired by persistent signs of inattention and hyperactivity (Bignell &Cain, 2006).
- Language structure impairments also similar with ADHD symptoms. There are deficiencies in the use of syntax and phonology, two structural components necessary for effective communication. (Green et al., 2014).
- Educational incompetence is also associated with inattention and hyperactivity (Dally, 2006).
- Inattention among pre-schoolchildren later develops learning disorders due to phonological processing and phoneme awareness evolution (Stephenson et al., 2008).
- Inability to pay attention might also have an immediate effect on the acquisition of structural linguistic skills, as a result, decision-making functions like working memory are not activated whichis important for literacy development (Holmes et al., 2014).

- There is conflicting evidence about the specificity and potency of these relationships. The children who had complications with attention and learning- language are receiving treatment from specialists; including speech and linguistic pathologists/therapists, educational psychologists, psychiatrist, and pediatricians in school-based special education in a multidisciplinary approach (Willcutt et al., 2005).
- These differences in the relationship between pragmatic and structural language and behavior components are in line with the concept that problematic language components may well have different origins. (Bishop, 2000). The qualitative study of linguistic by Monte-Serrat & Cattani (2021) shows that it has rational (rules), biological (human apparatus), and social (otherness) properties. This entire complex is used in the organization and production of information by human beings. The authors Monte-Serrat & Cattani (2021) describe the form of natural language as a dynamic process interconnected logically (signal-to-signal in a locked connection arrangement); to the body (connection of biological substrate connected to a symbolic process that differentiated physical health from exteriority); and the societal context (which has as its function the construction of oneself, a formation of psychological combination). Thus, the human cognitive-linguistic process uses the biological and symbolic systems to activate the received stimuli and elaborate a resultant perception output from them. There is a relational union between the stimuli received by the body and the establishment of information (Monte-Serrat & Cattani, 2021) forming a functional hierarchy in the process of building understanding.
- Sensory processing of speech decoding within the brain act as working memory which is needed for maintaining the coherence of speech during the conversation (Kane et al., 2007).

- However, children who exhibit significant pragmatic language disorder symptoms may also have phonological deficits and issues with language structure..(Gooch et al., 2011).

2.8.2 Behavioral symptoms:

- Pragmatic language impairments cause impairment of socialization and development of behavioral difficulties as a secondary consequence (Leonard et al., 2011; Staikova et al., 2013).
- Symptoms such as distraction and hyperactivity in children with ADHD is a possible source of executive function difficulties which causes behavioral problem in children with ADHD (Norbury et al., 2004; Holmes et al., 2014).
- Children with ADHD may exhibit both inattention and impulsive behaviors due to two functionally distinct disruptions of neurodevelopmental systems: a cognitive-linguistic activity that includes working memory execution planning, and inhibition, which corresponds to inattention; and impulsive behaviors linked to delay aversion and hot affective processes, which correspond to inattention. (Castellanos et al., 2006).
- Behavioral inattention and hyperactivity impair the language acquisition of classroom behavior reading skills (necessary to learn to read), and lowers the capacity of children to concentrate toward clear instructions within a classroom (Sciberras et al., 2014).
- Both pragmatic and behavior disorders inhibit self-control; such as being able to regulate impulsive or hyperactive actions, taking turns in conversations, and not talking too much (Martin & McDonald, 2003).

- Moreover, the association between behavior and pragmatic domains is present directly. Behavior disorders severely restrict social connection both at residence and class, which prevents the development of social language abilities. (Staikova et al., 2013).
- There are different and additional sources of origin for language structure impairment to pragmatic and behavioral disorders. Cognitive linguistic deficits edge the acquisition and progress of language skills, which causes decision-making function disorders that are distressing control of behavioral and societal communication. Children's phonological abilities are closely related to their phonological awareness, reading comprehension, and spelling skills. Difficulties with phonological processing skills affect how letters and sounds are acquired during reading instruction. (Dally, 2006; Ramus et al. 2013).

2.8.3 Children with ADHD and Typically Developed children have differences:

Typically developed children	**ADHD**
No pragmatic language impairments.	Inattention and hyperactivity impaired the formal language acquisition of children and as a result, pragmatic language disorders are frequent in ADHD (Bignell & Cain, 2007; Mueller &Tomblin, 2012).
No problem in this regard.	Impairment of socialization is common because pragmatic aspects of language involve the proper use of language in accordance with the situation and circumstances, such as ensuring adequate conversation related to topics, coherent

	speech during interactions, and translating non-verbal cues of others. (Bishop & Baird, 2001).
Example of pragmatic use of language and socialization	
Typically developing children can take part in coherent speech and conversation (within 3 years to 3.5 years)	An ADHD child is unable to take part in a conversation with others due to his inattention and hyperactivity.
Symbolic play develops among normal children within 19 -24 months,	An ADHD child is never able to play with the symbol with their peers.
A typical child can take part in wordplay, singing with other kids between the ages of 25 months and 2.5 years.	ADHD child is unable to participate with his peers in playing, rhyming, or singing.
No defiant and aggressive behavior.	The most common problems in children with ADHD are refusing to follow instructions from caregivers/parents and teachers defiant and aggressive behavior may have emotional outbursts when asked to do things they find difficult or challenging (Moffitt et al., 2015).
Example of unable to pragmatic use of behavior	
Within 5 years typically developed children can control their unusual behavior according to situation and context (pragmatic).	ADHD child is unable to control his/her unusual behavior according to situation and context (pragmatic).

	 

Table 1 Difference of opinion between typically developed children and children with ADHD

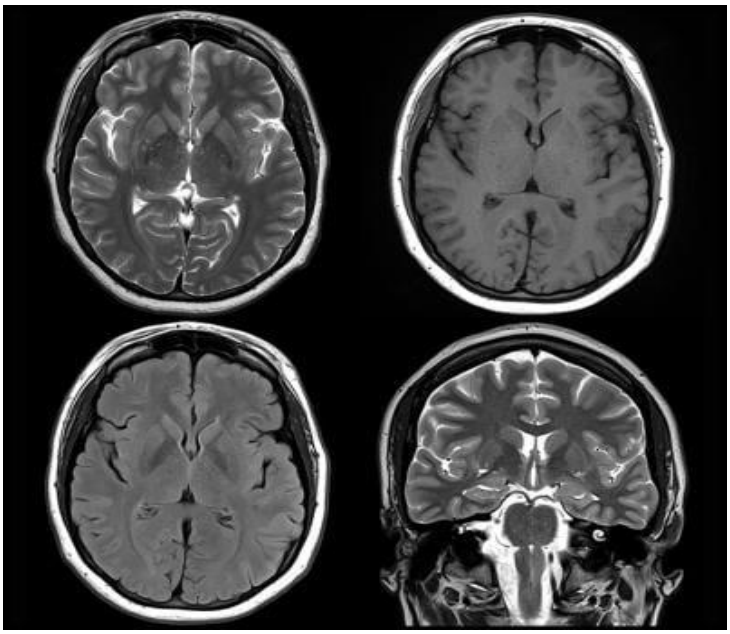

Figure 13 Children with Attention Deficit Hyperactivity Disorder differ from one another according to the psychoradiologic value of MR imaging. Sun, et al. (2018)[14]

International neuroimaging consortium has identified by Magnetic Resonance Imaging(MRI) that the frontal, temporal and parietal regions are hetero modal associations and have specific anatomical abnormalities in cortical components of attentional systems which explain the symptoms of hyperactivity disorders (Sowell et al., 2003). Statistical differences are present in the brain cortical and subcortical indices of the neural system in

[14] Source: https://www.itnonline.com/content/mri-shows-brain-differences-among-adhd-patients

children with ADHD. Distinct anatomical abnormalities were in total brain volume - decreased volume, the amygdala is normal but the internal capsule reduced whereas in typically developing children there were on no account abnormalities in the anatomical and structural component of the brain (Cherkasova &Hechtman, 2009).

2.9 Autism spectrum disorder (ASD):

A bundle of compound neurodevelopmental disorders known as autism spectrum disorder (ASD) are characterized by restricted, recurring behavior patterns and impairments in sociolinguistic reciprocity (Shattuck, 2006). The symptoms that affect daily functioning are present from early childhood. The numerous symptoms refer to the term "spectrum" which measures the abilities and degrees of functioning disability that can be present in children with ASD. Some children are fully capable to perform all daily living activities on the foundation of language acquisition of phonetics phonology, syntax-semantics, and pragmatic use of language in their daily living activities, while other children need fundamental support to execute their routine daily activities (such as change of cloth, toileting, eating, etc) (The Diagnostic and Statistical Manual of Mental Disorders (DSM-5), published in 2013).

2.9.1 Types of autism spectrum disorder:

1. Autism associated with intellectual impairment
2. Autism without intellectual impairment

Social communication difficulties limited repetitive behavior patterns, varying the severity. (DSM-5, published in 2013).

2.9.2 Linguistic symptoms:

- Children with ASD prefer to be alone and do not know how to take part in a conversation and play with other children. ASD children cannot recognize other people's emotions and cannot express their feelings to others. Depending on the setting and context, children with ASD may have a variety of linguistic abilities, from being completely silent to speaking fluently but inappropriately. Some children with ASD may develop their speech and linguistic ability more slowly, replication of phrases, and respond to queries in an irrelevant way**.** (Snell, 2010).
- ASD has limitations when it comes to using and comprehending non-verbal cues like gestures, sign language, and voice, with little consideration for the person they are speaking to. For example, Young children with ASD are unable to comprehend what a hand wave is: Goodbye. ASD Children only discuss a small number of their favorite topics in a flat, monotonous, robotic, sing-song voice., (Johnson, 2004).
- These specifiers contribute an opportunity to the clinician for the affected children to individualize, for diagnosis and clinical description. For example, Autism spectrum disorder, not language or intellectual disability, will henceforth be used to diagnose Asperger's disorder.

2.9.3 Behavioral symptoms:

- Social interaction difficulty is a significant symptom of ASD. Abnormal communication and reciprocity are challenging. ASD children may not reply to their names or make eye contact with others, and they may only engage with others to further certain objectives. (Johnson & Myers, 2007).
- Autism spectrum disorder is characterized by persistent deficits in social communication and social interaction across contexts, including deficits in social-emotional verbal reciprocity, social interaction, nonverbal communicative behaviors,

and skills in developing, maintaining, and understanding relationships (American Psychiatric Association, 2013).

- Along with social communication difficulties, limited, behavior patterns that are repeated, interests, and activities must be present for autism spectrum disorder to be detected. Met the diagnostic criteria based on historical information, despite the fact that the current presentation must significantly impair social communication because symptoms change with development and are covered up by compensatory mechanisms. (Rutherford & Subiaul, 2016).
- The identification of autism spectrum disorder includes specifiers that describe the autistic symptoms (associated symptoms of intellectual impairment with or without structural language impairment; known medical/genetic or environmental/acquired situation; associated with another neurodevelopmental, mental, or behavioral disorder); and individual clinical characteristics (age at first concern; loss of with or without established skills; severity) (Ida-Eto et al., 2017).

2.9.4 Children with Autism Spectrum Disorder and Typically Developed children have differences of opinion (Ferdous et al., 2018).

Typically developed children	Autism spectrum Disorder
They can express single-meaning full words within 12-14 months.	Autism spectrum disorder has a speech delay.
They can use nouns and pronouns within 25 months to 2.5 years.	Unable to use nouns and pronouns. Example (*Ami khabo* – in Bengali) Typically developed children say: I will eat (*Shakib kkhabe* – in Bengali) Autism

	children say: Shakib will eat (*Amar dike taka bena* – in Bengali) Typically developed children say: Don't look at me (*Shakiber dike dike takebena* – in Bengali) Autism children say: Don't look at Shakib
They use nonverbal use from birth.	Unable to use nonverbal cues of communication. Example: eye contact, pointing.
They can express their emotions based on the circumstances and context.	The inadequate use of language in practical situations hinders socialization.
Example of pragmatic use of language and socialization:	
A child (within 9 – 11 months) grinning in response to a favorite activity by their parents or other caregivers.	ASD child is unable to respond with a smile to other activities which he/she likes.
A child (between 9 and 11 months) can point and examine objects with others.	ASD child cannot point and examine objects with others.
A normal child can make eye contact and recognize others' facial emotions between the ages of 12 and 14 months.	ASD child cannot make eye contact and unable to recognize others' facial emotions
Normal children (within 3 years to 3.5 years) can participate in a conversation.	ASD child is unable to take part in a conversation with others.
A normal child (within 19 -24 months) can play with a symbol.	ASD children can never play with the symbol with their peers

normal children aged ranges 25 months to 2.5 years can take participate in a rhyme/song with other children.	ASD child is unable to participate with his peers in playing, rhyming/singing.

Table 2 Differences of opinion typically developed in children and autism spectrum disorder

In ASD, in the early years of life, a pattern of early brain overgrowth is followed by dysmaturatity in adolescence. There is evidence with a suggestion that some specific regions have differences of volume abnormalities in both grey and white matter, according to analyses of magnetic resonance imaging (MRI), which have shown that local and subcortical connectivity is impaired and increased in a long-range manner in this condition. Early brain overgrowth and replicated finding exist in the brain of an ASD child. As the patterns of abnormalities develop with age, cortical-thickness measurements and surface morphometry must be clarified in greater detail. These findings implicate particular processes like: neurological or neurological development. Magnetic Resonance Imaging (MRI) techniques suggest that functional and structural connectivity such as abnormalities in volume are linked (Anagnosto & Taylor., 2011) and the total brain volume of ASD children increased, the amygdala was overgrown, and the internal capsule was unclear (Dougherty et al., 2016), and there were no abnormalities in the anatomical or structural component of the brain in children who were typically developing.

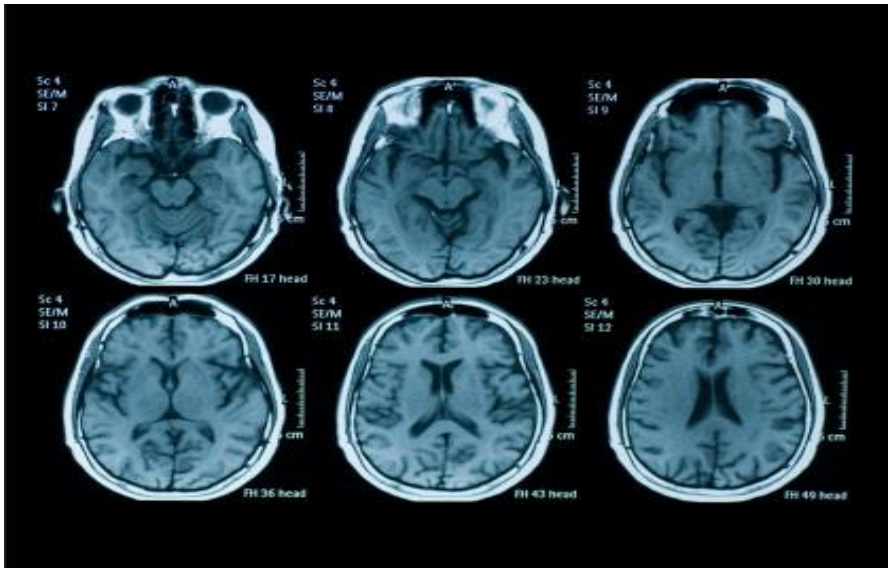

Figure 14 Mind measures: Two imaging studies find few consistent differences between autistic brains and those of typically developing children.[15]

2.10: Intellectual Development Disorder (IDD)

Children have deficits in language acquisition of perceptive, verbal/expressive, and pragmatic use of language which are more substantial and premature than expected age, Intellectual Disability is another name for Intellectual Development Disorder (IDD) (ID). Additionally, they struggle with rational thought, planning, judgment, abstract thought, and diverse learning styles. In earlier DSM editions, many of the symptoms were referred to as "mental retardation" or IDD by people. renamed the illness in the DSM-5. The three basic kinds of IDD symptoms are theoretical, social, and practical.

Receptive/Perceptive domain:

- Deficits throughout different developmental stages across the multiple types of learning.
- Drop out from schools or other academic intuitions

[15] Source: https://www.spectrumnews.org/news/cognition-and-behavior-brain-scans-yield-few-signs-of-autism/

- Competencies like memory, problem-solving, knowledge, and reasoning are ineffective.

Sociolinguistic domain (or situation and context) emotion:

- Unproductive to communicate in conversation across different situations and contexts.
- Social detachment due to failure to explain definite gestures, cues, and behaviors of others.
- Face difficulties maintaining and keeping peer relationship

Expressive Domain:

- Symptoms of a milestone of developmental delay present: such as crawling, walking, and talking
- Difficulty continuing to use daily skills, such as money management and self-care.
- Inability to coordinate duties or retain responsibility

2.10.1 Types of Intellectual Development Disorder:

1. Mild
2. Moderate
3. Severe
4. Profound

Deficits in intellectual functions, adaptive functions, and receptive/perceptive, expressive / verbal, and sociolinguistic development levels of the severity of IDD (American Psychiatric Association, 2013).

2.10.2 Linguistic symptoms:

- Linguistic disorders include speech sound disorder, sociolinguistic (pragmatic) disorder, coherent speech disorder, and childhood-onset fluency disorder (stuttering) (Phillips & Shonkoff, 2000).
- Deficiencies in language acquisition and usage; distinguish by speech, and societal communication disorder according to situation and context individually. Interference of the normal fluency and motor production of speech known as childhood-onset fluency disorder includes repetitive sounds or phonetic units, interruption of consonants and vowel phonation, fragmented phrase, obstruction or phonemes manufacture with an excess of physical tension (Cortese al., 2003).
- According to situation and context (pragmatic), conversation impairment is frequently more in children with Intellectual Developmental Disorders (Phillips &Shonkoff, 2000).

2.10.3 Behavioral Symptoms:

- Developing behavior difficulties among children with intellectual disabilities are more common. IDD children's mother affect stress more than typical developing children's mother. (Dykens *et al.*, 2000*).*
- Children in IDD who are being socially isolated face greater challenges from their caregivers, which puts people whose families are responsible for their care under more of a burden because community living attempts have failed, they have had poor academic and vocational outcomes, and they have been displaced from their homes and placed in residential treatment facilities. (Maes *et al.* 2003; Pearson *et al.* 2000).
- The challenges that these children and their caregivers face as a result of the increased risk for behavioral and psychiatric disorders appear to be extended to them

(Emerson, 2003). It has been noted by studies that certain psychiatric symptoms linked to IDD may possibly affecting children's behavior both directly and indirectly through caregiver and family adjustment. (Dykens et al., 2000)

- At an early age symptoms of behavior problems present. Feldman and colleagues (2000) found that children with or at risk for developmental delays at the age of two do not exhibit more behavioral issues than their peers who are developing normally. Furthermore, Collaborative Family Study (CFS) found that developmental delays and behavior problems showed more significantly among 3years children than among typically-developing children (Baker *et al.*, 2002).

2.10.4 Differences of opinion typically developed children and children with Intellectual Development Disorders (Ferdous et al., 2018).

Typically developed Children	**Intellectual Development Disorder**
No such language problems are found in typically developed children.	- Unable to perceive complex sentences in expected age. They can understand only simple meaningful sentences. Example: *Amra nanar bari gia amon mozar kala kalasilam ja amader kub annonda hoyasilo* – in Bengali. (We have been visited to grand father's house, played sports and enjoyed a lot) - They cannot express their own emotion and thoughts by speech to others due to speech and intangibility being poorer than expected age.

No such difficulties are found.	The deficit in self-dependent adaptive functioning across multiple situations and contexts: such as home, educational institutions, and community.

Table 3 Differences of opinion typically developed children and children with Intellectual Development Disorders

MRI is recommended in Mental Retardation (MR) and may identify minute unusual brain findings. The neuroimaging finding was positive with the presence of neuroanatomical microcephaly (Pandey et al., 2004). Children with mental retardation have a clearer neuroanatomical picture on their cerebral MRIs. Images represent supratentorial axial slices, mid-sagittal images, and posterior coronal fossa, and cerebellar abnormalities and malformations were found. The high frequency of cerebral and posterior fossa abnormalities was evaluated by neuroimaging method. The most frequent were white matter anomalies and cerebellar or vermian atrophy also disorganized cerebral cortical dysplasia and dysplasia of the corpus callosum, partially opened septum pellucid and cavum septum pellucid, ventriculomegaly vermian hypoplasia, and subarachnoid spaces enlargement in the posterior fossa.

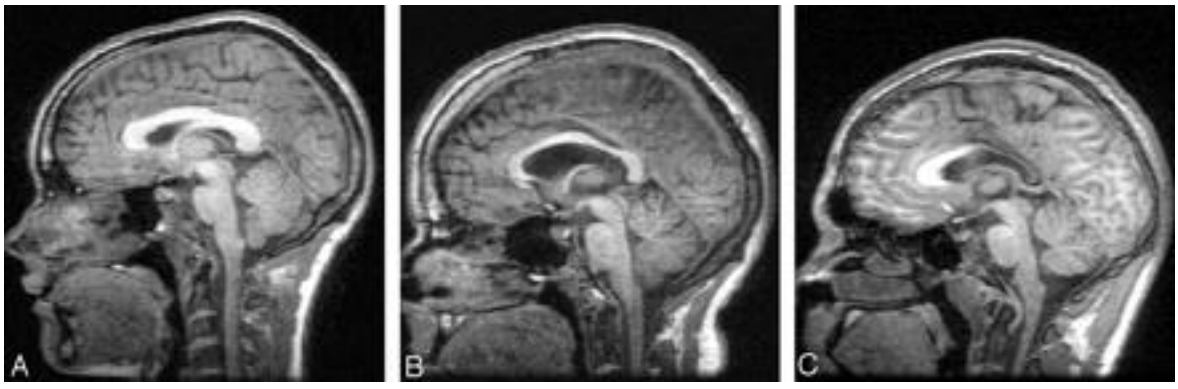

Figure 15 Midsagittal MRI images of Mental Retardation Children (Spencer et al., 2005)[16]

[16] Source: https://www.researchgate.net/figure/Examples-of-absent-A-moderate-B-and-marked-C-thinning-of-the-corpus-callosum-on_fig1_7482859

A high prevalence of subtle cerebral abnormalities and unexpectedly mild forms of cerebellar cortical dysplasia have been detected by MRI, (Sowell et al., 2003) So MRI allowed the detection of multiple minor morphological anomalies which considered markers of cerebral dysgenesis (Soto-Ares et al., 2005)

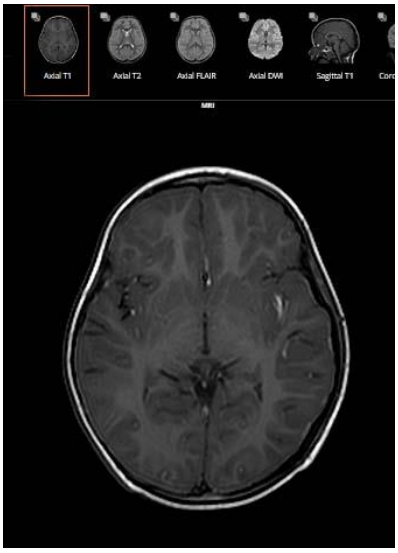

Figure 16 Normal MRI examinations of the brain[17]

2.11: Cerebral Palsy (CP)

2.11.1 Types of Cerebral Palsy:

Cerebral palsy (CP) originating throughout the prenatal, neonatal, or early postnatal period is also known as a non-progressive disease of the brain. The most common manifestation of CP is Spasticity of motor movement, difficulties with the sensory perception of speech and verbal motor impairment, language acquisition, and significant impairment of articulation of language(dysarthria) (Harvey et al., 2013). The disorders are notably associated with abnormalities of phonation, visual perception, adaptive functioning, and (frequently) seizures. Moreover, CP circumscribes a broad range of clinical presentations that

[17] Source: brain. https://radiopaedia.org/cases/normal-paediatric-mri-and-mra-brain

extend from mild to severe motor deficits and the inability to walk with normal intelligence (Rosenbaum et al., 2007).

2.11.2 Linguistic Symptoms:

- Children with CP experience a reasonable delay in picking up their first language and behave differently than a typical child who picks it up in accordance with their chronological age.. Severe functional impairment among patients with mild forms of CP may remain undiagnosed, leading to an underestimation of the actual prevalence of CP. (Geytenbeek et al., 2015).
- The linguistic domains and elements development such as: phonological, morphological, semantic, syntactic, and cognitive, the prime method is to find out of those children. Children with CP have been found to have extremely difficult times communicating with others because of their impaired and fragmented speech, which is hard for adults to understand. (Pirila et al., 2007).
- However, it is considered that they do attempt to interact with their environment with what little speech they do have. Phonological and morphological development has been considered and children communicate using single words or phonemes, vocalization, facial expression, gestures, and body movement (Himmelmann et al., 2013).
- According to the study, language acquisition's critical phase lasts until about the age of 12. Additionally, it has been asserted that learning a language in a normal and completely functional way is impossible if no language has ever been learnt before. (Vroland-Nordstrand et al., 2016).
- The development of language is an inborn trait that depends on specific neurological processes and also certain stages in the child's development dependent upon some

unspecified minimal exposure to environments. Neurological development strongly suggests that nervous system development and synaptic connection in the brain during the development period are essential for language acquisition (Hidecker et al., 2011).

- Cognitive-linguistic mainly supports the infants' acquiring new names for new things from their surroundings. Dickens and Dickens, (2001) believe that cognitive-linguistic is an evolutionary process. Cognitive-linguistic relates to the capacity for comprehending the connotation of words by assimilating and accommodating focus on triggering the stimulus in language acquisition.. This sensory processing of assimilation and learning the meaning of words is the gateway to children. Children acquire all the components of a word's meaning step by step according to their chronological age. Communication and speech limitations are conjoint in cerebral palsy (CP), and they have a major negative effect on a child's personal health, social lifetime, and educational outcomes. (Pennington et al., 2013).
- Motor disorders of CP can be affected each domain of communication underlying movements. Consequently, difficult for verbal and nonverbal communication between parents/caregivers to understand. Without motor disorders positively reinforcing early interaction with parents/caregivers, in addition children with CP may also struggle with cognitive-linguistic impairments, delayed language acquisition, and issues with the sensory processing of spoken language that influence their verbal/expressive communication development. (Rosenbaum et al., 2007).

2.11.3 Behavioral Symptoms:

- Communication signals may be challenging to understand due to the motor disorders associated with cerebral palsy (CP), which may alter the motor movements required for discourse. Speech disturbances that disrupt cognitive-linguistic and sensory

processing, which are very common in CP, possibly affecting children's ability to communicate. (Rosenbaum et al., 2007).

- The prosody of speech depends on respiratory and laryngeal muscle coordination and created a pitch, syllable duration, and loudness of speech. CP patients' inability to control their vocal tract in any way can result in speech issues that can range from mild, with a little bit of word and phrase imprecision, to profound., (Fox et al., 2008).
- Communication problems Children with CP run the risk of living shorter lives. When it comes to children with serious or profound disorders; alternative and augmentative communication (AAC) systems should be implemented to express themselves and their ideas clearly, speech may not be as effective as the main means of communication (Hustad et al., 2016).
- Communication requires at least two persons to give and receive messages through voice, vocalization, face expression, gesture, and whole-body motions. If treatment is to help children with CP become active and independent in their daily contexts, it must involve not only the children with CP but also their parents because communication requires at least two persons.

2.11.4 Differences of opinion typically developed in children and cerebral palsy (Ferdous et al., 2018).

Typically developed children	**Cerebral Palsy**
Motor speech disorders (dysarthria) are unusual in a normal child.	The prevalence of motor speech disorders (dysarthria) is associated with all types of CP- spastic, dyskinetic, and ataxic. example- Up meaning in Bengali is *upor,* but child can

	articulate as *ofor*; Doing meaning in Bengali is *korso,* but child can articulate as *koso*; In the initial and middle stages substitutions speech of occurred).
No such speech characteristics are observed in normal children.	Different types of CP share many speeches when listening to speech recordings. Example: words (vowel) Brick meaning in Bengali is *et,* but child can articulate as *eeee* (slowly); Potato meaning in Bengali is *alu,* but child can articulate as *–aa-e-* (slowly) When the children attempted to utter vowel words, they had articulation disorders (during articulation of vowel words, the findings were, the vowel words were changed to semi-vowel, glide like semi-vowel or consonant-like vowel).
Speech production depends on (e.g., respiratory system, phonation, resonance and muscles of articulation).	Speech disorders occur due to underlying processes impaired such as respiration, phonation, resonance, and articulation. (-leaf -pata (with soft t)-, the child articulates- -pata (with not soft t)-; -crow- -kak-, the child articulates- -ak-; -net- -Rvj- -jal-, the child articulates- -al-). the children

	had articulation disorder, especially substitution of dental -Z- -ta (with soft t)- by alveolar -U- -ta-. It was discovered that the word's initial consonant to vowel position had been deleted. Furthermore, -give -dan-, the child articulates- -da-; -good -valo-, the child articulate -va-; -no relation- -ci- -por-, the child articulates- -c- -pa-. All of the children had articulation issues, according to observation. Deletion in the final position was found.

American Academy of Neurology described that cerebral palsy diagnosis must be evaluated by neuroimaging findings, for the strengthening of the diagnosis. This advice, which is supported by the data from magnetic resonance imaging (MRI), discusses the potential advantages of imaging techniques, provides future directions, and examines how they are currently being used with an eye toward etiologic understanding development. The most frequent abnormality among children with cerebral palsy who have abnormal neuroimaging findings is white matter damage. Children with hemiplegia are more likely to have isolated white matter abnormalities than those without, while bilateral spasticity and ataxia are more likely to have isolated gray matter damage. Isolated gray matter damage is the least frequent finding. Neuroimaging is necessary for the strength of the diagnosis and to comprehend the etiology and pathogenesis of cerebral palsy, even though the diagnosis is based on clinical findings. Neuroimaging studies have improved our understanding of the abnormalities in brain development in cerebral palsy. In the future, sophisticated morphologic findings in imaging procedures will be applied to cerebral palsy, specifically connected to

etiologic events and exposures, thus leading to prevention possible pathways (Korzeniewski et al., 2008). Neuroimaging findings are also necessary for the understanding of the neuroanatomical severity related to the timing of the lesion which is necessary for intervention (Himmelmann & Uvebrant, 2011).

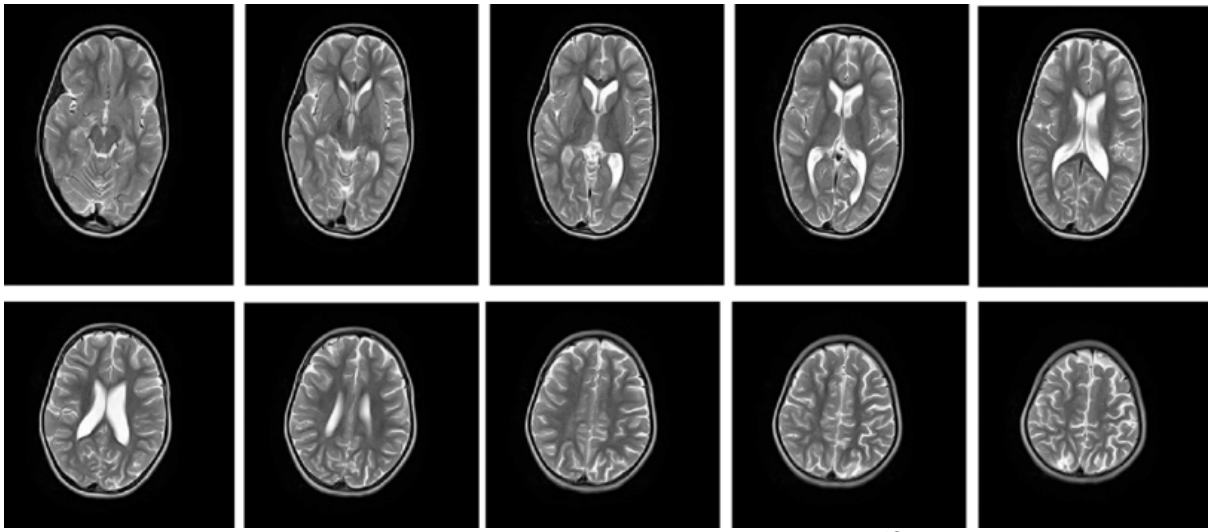

Figure 17 MRI brain showing normal findings, no abnormal density[18]

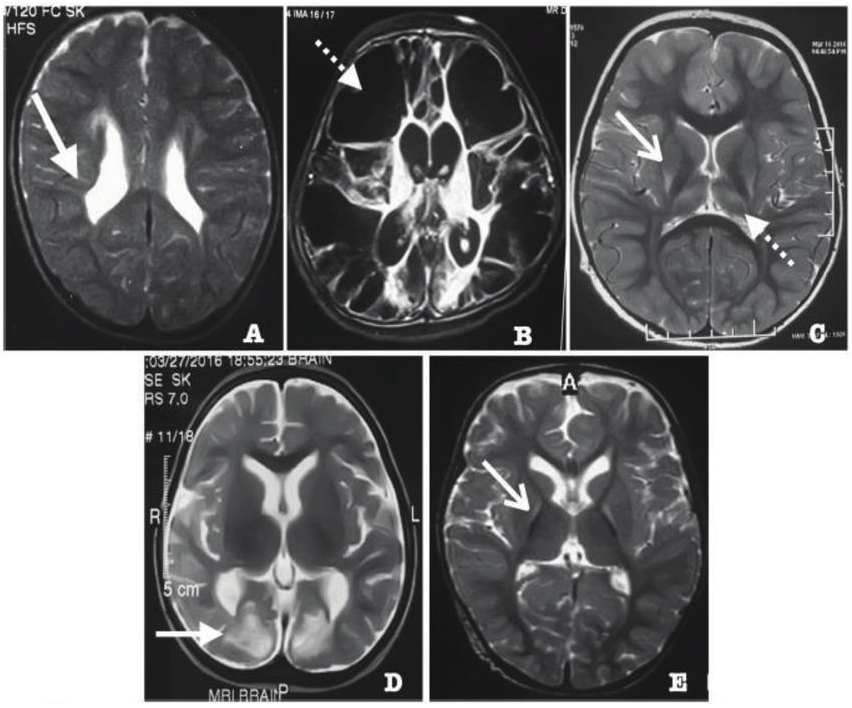

Figure 18 MRI changes in cerebral palsy shows a T2-weighted image with periventricular hyperintensities and undulating ventricular margins[19]

[18] Source: https://www.researchgate.net/figure/MRI-brain-showing-normal-findings-no-abnormal-density_fig8_276152606

Infants with ischemia/asphyxia frequently have this pattern of lesions. T2 hyperintensities bilaterally in the posterior putamen and thalami also occipital lobe are seen in infants with the term hypoxic-ischemic encephalopathy (HIE). More study is therefore needed to determine how to apply this knowledge in clinical practice. This will ensure that clinicians can work with CP children and their families to establish a realistic, fulfilling life.

2.12: Similarity of ADHD, ASD, IDD, and CP:

These disorders are of neurodevelopmental origin. They have both behavioral and linguistic problems**.** These disorders are detectable before the age of 18. The primary issue identified is language development, but the features also represent behavioral problems. Definite diagnosis to establish at an early age. At preschool age changes in development may occur. Among several existing symptoms, some may exhibit more and less prominent symptoms. When assessing young children with developmental deviations, the significance of these early symptoms cannot be overstated. This theory emphasizes how various behavioral issues can coexist with a variety of disorders, including attention-deficit/hyperactivity disorder (ADHD), language disorders, and intellectual disability (ID) as follows:

- Temper outbursts,
- Sleeping disorder,
- Feeding disorder,
- Hyper /hypo-sensory sensitivities.

Evidence for overlapping genetic influences reported by the UK based on a community twin sample on ASD and ADHD behaviors (Ronald et al., 2008). There was a significant

[19] Source: https://www.researchgate.net/figure/Salient-MRI-changes-in-cerebral-palsy-Panel-A-shows-a-T2-weighted-image-with_fig1_333142709

overlap between ASD and ADHD; 41% of ASD children who met the criteria also had suspected ADHD, and 22% of those with suspected ADHD also fit the ASD criteria. The research's findings suggest that some common genetic influences are at work in the normal variation of autistic traits and ADHD traits. Pointed out in the research that the importance of stimulant medication must be considered for children with ASD and ADHD to improve adaptive behavior (Frazier et al., 2001).

2.13 Dissimilarity of ADHD, ASD, IDD, and CP:

Autism Spectrum Disorder	ADHD	Cerebral Palsy	Intellectual Development Disorder
Persistent impairment in social interaction and communication depending on the circumstance and context	Due to inattention, difficulty remaining focused during conversation and therefore, language difficulty	Due to articulation problems conversations are more concrete	Conversation and language are more concrete and immature according to their chronological age.
Semantic, pragmatic ability is impaired	Pragmatic language impairments are common	Phonetics & phonology impairment; also, impairment in the pragmatic ability	Pragmatic ability is impaired
Disorders that show up as stereotyped behaviors, verbal	Inattention and hyperactivity both symptoms are	Cognitive-linguistic disorders may be at risk in children with	Represented by significant impairment of

and nonverbal communication issues, and social-emotional interactions	increase	CP diagnoses.	cognitive linguistic functions, with limitations of learning, adaptive skills

2.14 Epidemiological prevalence:

In the modern era of epidemiology, the neurodevelopmental disorder is now regarded as a subject that requires special attention. According to research, there needs to be a better understanding of the issues that millions of children worldwide experience in silence. Autism, attention deficit hyperactivity disorder, learning disabilities, developmental delays, and mental retardation are examples of neurodevelopmental disorders that take a significant emotional, mental, and financial toll due to compromised quality of life and permanent disability. (Gupta, 2007). Nowadays ASD is estimated as a major public health challenge that occurs at expressively higher rates than pediatric cancer, HIV, and heart disease recognized by the Centers for Disease Control and Prevention(CDC) in the USA. Unfortunately, resources allocated to research and the sharing of best practices for autism are among the major mental health disorders with the lowest levels. One of the main causes of childhood disability is cerebral palsy (CP), which is estimated to have a global incidence of 2 to 3 per 1000 live births.

It was significantly found that the frequency of ADHD in male children is higher than the mid-aged children (6-8 years) in Bangladesh. It has been predicted that Bangladesh continues to undervalue the importance of autism as a health problem. Mullick and Rabbani's

community studies from 2005 and 2009, respectively, found that the prevalence of autism was 0.2 and 0.84 per 1000 children. The prevalence of ASD was found from a systematic review, to be ranging from 0.15–0.8% in Bangladesh (Hossain et al., 2017). In seven upazilas and a population of 7200 people, a national study conducted in Bangladesh in 2013 found a prevalence of 0.15% for autism. In Bangladesh 2016another study done by the Social Welfare Ministry, it was discovered that 19% of all neurological disabilities reported had autism. (Disabilities Screening Bulletin, 2016).

Impairments in intellectual and adaptive functioning are characterized by Intellectual disability (ID). The people of Bangladesh were ignorant about intellectual disability until 1977. The Society for the Welfare of the Intellectually Disabled, Bangladesh (SWID, Bangladesh) was founded by parents that same year, and programs for kids with intellectual disabilities were launched by renowned psychologist Professor Sultana S. Zaman. In the country Report on Intellectual Disability Bangladesh, the overall Intellectual Disability was reported as 4.6 million (WHO) and was presented at the 19th Asian Federation on Intellectual Disabilities Conference, Singapore, 2009. Numerous prenatal stressors, including anxiety, partner relationship issues, and natural catastrophes, have been proven to increase the possibility of a variety of negative neuro-developmental consequences in the child. These include autism, behavioral issues, and decreased cognitive development Similar to many other underdeveloped nations, Bangladesh views neurodevelopmental diseases like autism predominantly through the prism of shame and stigma. Propagation within a community level of a modern protocol is an extremely multi-factorial challenge. Despite these difficulties and complications, Bangladesh has been successful in implementing the most fundamental measures to deal with autism. Bangladesh is currently working to create a rights-based

approach for people with neurodevelopmental disorders, such as autism, after determining that it requires national policy priority. (Muhuri,2012).

Worldwide, there are more than two cases of cerebral palsy (CP) for every 1000 live births. Approximately 10,000 (ten thousand) children are given CP diagnoses each year in the United States (Blair & Watson, 2006; Odding, Roebroeck, & Stam, 2006). The burden of cerebral palsy is higher in low-income countries, according to fundamental epidemiological research, and it affects motor functioning, quality of life, families, and society. (Dand &Paneth, 2017). ASD is thought to affect one in 160 children globally. This estimate reported the prevalence of the disorders. Some well-controlled studies have reported higher figures substantially. The occurrence of ASD in low- and middle-income nations is unknown. According to epidemiological research published in the previous 50 years, the occurrence of ASD appears to be rising worldwide due to increased awareness, expanded diagnostic standards, upgraded diagnostic systems, and better reporting. (WHO, 2017). According to a recent study, ADHD is a disorder that affects all human populations, regardless of place or time. Attention deficit hyperactivity disorder (ADHD) affects 5.29% of people globally. These reports support the indication that ADHD has been acknowledged differently in various nations and regions around the world since it first emerged in the USA in the late 1950s. (Jarrett, 2017).

In 2011, Maulik et al. performed a thorough review and meta-analysis of studies on the occurrence of intellectual disabilities published between 1980 and 2009. The authors highlighted the sociodemographic variable. The frequency of psychological retardation is estimated as highest in low- and middle-income countries and populations, psychiatric assessment tools were used to recognize disorders in children/adolescents. They came to the conclusion after making a brief six-year observation that the best estimate of the prevalence

for that time was 1%. Many studies from nine different nations were found that sought to answer this question. These studies suggest that more than 1% of people worldwide may have intellectual impairments (Loomes et al., 2017).

CHAPTER 3
LITERATURE REVIEW

The primary method of communication is language. Acquisition of language begins from intra-uterine life and matures chronologically as human expected age. During the developmental period of language, conceptual organization, categorization principles, processing mechanisms, and environmental influences are necessary. Conceptual domain or perceptive process through Wernicke's area, expressive process, i.e., motor function through Broca's area of neurolinguistics are involved (Gautam and Sing, 2016).

3.1 Autism Spectrum Disorder

Autism impairs language processing in the brain by impairing the connections and organization of nerve cells and their synapses (Levy, 2009). As a result, autism is a neurodevelopmental disorder (Geschwind, 2008) that appears during the developmental period and runs its course without remission. German-Swiss Psychiatrist & Eugeniust first used the well-known term "Autism" in 1911. Autism and schizophrenia are now recognized as two distinct diseases, Eugen Bleuder coined the term to express an individual bundle of symptoms that were like schizophrenia symptoms due to extreme social withdrawal (Matson & Nebel-Schwalm, 2007). Austrian-American psychiatrist and physician Leo Kanner, founded in the United States in 1943, the first child psychiatry clinic and later at Johns Hopkins Hospital employed as the chief child psychiatrist. Currently, he is considered as one of the most notable American psychiatrists of the 20th century. He published his seminal paper, "Autistic Disturbances of Effective Contact," in which he described eleven (11) children who were mostly intelligent but had a strong devotion to social abandonment with emotional limitations. He dubbed this children's situation "Early Infantile Autism," which is

now established as Autism Spectrum Disorder(ASD) (Landa, 2008). An Austrian physician, medical theorist, and academic named Hans Asperger defined ASD in 1944 as a disorder of children with standard intelligence but complexity with social and communication / conversation competence. Later, children who had complexities with social and conversation / communication competence were diagnosed with "Asperger's disorder". Asperger's syndrome Children struggle with identical communication and social interaction issues, but their language development is not the same. (National Autism Center at May Institute, 2006-19). Due to the fact that communication and socialization are preceded by language, neuro-linguistics elements that affect language development are learned throughout the developmental stage. The ability to identify the neurobiological deficit by the linguistic domains was the strongest and earliest sign of ASD. The neurobiological theories of ASD have significantly altered the ASD clinical picture and the treatment approaches of this disorder, which varies from patient to patient (Mody et al., 2013). Historically it was thought that passing minor currents of electricity among the nervous system activated a brief convulsion intentionally, and the resulting seizure event was theorized to change nervous system chemistry in a way that lower mental health manifestations such as work for self harm and devastating behavior with agitation, although at that time advice for behavioral therapies have exhibited significant effectiveness (Matson & Nebel-Schwalm, 2007). In 1977, the first systematic study of twins was carried out by Sir Michael Rutter, the first professor of child psychiatry at Kind's College London Maudsley Hospital, and Susan E. Folstein, a scientist, physician, and founder of the University of Miami Autism clinic. Of the 21 same-sex twin pairs included in the study, one or both of the twins had autism.

Their work significantly contributed to the shift in medical paradigms that led to our modern society's understanding of ASD as a developmental brain disorder. (National Autism

Center at May Institute, 2006-19). Whereas children with ASD struggle to develop language domains and understand what others say, their intellectual and sociolinguistic development determined their capacity to communicate through language. Some ASD children may have minimal phonological awareness and expressive linguistic development and are unable to understand words and sentences at a normal level. They may also have difficulty communicating nonverbally, through gestures, eye contact, and facial expressions. Aside from these, some ASD kids experience communication issues, they may have a better vocabulary and be able to talk in-depth about some topics. Many kids are really good at remembering what they've recently seen or heard. Susan E. Folstein contributed significantly to the advancement of the genetics of ASD, which is now acknowledged for its importance in understanding ASD; the interaction of multiple developmental strategies designed in a newer way. In 2010, she received a life span acquirement grant from the society of international psychiatric genetics as a notable scientist who has contributed to the development and understanding of how genes proceed from one engendering to the next. This theory of ASD as a hereditary neurobiological condition allowed us to design an understanding of new treatment strategies for children with ASD (Folstein, 2010).

Language development has a significant impact on cognitive, sociolinguistic, and emotional domains, all of which influence how children think, learn, and interact with one another (Mody & Siliman, 2008). ASD children have expressive, receptive/perceptive language problems (Hudry et al., 2010), and these deficits may impair the core difficulties with sociolinguistic/ pragmatic communication, delayed babbling, typical prosody (flat intonation, poor volume control), difficulties with verbal imitation, idiosyncratic order of speech sound acquisition, and reduced use of phonetic contrasts (Shriberg et al., 2011). ASD children show atypical linguistic response, and language profile contributes to unusual speech

perception and production associated with social pragmatics. During the developmental period, a child's ability to express themselves through gestures is a precursor to speech and social-emotional interaction. Children's thinking, learning, and interpersonal interactions are greatly influenced by their language development. (Mody & Siliman, 2008). Most of autism children have difficulty communicating with gestures. The core of communication issues in children with ASD are deficits in social skills and language pragmatics, which vary with age and some ASD children have evidence of phonological impairment (Shriberg et al., 2011). This is in addition to a limited vocabulary and a higher-order semantic and syntax deficit (Kjelgaard & Tager-Flusberg, 2001; Rapin &Dunn, 2003). It is thought that phonology is connected to a person's linguistic environment (Schoen et al., 2011) which is in contrast with semantic deficits. Phonological findings of syndicating impairment have been mixed (Eigsti et al., 2007) where the mean length of utterance shows a deficit in syntactic complexity errors with grammatical morphemes, they also have significant impairments in morphology and syntax. The Linguistics profile (phonology, semantics, and syntax) for these ASD children shows impaired prosody (i.e., lexical stress and affective intonation) and pragmatics (responses that are appropriate for the situation during social interactions).

Communication in the middle of the frontal and temporal lobes in the human brain is responsible for normal linguistic development. In ASD children (Carper et al., 2002; Schumann et al., 2010), the frontal and temporal lobes' posterior and anterior language nerve tracts both experience white matter disruption, i.e., the Broca's and Wernick's areas (Catani et al., 2005; Petrides & Pandya, 2009) connected with fibers from arcuate fasciculus and superior longitudinal fasciculus. Both fibers connect each other and make up the dorsal language pathway. These two areas are thought to be involved with sound for articulation (Warren at el., 2005; Hickok & Poeppel, 2007), and processing of serial sequences

phonologically and syntactically. These fibers originate from the ventral language nerve tract, which passes through the external capsule to connect the ventrolateral prefrontal cortex and the middle temporal lobe. (Petrides & Pandya, 2009). Measurement of sound that is meaningful, which is comprehension and semantic retrieval, involves the ventral stream. (Saur et al., 2010). The rate of growth in whole brain volume in the first two (2) years of life is therefore crucial for language acquisition by the influence of the social environment, as is the functional organization of brain networks in ASD (Radua et al., 2010). During 1st year of life, speech perception occurs through the vocalization of the sound of language in their environment that they have heard, and the next stage is the children attempting to imitate (Vihman et al., 1994). A deficit in the left hemisphere in reaction to verbal perception and language understanding in advanced years of life may impediment on fundamental linguistic acquisition and also weaken the development of societal behavior. The challenges are to understand the language acquisition of ASD as impediments of neurobiological (Fuster, 1998; Pulvermüller, 1999), and psycholinguistic (Liberman et al., 1967; Liberman & Whalen, 2000) network within the brain for speech perception and speech production (Mody et al., 2013). Children typically learn language by listening to and seeing the people around them. This information is transmitted to the brain via the network children talk in and detects the patterns that comprise speech. If the brain fails to process sounds effectively, the potential for a child to learn a language could be compromised (Autism and auditory processing disorder). Compared to children who are typically developing, ASD children are less impressed by verbal and visual information. A child with ASD is deprived of the knowledge necessary to develop typical responsiveness to visual and auditory verbal information when they are focused on the speaker's face. Therefore, auditory speech is essential for language development (Bergeson & Pisoni, 2004). For the maintenance of socialization and the development of language, seeing and listening to speech are both necessary. (Bergeson &

Pisoni, 2004). Children with ASD are less able to detect visible speech information when speakers don't pay as much attention to their faces, which reduces audio-visual integration. (Massaro & Bosseler, 2003; Williams et al., 2004). The fundamental processes in speech perception in children with ASD are concentrated on understanding mechanisms of delay and deficits in language acquisition because language is a key prognostic factor for long-term outcomes in children with ASD. (Lord & MaGill-Evans, 1995). Early identification of children with language deficits is linked to improved neurolinguistics factors and a better outcome (Lord & MaGill-Evans, 1995; Vostanis et al., 1994; Robins et al., 2001).

The need to increase language comprehension, adaptive social behavior, and expressive language also explain the neurodevelopmental and behavioral disorders of ASD. It was found that neurobiological conditions must be treated with psychotropic medications for aggression, irritability, hyperactivity, and self-harm conditions. Infantile ASD was listed for the 1sttime in DSM-III in 1980, and it was separated from childhood schizophrenia. In 1987, infantile ASD was replaced with a more expanded definition of ASD in DSM-IV, which included diagnostic criteria. In 1997, a proposal was passed where it was mentioned that ASD children with appropriate extensive and in-depth resources collaborate language and speech assessment intervention, special education, and behavioral intervention, and these plans of action have been manifested to extremely upgrade well-being. In 2013, ASD was expanded in DSM-V, re-conceptualization of ASD in current ways that ASD is present from birth, and it is a social, emotional, and communication disorder as well as a neurodevelopmental condition (National Autism Center at May Institute. *2006 - 2019*). The development of language has a significant impact on cognitive, social, and emotional domains which influence the thinking, learning, and social relationship of every ASD child (Mody & Siliman, 2008).

3.2 Intellectual Developmental Disorder (IDD)

Human intellectual activity refers to how language interacts with cognition, which includes cognitive, linguistic, and pragmatic language use (DSM-5).(IDD) or (ID)or Intellectual Developmental Disorder is a neurodevelopmental disorder that manifests itself during the course of development, where language acquisition, perception, and production are impaired, particularly the cognitive and psycholinguistic portion of the neurolinguistics is impaired and immature for their expected age (Mody, et al., 2013). In the nineteenth century, attitudes toward IDD in the United States were optimistic and compassionate, and many educational programs for children with IDD were established. By the 1960s, President John F. Kennedy had established a national agenda for the urbanization and industrialization of children with IDD in terms of research-based interventions carried out locally with IDD. This agenda includes educational policy, health services, and prevention, research-based interventions that are carried out locally in practical settings, and the effectiveness of the program has reached the forefront of executive attention for these children with IDD (History of Intellectual Disability).

In America the onset of the twentieth century there was a famous psychologist and eugenicist named Henry Herbert Goddard. He primarily advocated the use of (IQ) intelligence question tests in public institutions such as hospitals and educational institutions, and he contributed to the development of new clinical psychology topics. He also helped to write the first U.S. law requiring children who had limitations in vision, hearing, and intelligence, and he served exceptional teaching within community schools. He was the first American psychologist to give evidence in a court of justice that insufficient intelligence should restraint accused lawbreaker liability (Goddard, 2008) because children with IDD have significant limitations in expressing their thoughts, emotions, and feelings through

social and practical interpersonal communication skills when correlating to their age-equal friends (DSM-5).Children with IDD, in particular, show early neurolinguistics vulnerability; they begin to miss out on opportunities to learn foundation skills such as phonetic decoding; they lag in interaction; and their social world and instruction systematically differ from their peers (Lange & Thompson, 2006). The neuro-linguistic developmental process begins in childhood with exposure to cultural information concepts such as the development of phonemic awareness, automatic rapid access to vocabulary, letter, word, and book-level orthographic skill that corresponds to speech sound. Children with IDD who are deficient in linguistic factors such as neurobiological, cognitive-linguistic, and theoretical linguistic factors are more likely to develop learning disabilities; therefore, neuro-linguistic factors are thought to confer vulnerability (Francis et al.,1996).

Communication requires the expression of our thoughts, emotions, and feelings through language conceptual organization, categorization principles, and processing mechanisms, as well as the creation and maintenance of social relationships. At the time of language acquisition, language is processed, perceived, and produced sound based on the situation and context; through speech, we express our emotions and thoughts; these speech sounds are perceived by the psychoacoustics and psycholinguistic mechanisms of the brain, which means comprehension of speech messages via Wernicke's area of the brain and transmission of speech messages via Broca's area of the brain (Menmisevic et al., 2013). A child who struggles with receptive or perceptive language disorders has trouble deciphering the gestures of others. Others' concepts and ideas, question answering, following directions, and identifying objects are all difficult to learn new words through what he or she read. A child with an expressive or motor language disorder has difficulty expressing ideas and thoughts through words, using gestures, and asking questions according to pragmatic rules

(American Psychiatric Association, 2013). Improving language development intervention is designed to improve vocabulary development, utterance length, language pragmatics practice, and sustained social interaction; as a result, learning disabilities are considered targets for preventive services. Preventive services are built on theoretical linguistics regarding the etiology of learning disabilities.

A set of proposed preventive interventions that have benefits for identifying neurolinguistics risk factors that are observed in early childhood as occurring in natural contexts such as home, pre-school, and community. Interventions are designed by professionals and parents to identify risk factors in a naturalistic setting. Developing orthographic and pragmatic abilities through exposure to language's phonological system and information on how to convey information by improving phonetic skills through exposure to the language's phonological system (Lange & Thompson, 2006).

3.3 Cerebral palsy (CP)

Cerebral palsy (CP) is a movement disorder that appears during the developmental period. Symptoms include poor coordination in speaking muscles (Palsy, 2013), as well as limitations with cognitive, studying, affection, conversation/communication disorder, and behavioral problems (Rosenbaum et al., 2007). Compared to the motor skills outcome, these linkage disorders that co-occur with cerebral palsy are more incapacitating (Sewell et al., 2014). Children with cerebral palsy frequently have difficulties with their speech and language. When speaking, the muscles of respiration, laryngeal velopharyngeal, and orofacial muscles co-ordination are required; however, in cerebral palsy children, these muscles are impaired, resulting in movement of the muscles of articulation causing "dysarthria"(Sewell et al., 2014; Myrden et al., 2014; Russell & Wanda, 2013). Cerebral palsy was first documented in the 5th hundred-year period by Hippocrates in his work (Panteliadis et al., 2013). Extensive research into this situation started in the nineteenth century with Dr. William John Little, an English Surgeon who founded the "Royal Orthopedic Hospital" of London. He is credited with the first medical identification of the spastic type of CP in the 1860s. He was the first to medically document this condition in writing.

For many years; spastic CP was referred to as "Little's disease," but the name was later changed. Sir William Osler was a Canadian pathologist and physician who was one of the four founding professors of John Hopkins Hospital, named it "Cerebral Palsy". Cerebral Palsy is a catch-all term for children who have difficulties with cognition, thinking, learning, speaking, linguistic, and conversation. The prevalence of the developmental motor disorder is associated with a speech disorder which is known as Dysarthria. All factors of speech production are frequently impacted in children with CP, including respiration, phonation, resonance, articulation, and prosody. Impairment includes poor articulation, hyper-nasality,

pitch variation due to irregular breathing, reduced or unexpected pitch, and harsh voice. Speech has the effect of making children's speech less understandable, which can cause communication problems (Mary Watson & Pennington, 2015). Communication disorders cause institutional and public separation and have an unfavorable influence on all domains of development (Romski & Sevcik, 2005; Sevcik et al., 2004; Light & Drager, 2007). Diagnosing and acting towards language and speech difficulties at the initial possible time is thus part of the developmental period. The variability of speech-language assessment makes it difficult to categorically identify communication difficulties as determined by thorough speech and language testing during the developmental stage, especially when deficits are subtle, the severity of language and speech impairments based on the presence or absence of linguistic variability (Hustad et al., 2014).

The capacity to comprehend language articulation, perception, lexicon development, and the potentiality to involve in direct conversation/communication depends on developing brain connections. The child diagnosed with CP impaired brain connections, i.e., cause neurological injury, which could have a negative impact on several factors mainly linguistic variability (Lidman et al., 2018). Lesions in the connections of the nervous system which is accountable for speech production often cause speech difficulties that are the organization, performing, or controlling the motor functions of skeletal muscles used in speech. There are varying stages of impairment, depending on the inadequacy of coordination of the motor speech system and also weakness or paralysis of the motor speech system (Sigurdardottir, 2011). Children with significant speech and motor issues had severe delays in communication development. Children with motor speech difficulties have a delay in early skills of language comprehension. The ability of a child with CP to understand language can accurately predict their language skills difficulties (Matheis & Estabillo, 2018). The various forms of language

use are learned during the developmental stage, and when it comes to the developmental stage, the language issue is psychological. The implications of motor development provide an understanding of the interferences and disturbances that may lead to impaired language acquisition in children with CP. Speech/verbal and language difficulties, as well as communication/conversation difficulties, are common in children with cerebral palsy; a combination of neuromotor dysfunctions, mental retardation, and organic behavioral disorders may be present (Pennington, 2016). Compared to children with simply motor impairments, those with dysarthria and language issues had poorer comprehension. Children with dyskinetic CP who do not have a speech disorder but who have good receptive language skills may have a motor impairment, which may describe motor speech issues that are perceptive conversational.

However, neuro motor speech difficulties or the lack of a speech/verbal disorder are not to blame for intellectual disabilities that are applicable to perceptive communication/conversation competence. The sequential phase of the child is crucial for figuring out whether there was a language developmental delay during the development period of CP children between the ages of 18 months and 4.5 years. Children with significant speech and motor disorders experience a delay in communication / conversation (Morgan et al., 2016). Communication difficulties in people with CP are multifactorial, and they are directly related to motor impairment and cognitive sensory processing deficits. Children's speech production is hampered by CP's motor disorder. Because speech production disorder is associated with a motor function (gross motor), the existence of an intellectual disability, and the location of nervous system mal-development and lesions, children should have the opportunity to communicate as part of language intervention programs. (Ferdous et al., 2017). Communication is a vital link between CP children and their caregivers; as communication

skills improve, CP patients are able to engage in a wider variety of activities. SLPs/therapists deal with language development, human communication/conversation, and associated disorders. SLPs assess patients' abilities and limitations for various therapeutic interventions (Speech therapy for cerebral palsy). Speech-language therapy assists children with cerebral palsy in achieving the goal of independent communication. For the prevention of future problems, earlier intervention is required (Pennington, 2016). Speech-language therapists assess word development, articulation, perception, vocabulary development, and the capacity to interact with direct conversation.

If the child has difficulty in expression (nonverbal), a speech-language pathologist can cooperate in different ways in which the child can express his/her emotion and think during human communication. Speech-language therapists teach children adaptive and compensatory communication strategies through signing, image, affecting, painting boards, and mechanization-based procedures, and improve their skills, ability to learn, confidence and independence. Starting this activity too soon in development will open up the chance for linguistic competence, because the nervous system can form links that cannot be formed afterward in life. Language is intertwined with physical (especially speech), social, occupational, and psychological development; if intervention is made late, a child will have to change how he or she builds an understanding of design and bodily habits, which is far additional challenges, and all will be unfavorably impacted if treatment is delayed for an extended period (Welling & Ukstins, 2017).

3.4. Attention Deficit Hyperactivity Disorder (ADHD)

Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder that primarily affects children. Dr. George, a British pediatrician, coined the term "an abnormal defect of moral control in children" in the 1902s, referring to the fact that some children are unable to control their moral behavior in the same way that a typical child can (Legg, 2017). He defines the pathological condition as a "defect of moral control" caused by a neurobiological abnormality. He also described this condition as moral dementia caused by the pathological condition of the mind with insanity while still in the womb, and these difficulties were not associated with environmental factors, nor any intellectual impairment. The American Psychiatric Association (APA) characterized ADHD as a hyperkinetic reaction of childhood that was replaced by brain neurobiological dysfunction in 1968. The symptoms of inattentiveness also interfered with language comprehension because attention plays a significant role in language comprehension. These symptoms also point to a link between ADHD and difficulties with pragmatic communication (Bellani et al., 2011). Hyperactivity-impulsivity symptoms interfere with speaking without thinking and listening comprehension, resulting in ADHD children interrupting others' speech and talking excessively; children who had chronic difficulties with attention and self-regulation, presenting with challenging and oppositional behaviors; the cause of these hyperkinetic reactions is due to brain developmental abnormalities and with a neurobiological basis (Carr-Fanning et al., 2012). Attention aids executive function and pragmatic language competency, both of which are required for children's societal and educational functioning.

Children with ADHD frequently experience attention deficits, and these issues are consistent with executive function deficits, and as a result, they present with pragmatic language competency difficulties (Legg, 2017). Inattention symptoms are strongly linked to

central executive verbal processing which causes both neuro-psycho-linguistic and cognitive-linguistic deficits and relatively develop typical social norms, although severe impairment in the pragmatic and narrative discourse skills to encode explanation applicable to the conversational circumstances impair understanding of children with these disorders. But they can give rise to well-formed semantic complete words which allow them to take part in the effective conversation (Green et al., 2014). As a result, working memory is divided into two functional components. One is for short-term memory, which stores only information, and the other is for long-term memory, which is used for manipulation during complex cognitive tasks. The maintenance components are again subdivided into the linguistic circuit, which keeps track of express information, and the visual writing pad, which keeps track of visual information. One area of executive functioning that is impaired in children with ADHD is the cognitive task (Papaeliou et al., 2015). ADHD received significantly lower scores in spoken language, which include verbal expression, sentence copying, morphological understanding, word differentiation, and the listening semantics and syntax composite quotients. A frequent co-morbidity of behavioral problems and psychiatric disorders is delayed language development (Beitchman et al., 2001). It is possible to avoid early symptoms from parents during the developmental period, which can be exacerbated by day-to-day co-occurrence. Language development delays observed during the developmental period are related to hearing and listening as an operational process, the unable to concentrate and continue attending to the voice and sounds in the surrounding circumstances (Gupta & Ahmed, 2003).

Executive functions of the brain are coordination of our plan, impulse control, and language delivery according to pragmatics. Attention issues can have trouble with hyperactivity impulse control behavior and inattention. This affects language and communication in various ways as attention issues in children can cause trouble in using and

understanding language in social situations. During the developmental period, attention is necessary for concentrating on linguistics to encode and ignore irrelevant input as well as control impulses. The association between an object and language processing depends on attention, the advancement of linguistic sequences, societal routines, and practical skills. If the child is unable to do this either because of attention deficits, the process of language encoding will be disrupted, especially L1 (Mueller & Tomblin, 2012). There aren't many studies that particularly look at language abilities. Early treatment can assist manage behavioral issues and linguistic impairments, in addition to lessen the brutality of these symptoms. (Rappaport et al., 1998). When language is impaired, behavioral problem arises which is directly linked to communication. Early identification and treatment of ADHD, a complex neurodevelopmental disorder, is essential to reduce its long-term effects. The speech-language pathologist is equipped with the knowledge and talents needed for both the diagnostic and intervention phases of therapy to help in deciphering the behaviors linked to language impairments.

A multidisciplinary approach to treatment is necessary, as is professional team coordination with the child's family. There may be a direct link between the impulsivity that is so disruptive at home and school and temperamental or neurological deficiencies in behavioral regulation (Heyer, 1995), which is controlled by medication (ASHA). Speech-language pathologists assist children in acquiring good pragmatic language skills and effective social skills, both of which will eventually be beneficial. The consequences of ADHD will be reduced if this treatment effectively intervenes in their functioning in all areas of their interaction with the environment and the positive impact on ADHD children's functioning will be maximized (Heyer, 1995). Virgina Douglas and her colleagues at McGill University in Canada observed specifically behavior and cognitive measures in the 1970s and

concluded that symptoms involving an inability to sustain attention and control impulsivity are the most significant factors for hyperactivity (Legg, 2017). The American Psychiatric Association (APA) then drastically changed the definition of the condition in 1980, based on the observed effects of stimulants on inattentiveness is responsible for executive language skills, with or without the presence of hyperactivity (Barkley, 2006). The focus on inattention as a characteristic of the disorder changes the diagnostic criteria. The validity of Douglass' model emphasizes inattention as a core feature of ADHD, even though it was a unique and qualitatively different disorder because behavioral symptoms did not account for the diagnosis. Later, these diagnosis issues of treatment outcomes of hyperactivity and impulsivity were resolved (Weiss & Htchman, 1993).

A persistent pattern of inattention and/or hyperactivity-impulsivity that hinders functioning development, as well as a number of inattentive or hyperactive impulsivity symptoms that start during the developmental period and clinical symptoms present before the age of 12 years (DSM-5), were the basis for the American Psychiatric Association's (APA) 2013 revision of the ADHD diagnosis. Research in both biological and behavioral science has long supported the validity of the diagnosis of ADHD. (Green et al., 2014). Researchers began rethinking the disorder based on neuro-linguistic factors in the latter half of the 20th century. The central feature was hyperactivity, and the diagnosis was refined to include a current understanding of the role of inattention and impulsivity. Executive function and pragmatic language competency are aided by attention, and pragmatic language competency is required for children's societal and academic functioning (Legg, 2017).

3.5 Neuro-developmental Disorders: Bangladesh perspective:

In many nations around the world, neurolinguistic research is well-established on neurodevelopmental disorders in children, such as autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), cerebral palsy (CP), and intellectual developmental disorder (IDD), but it is still very new in Bangladesh. In this country, there are speech therapy departments in *Savar* and *Mirpur* (Islam et al., 2013) and a linguistics department at University of Dhaka. Children with neurodevelopmental disorders may not have these diagnoses or be treated due to a lack of neurolinguistics research. In many other developing countries, like Bangladesh, neurodevelopmental disorders are seen as a disgrace from God primarily. The the era of a modernized agreement the propagation, of neurodevelopmental disorders within a community is an extremely complex multifactorial challenge. Despite these complexities and challenges, the first steps have been taken to successfully deal with neurodevelopmental disorders. We distinguish in Bangladesh at present demand to develop of an international strategy rights-based paradigm for children with neurodevelopmental disorders individually. (Muhuri, 2012) observed in a study(i)Socio-demographic status of the NDD children; ii) Significance of the related inadequacy; iii) supervision of the management strategies; iv) observation of the epidemiological prevalencefrequency and risk elements. Linguist Nasrin (2017) found in her research that Bengali autistic children had a sociolinguistic disorder.

To determine the prevalence of intellectual disability, Mullick and Goodman (2005) conducted a systematic review and meta-analyses between 1980 and 2009. These authors highlighted the socio-demographic variables for estimates of prevalence covering states, sex-groups, and study designs; the approximate prevalence rates were maximum among low- and middle-income communities, in child/adolescent populations, and intellectual disability was

diagnosed by psychiatric assessments method. In recent yearschanges in diagnostic procedures, population characteristics, and exposure to known risk factors, according to the authors, these estimates into question and make it vital to investigate more recent research on prevalence and incidence. They conclude that the prevalence for that period was one (1%). Review literature was carried out for publications briefing six (6) years observations and research associated among nine (9) countries to establish the prevalence of intellectual disability worldwide which presents the wish for understanding. According to this research, the universal prevalence of intellectual disability may be fact in > 1%. The people of Bangladesh were not aware of intellectual disability until recently.

This changed with the activity of the Society for the Welfare of People with Intellectual Disabilities Bangladesh (SWID, Bangladesh) which started schedules for children with intellectual disabilities. The country's report on Intellectual Disability points to 4.6 million (Disabilities Screening Bulletin, 2016). Mullick and Rabbani (2005, 2009) found an autism rate of (0.2) and (0.84) per 1000 live children. In Bangladesh (Hossain et al., 2017) systematic review research found the frequency of ASD stretched between (0.15–0.8%). In 2013 another international study was done in Bangladesh at the community level in seven districts, among a population of 7,200. The result found that the prevalence of autism was 0.15%. In another study done by the Social Welfare Ministry, the prevalence of autism was 19% of all reported neurological disabilities (Disabilities Screening Bulletin, Bangladesh, 2016). In low- and middle-income states, the standard of living and health-related quality are inextricably linked to economic situation. As a result of homebirth, cerebral palsy (CP) was the most common physical disability in children. Bangladesh had 3.4 cases of CP for every 1000 children. (Al-Imam et al., 2021). A national mental health survey was performed by the health and family welfare ministry in 2019. The findings are:

- Prevalence of child mental health in Bangladesh (12.6%) and NDD (5.05%). A study observed “Factors (perinatal) among neurodevelopmental disorders children attending Dhaka tertiary care hospitals (Zohra et al., 2018). The findings represent that:
    - Prevalence of birth complication (82.6%) and birth asphyxia (61.7%). Linguist Begum (2012-13) described in her research pathology within the brain affects the components of linguistic elements.

A neuro-developmental disorder known as ADHD, or Attention Deficit Hyperactivity Disorder, is characterized by severe difficulties with behavioral traits like lack of attention, impulsiveness, impulsivity, or a pairing of the two. Children with ADHD can successfully lead normal lives if they manage their symptoms early. Treatment with methylphenidate for 6 months given to the patient resulted in improvement at the end of 2 years, and it was observed that the child became communicative. Children with ADHD are frequently underdiagnosed, and this needs to change because early detection and treatment are crucial for preventing negative long-term effects. (Hamid & Roy, 2013). Early diagnosis of neurodevelopmental disorders should be done through a child guidance protocol (Alam, 2015). Linguist DIL (2014) described culture influences the Bengali language in real life. Sultana et al. (2016) also described the importance of morphosyntactic development among Bangla-speaking children. Although Linguists, genetic scientists, and psychologists started research in Bangladesh at the onset of the twentieth-first century (Arif, 2009). But significant treatment gap exists within intervention due to the inadequacy of multidisciplinary approach.

CHAPTER 4
METHODOLOGY

4.1 Justification for Neurolinguistic research:

This doctoral research in neurolinguistics looking at children with neurodevelopmental disorders will be groundbreaking in Bangladesh. References are made according to the country's health indicators. We intend to achieve the Millennium Development Goals by decreasing the infant and maternal mortality rate, but till now neurodevelopmental disorders are considered in Bangladesh as disgraceful with the belief that psychological or behavioral problems are from supernatural forces and evil deeds. The general population seeks traditional treatment rather than a hospital for scientific management, and by the time they realize that the traditional treatment is flawed, it is already too late to take the appropriate treatment course.

Unlike studies in which language is studied as a communication system processed in several different places in the human brain, this research brings avenues of investigation aimed at a language retrieval structure according to the view that linguistic and cognition are part of the similar dynamic method incorporated in a network, from starting subsystems (auditory, tactile, visual, etc.) until reaching the central nervous system. This perspective helps progressing recovery strategies for certain brain impairments and fills some gaps in our current knowledge about the functioning of cognition. This new light on the dynamic functioning of language-cognition interactions is important to understand how one can intervene in language recovery through documentation, discovery, interpretation, and development of methods and concepts for the advancement of our knowledge, which helps progressing of new services and treatments to support children with neurodevelopmental impairments. Through this study, it was observed that it is desirable to make an early

diagnosis and intervention through assessment and speech therapy, to reduce the deleterious effects of language damage suffered by the individual. This is due to the verification that there is an increase in the brain's ability to self-regenerate, stimulated to develop according to the social context to bring a better quality of life to patients and reduce family, social, and state burden

4.2 Research Question:

This research tried to find out the inquiry: To what extant are the atypical neurolinguistic features available in Bengali children with neurodevelopmental disorders?

Neurodevelopmental disorders come in a variety of forms, each with their own unique set of symptoms. Children with and without neurodevelopmental disorders share a few traits. Because of this, parent’s even doctors and service provider are unable to determine whether the traits are typical or indicative of a neurodevelopmental disorder. Discovering the atypical features of neurodevelopmental disorders in Bengali children will help parents, service provider and medical professionals tell them apart from typical children, which is why this question was chosen.

4.3 Research design:

This cross-sectional narrative research is designed as a quantitative study. The presence of open-ended questions in qualitative interviews distinguishes them from quantitative interviews. Questions for which there are no answer options are provided by the researcher which compels responders to respond on their terms. Textual data are created through qualitative inquiry (non-numerical). Quantitative research, on the other hand, produces "numerical data," or knowledge that can be expressed as numbers. There were no

open-ended questions in this study; all the questions had defined answers that could be converted into numbers. This study was designed as a quantitative study because It is an efficient instrument for gathering and evaluating data. It is perfect for understanding the relationship between two variables. Researchers frequently use the quantitative study to verify their hypotheses in their experiments, to perform statistical analysis, and to carry out research. Additionally, the results of quantitative research are straightforward to calculate and may be presented as objective facts. The numerical underpinning of quantitative data makes prediction simpler. The capacity to transform quantitative data into forecasts is a significant benefit.

Over the years, there has been discussion and disagreement on whether qualitative or quantitative research approaches are more suited for performing social research. According to Robson, constructivists and positivists have been engaged in a paradigm conflict (2002). However, because each methodology has a different approach to gathering and interpreting data, the two procedures are incompatible. The two methods are tools used to achieve the similar task using various methods and strategies, even though they have distinct strong points and lines of reasoning. Both research methods are a component of a wider research continuum (Creswell, 2009; Johnson & Christensen, 2012). Because of the many benefits of quantitative research, including the first one—with statistical data as a tool for saving time and resources—we carried out a quantitative study. Bryman (2001) said about the collecting and interpretation of data, the quantitative research technique places a strong emphasis on numbers and statistics. Implicitly, one may consider the quantitative research technique to be scientific in character. Time and effort are saved by using statistical data for study descriptions and analysis. Statistical software may be used to examine data by computers, saving a lot of time and money (Gorard, 2001; Connolly, 2007). Secondly, this sort of

methodology allows generalization by using scientific approaches for information collection and interpretation. It is possible to apply the interactions with one group to others. Similarly, it's not necessary to ignore the interpretation of research results as a mere coincidence (May & Williams, 1998). The researcher will follow clear guidelines and objectives rather than making educated guesses because the research approach depends on testing hypotheses. (Lichtman, 2013). Since the research study using this type of research instrument has a clear goal and guidelines and can be repeated at any other time or location and still produce the same results, it is conducted in a broad or public manner. (Shank and Brown, 2007). Additionally, this research methodology allows the use of control and study groups.

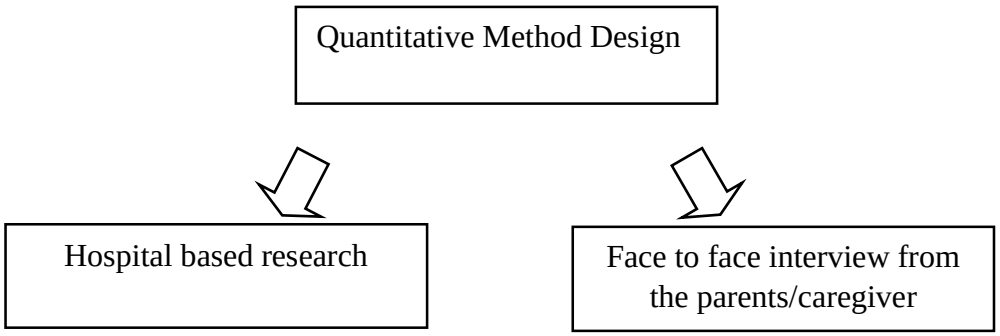

Figure 19 Study design

4.4 Place of study:

This study has take place in Diagnostic and Intervention Centers of Neuro-developmental Disorders in tertiary level hospitals in Dhaka Medical College and Hospital, National Institute of Mental Health, Dhaka, and in the Department of Psychiatry, Z.H. Sikder Women's Medical College and Hospital, Bangladesh.

4.5 Justification of the place of the study:

These tertiary-level hospitals were chosen purposively because they represent the general picture of Bangladesh, as patients with, more or less the same background come for

treatment from all over the country. Easier access for the researcher was also taken into consideration in choosing these three tertiary-level hospitals.

4.6 Study population:

During the study period, Bengali children with neuro-developmental disorders like IDD, ASD, ADHD, and CP, of age between 3 to 18 years attending Diagnostic and Intervention Centers in tertiary level hospitals were included in this study.

4.7 Selection criteria:

Diagnosed cases of IDD, ASD, ADHD, and CP were considered on:

4.7.1 Inclusion criteria

- Those with the clinical diagnosis of Neurodevelopmental disorders with language disorder referring to Diagnostic and Statistical Manual-5 (DSM-5).
- Age range 3 -18 years.
- According to formal audiovisual evaluations or screenings, children's vision and hearing abilities are within normal ranges.
- Those who are capable of being submitted to brain MRI report.

4.7.2 Exclusion criteria:

- Children with vision and hearing impairment.
- Children with other language developmental delays (e.g., Social Pragmatic disorder, etc.).
- Children with language disorders due to a tumor or other event in language processing areas (Broca's area, Wernicke's area, and their associated fibers).

- Children with global developmental delay.

4.8 Piloting:

The adaptation was done by translating the questionnaires into Bangla from English by reviewing research papers, literature, and following the DSM-5. After that, the compiled version was interpreted into Bangla and English with the help of professionals. After that, the questionnaires were submitted to the linguist formulated for this adaptation process. The linguist finalized the questionnaires. Before the study, pre-testing was conducted among 20 children with neurodevelopmental disorders to ensure that the approach, including the research instruments, as appropriate. To ensure cultural equivalence, some of the questionnaires were modified, while others were combined, and then the questionnaires were finished.

4.9 Research instruments:

We have got support from history taking from the participant, MRI report, and DSM-5, for diagnosis of the NDD, done by a Psychiatrist. The researcher used a pre-designed structured questionnaire to make a diagnosis of a neurolinguistic disorder. A pre-designed structured questionnaire has been adapted for the study population reviewing research papers, and literature and following the DSM-5. Each questionnaire has 2 parts:

First part: Sociodemographic and relevant clinical questionnaire

Socio-Demographic History:

1. ID no
2. Age of the child
3. Sex
4. Date of Birth of the child

5. Education level of Father

6. Education level of Mother

7. Occupation of Father

8. Occupation of Mother

9. Monthly income of the family (Approx)

10. Place of delivery

(i) Home (ii) Hospital

11. Mode of delivery

(i) Per vaginal (ii) Caesarian section

12. Presence or absence of the child's crying immediately after birth?

(i) Yes (ii) No

13. Any traumatic symptoms in the head after birth?

(i) Yes (ii) No

14. MRI findings: I) Normal II) Abnormal

Second part: Domains of language development was observed, and information were taken from parents and children:

Four (4) domains of language development was observed, and information were taken from parents:

a) Receptive domain

b) Expressive domain

c) Sociolinguistic/pragmatic domain

d) Behavioral domain

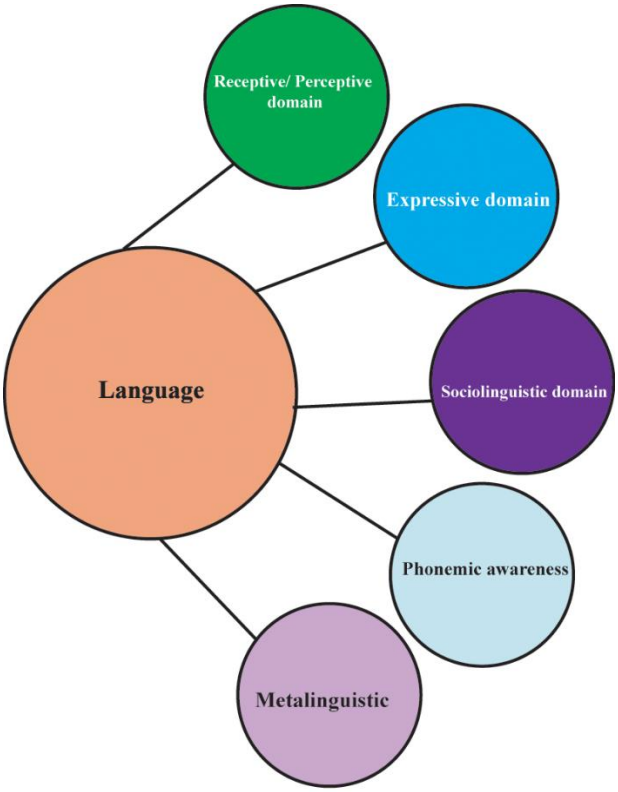

Figure 20 Domains of Language

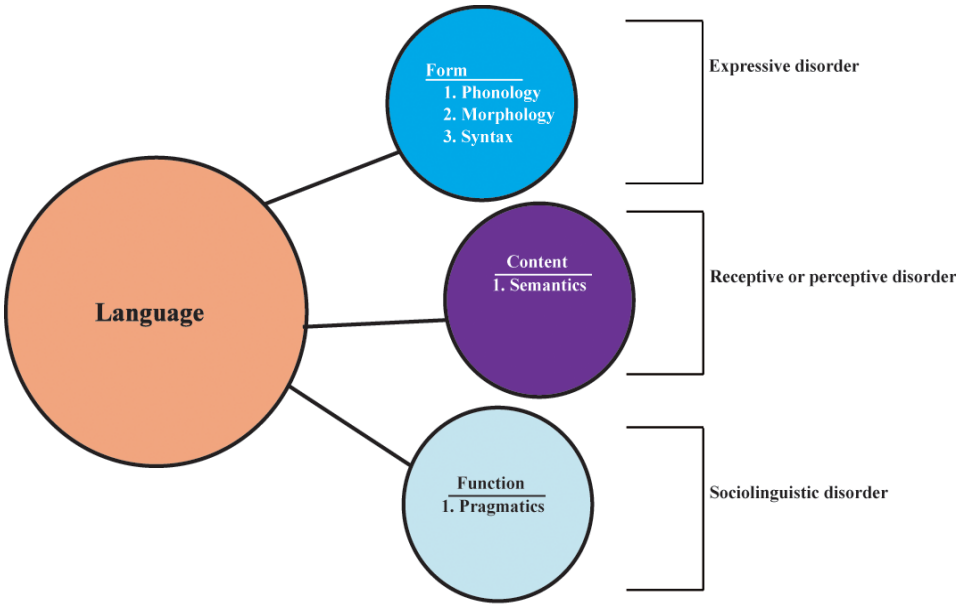

Figure 21 Components of language and effect on one or more fundamental components causes domains of language disorders

Two domains (2) of language development were observed, Information was taken from the children by asking questions and showing pictures.

a) Phonemic awareness

b) Metalinguistic competence.

(2) Diagnostic and Statistical Manual – 5(DSM-5).

(3) Brain MRI to find out if any organic brain lesion was present or not.

- **Interpretation of the questionnaire of Autism Spectrum Disorder children (ASD) for the diagnosis of the domain of language disorders.**

Receptive/ Perceptive language development disorder:
If the following three questions were answered "No," a child was diagnosed with receptive language development disorder: 1. Have you ever wondered if your child has hearing loss? 2. Does your child answer when called by name? 3. Does your child usually ask for something like, for example: where is the ear, toy, etc.?
Expressive language development disorder:
There were two questions in the expressive language development domain; if both answers were "No", then the child was diagnosed as having a language disorder in the expressive language development domain. 1. Does your child have a problem expressing nouns & pronouns (I, you, mine) and meaningful words and sentences? 2. Does your child say idiosyncratic/ neologism words?
Sociolinguistic development disorder:
There were four questions in the domain of sociolinguistic development domain. If any three questions were answered “No”, then the child was diagnosed with language disorder in the

sociolinguistic domain. 1. Does your child sing or recite rhymes with other children? 2. Does your child take part in a conversation with others? 3. Does your child understand other facial expressions and maintain eye contact? 4. Does your child point or engage in group looking at things?
Behavioral disorder:
There were three questions in the behavioral domain; if questions 1 and 2 were answered "Yes," the child was diagonis as having a language disorder in the behavioral domain. 1. Has your child displayed confined, recurring patterns of interest, behavior, or activities? (Example: arranging objects or idiosyncratic phrases) 2. Does your child have highly restricted habits and fixates on any subject? (e.g- fixated and restricted to eating the same food, and performing rituals every day) 3. Does your child have self-harm behavior?
Phonemic awareness disorder:
There were seven questions in the phonemic awareness domain, and if at least three of them were answered “No," then the child was diagnosed as having a language disorder in the phonemic awareness domain.
Metalinguistic Competence disorder :
In the phonemic awareness domain, there were seven questions, and if at least three of them were answered "No," the child was identified as having a language disorder in the Metalinguistic competence domain.

Table 4 Interpretation of the questionnaire of Autism Spectrum Disorder children (ASD) for the diagnosis of the domain of language disorders

- **Interpretation of the questionnaire of intellectual development disorder (IDD) children for the diagnostic domains of language disorders:**

Receptive/Perceptive language development disorder :
A child was diagnosed with receptive language development disorder if the answer to any one question was found 'No': 1. According to the situation & context, how many meaningful words does your child understand? 2. Do you think your child's understanding ability is similar according to the chronological age and linguistic age of his/her friends of similar age? 3. Does your child understand the words of his/her companions and friends of the same age, according to the situation & context?
Expressive language development disorder:
There was one question in the expressive language development domain; if answered "Yes", the child was diagnosed as having a language disorder in the expressive domain. Does your child have limitations in expressing meaningful speech to others?
Sociolinguistic development disorder:
There was one question in the sociolinguistic domain. If answered "No", then the child was diagnosed with language disorder in the sociolinguistic domain. 1. Does your child create & maintain peer relationships?
Behavioral disorder:
There was one question in the domain of socialization. If the answer was "Yes", the child was identified as having a language disorder in the behavioral domain. 1. Does your child have self-injurious behavior and other significant behavioral problems?
Phonemic awareness disorder:
There are seven questions in the phonemic awareness domain, and if at least three of them were answered "No," the child was identified as having a language disorder in the phonemic awareness domain.

Metalinguistic competence disorder:
In the metalinguistic competence domain, there were seven questions, and if at least three of them were answered "No," the child was identified as having a language disorder in the metalinguistic competence domain.

Table 5 Interpretation of the questionnaire of intellectual development disorder (IDD) children for the diagnostic domains of language disorders

- **Interpretation of the questionnaire of cerebral palsy(CP) children for the diagnosis of domain language disorders.**

Receptive language development disorder:
A child was diagnosed with receptive language development disorder if the answer toquestion2(b) was found 'No': 1. According to chronological age, was your child's language development normal? 2. Depending on the situation and context, sentences made by how many meaningful words does your child understand to others? a) One meaningful word/ sign language, pictures b)Sentences made by 2 or more meaningful words
Expressive language development disorder:
There were five questions in the expressive language development domain; if anyone's answer was "No", the child was diagnosed as having a language disorder in the expressive domain. 1. The following words (vowels) can your child pronounce? 2. The following words (semi-vowels) can your child pronounce? 3. The following words (consonant) can your child pronounce? 4. Does your child articulate the following alphabet/letter phoneme? 5. Does your child articulate complex sentences?
Sociolinguistic development disorder:
There was one question in the domain of socialization. If the answer was "No", then the child was diagnosed with language disorder in the socialization domain. 1. Does your child create & maintain peer relationships?
Behavioral disorder:
There were two questions in the behavioral domain; if any question answered was "Yes," the child was identified as having a language disorder in the behavioral domain. 1. Does your child depend on others for self-care, eating, money & to take any decision?

2. Often developed a conflict with his/her peers or adults for being unable to deliver speech according to situation & context?
Phonemic awareness domain:
There were seven questions in the phonemic awareness domain, and if at least three of the questions were answered "No," the child was identified as having a language disorder in the phonemic awareness domain.
Metalinguistic competence:
In the metalinguistic competence domain, there were seven questions, and if at least three of them were answered "No," the child was identified as having a language disorder in the metalinguistic competence domain.

Table 6 Interpretation of the questionnaire of cerebral palsy(CP) children for the diagnosis of domain language disorders

- **Interpretation of the questionnaire of ADHD children for the diagnosis of domains of language disorders.**

Receptive/perceptive language development disorder:

A child was diagnosed with receptive language development disorder if: among 4 questions, the answers of any of the questions were “No” and question no#4 must be found ‘Yes’:

1. 1. Have you ever wondered if your child has hearing loss?
2. 2. Does your child answer when called by name?
3. Can your child not remain attentive when listening or when someone talks to him directly?
4. Does your child follow directions properly? Does he or she complete tasks as directed? Is he/she excessively hyperactive or does he/she act inappropriately?

Expressive language development disorder:

There were three questions in the expressive domain; if anyone’s answer was "Yes" the child was diagnosed as having a language disorder in the expressive domain.

1. Does your child talk excessively?
2. (Does your child in the classroom usually answer before his/her classmates complete the answer or can't wait for his/her turn?)
3. Does your child frequently interrupt or meddle in other people's conversations?

Sociolinguistic development disorder:

There were three questions in the domain of sociolinguistic disorder. Among them, if question#1 answer was “No” or question no# 2 and 3 answers were “Yes” then the child was diagnosed with language disorder in the sociolinguistic domain.

1. Does your child create and maintain a peer relationship?
2. Is your child messy or disorganized at home and school?
3. Is it difficult to control your child in malls or grocery stores?

Behavioral disorder:
There were three questions in the behavioral domain; if any question answered was "Yes," the child was diagnosed as having a language disorder in the behavioral domain. 1. Does your child often lose his temper? 2. At school or during play, does your child get involved in arguments or fights? 3. Does your child often refuse to comply with an adult's request or engage in arguments with the adult?
Phonemic awareness disorder:
There were seven questions in the phonemic awareness domain, and if at least three of them answered "No," the child was diagnosed as having a language disorder in the phonemic awareness domain.
Metalinguistic competence disorder:
There were seven questions in the phonemic awareness domain, and if at least three of them answered "No," the child was diagnosed as having a language disorder in the metalinguistic competence domain.

Table 7 Interpretation of the questionnaire of ADHD children for the diagnosis of domains of language disorders

4.10 Sample size:

- Male to female ratio was almost 1:1
- Children were selected from different socioeconomic status
- Considering study duration, cost, administrative concerns, a minimum acceptable level of precision, and variability within the population or subpopulation (e.g. four types of neurodevelopmental disorders, different types of age, sex, socioeconomic status, areas of interest)

The following formula was used to determine the sample size:

$$n = \frac{Z^2 p \times q}{d^2}$$

Here,

n = the optimal sample size that would enable measurement of the various indicators

z = the standard normal deviation, which is usually set at 1.96 at a 5% level, or a 95% level of confidence.

Here p = 0.50 (There was no established p-value for NDD children's language disorders)

q=1 - 0.50 = 0.50

d = allowable error (normally from 1 – 10%) = 0.056 (assumed 5.6%)

So, the sample size for this study will be

$$n = \frac{(1.96)^2 \times 0.50 \times 0.50}{(0.056)^2} = 306$$

- n=306
- 75 children's data were from (ASD, CP, and IDD) and 67 data were collected from ADHD children. Total= 292 children were included in the research.

4.11 Sampling method:

The sample collection method of this study was purposive, quantitative sampling on purpose. Generally, purposive sampling saves time, money, and effort. Moreover, this sampling technique is flexible and meets multiple needs and interests. As a result, purposive sampling was selected as useful for this situation.

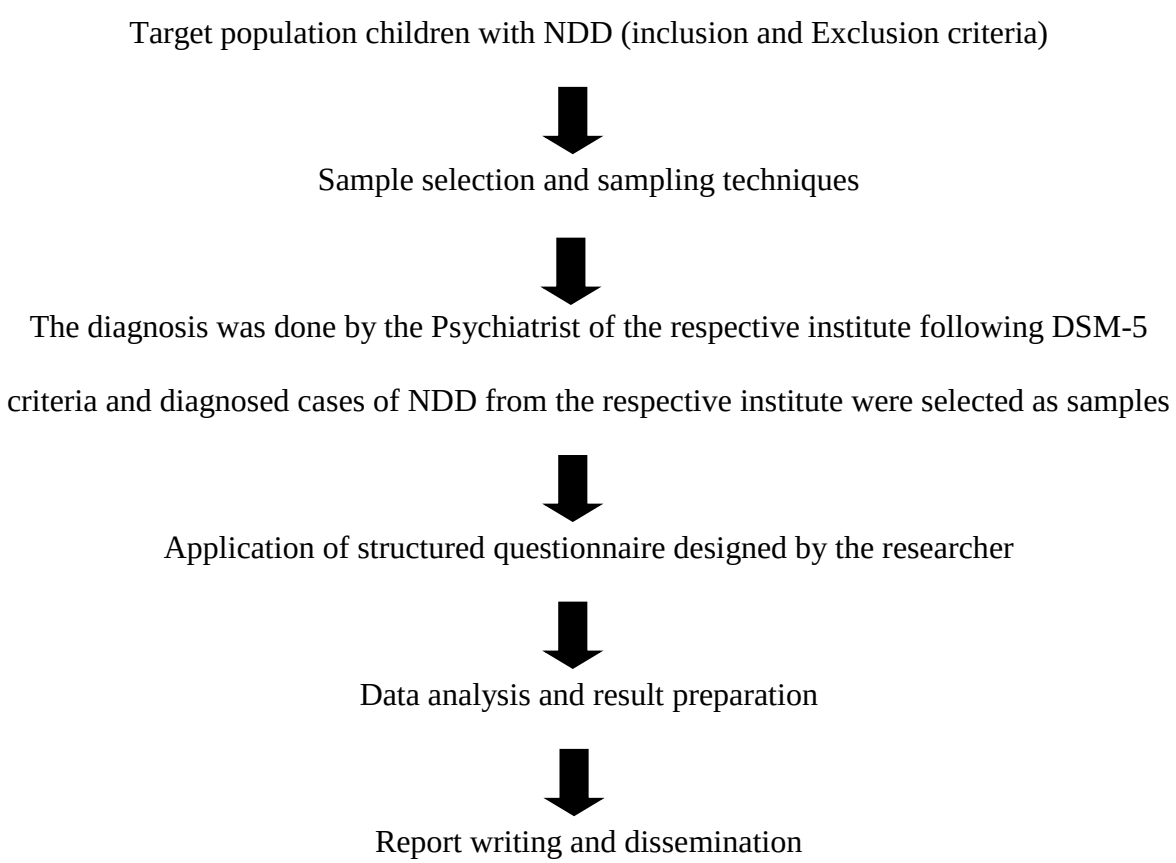

Figure 22 Flow Chart of sampling

4.12 Ethical consideration:

- The research protocol was authorized by the University of Dhaka's academic council prior to the start of this research. The University of Dhaka's Department of Linguistics oversaw entire study phases.

- The data were obtained from the institution of three tertiary level hospitals with prior authorization from the Institutional Review Board of three tertiary level hospitals (National Institute of Mental Health, Dhaka Medical College and Hospital (Department of Psychiatry) and Z.H. Sikder Women's Medical College and Hospital (Department of Psychiatry).
- In accordance with the WMA Helsinki Declaration's revision, the parents' signed informed consent was sought prior to data collection. A written handout with comprehensive study-related material was read out and explained in the local language.
- When collecting data, confidentiality was upheld with the utmost privacy.
- The parents and caregivers were informed that all information was kept confidential and that they could leave the study whenever they wanted during the data collection process.

4.13 Procedure of data collection:

Patients were first brought to the Outpatient Department(OPD), where they were given a registration number and a ticket. Patients were then referred to the Residential Physician (RP) at the National Institute of Mental Health, Dhaka Medical College and Hospital, and Z.H. Sikder Women's Medical College and Hospital. Enrolled children with neuro-developmental disorders who met the inclusion and exclusion criteria, parents with children were then adviced to the Department of Psychiatry. In Bangladesh, every government and non-government medical college and hospital have psychiatry departments, where patients from different districts come for treatment. The study's specifics were disclosed to the parents were informed that all information gathered would be kept private and that they could leave the study whenever they wanted to. Informed consent and socio-demographic data were

obtained from parents, the consent form was used for the children, and each patient was individually assessed. The diagnosis of neurodevelopmental disorders was done by a psychiatrist using DSM-5 criteria and a pre-designed structured questionnaire used for the diagnosis of language disorders. Detailed socio-demographic information, history, and neurolinguistic aspects of the language development of children with neurodevelopmental disorders were recorded in the questionnaire by the ethical standards of its responsible committee on human experimentation.

The diagnosis was done by the Psychiatrist of the respective institute following DSM-5 criteria and diagnosed cases of NDD from the respective institute were selected as samples. A total of 468 children underwent this study, but only 292 of them met the selection criteria. The data studied included cranial brain MRI report, in the case of cerebral palsy children a positive MRI finding of a hyperintense/hypointense area in the frontal lobe (Broca's area or area 44,45) was found, which is related to expressive language disorders, as it is an area responsible for the expression of language. In the temporal lobe, Wernicke's area is accountable for the perception, interpretation, and understanding of visual and auditory linguistic information. Diagnosis of brain MRI pathology: multi planner and multi sequences without contrast which included sagittal T1, axial FLAIR, axial diffusion and ADC, GRE and axial T2, coronal. T2 sequences had abnormalities, T1 had hypo-intensities, and T2FLAIR hyper-intensities in the frontal lobe or temporal lobe or both in the frontal and temporal lobe with anatomical location made by a radiology and imaging specialist.

All neurodevelopmental disorder diagnosis of cranial pathology was made by a radiology and imaging specialist; in the case of cerebral palsy, also a document of the history of delivery, diagnosis of perinatal asphyxia and neonatal hypoxic-ischemic encephalopathy

(HIE) was recorded, which was done by the pediatrician during delivery and hospitalization. Details of the mother's medical history, prenatal illnesses, type of delivery, duration of labor, and medications administered were obtained, along with information about the children's history of delayed language development.

4.14 Flow chart (Describe the sequence of research stages within a time frame)

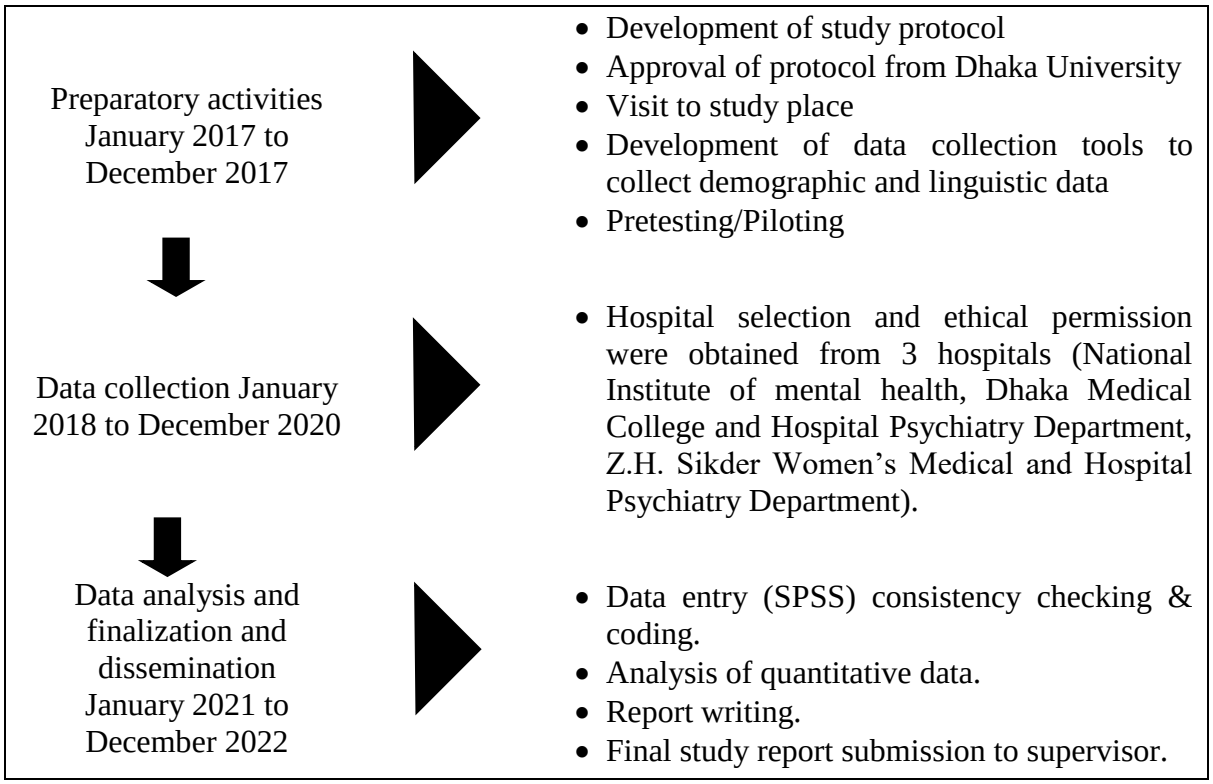

Figure 23 The sequence of research stages

4.15 Variables

Independent variables: Age, education, socio-economic status

Exposure variables: Spastic (hemiplegic, diplegic, or quadriplegia), dyskinesia, ataxic or non-classifiable cerebral palsy.

Outcome variables: Expressive language: Children were categorized as verbal or nonverbal communicators based on their expressive language functioning, which was assessed by speech and language pathologists (SLPS) or speech-language professionals throughout the

course of the research. These professionals are experts in the diagnosis and treatment of functional and organic speech defects and disorders.

4.16 Limitation of the study

Some study limitations were noted, such as the cases in which the patient, and caregivers (mainly the mother), were undergoing treatment far from the city of Dhaka, having faced many challenges in a pandemic situation. Another difficulty was the low education level of the caregiver, which limits the data collection procedure. The lack of financial resources also adds to the limitations, as many caregivers had to travel to Dhaka city and the monitoring, which should be daily, was hampered by the lack of funding for their trips.

4.17 Data processing and data analysis:

The Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) was used to conduct statistical analyses. The frequency and percentage of the qualitative observations were displayed. The categorical variables were examined using the Fisher's exact test and the Chi-Square test. Standard t-test was used, and numerical data were presented as mean with standard deviation. Statistical significance was defined as $P < 0.05$. (Bryman, 2001).

4.17 Analytical framework according to methodology (descriptive, observational, quantitative research) (Mozammel, 2021; Kumar, 2018)

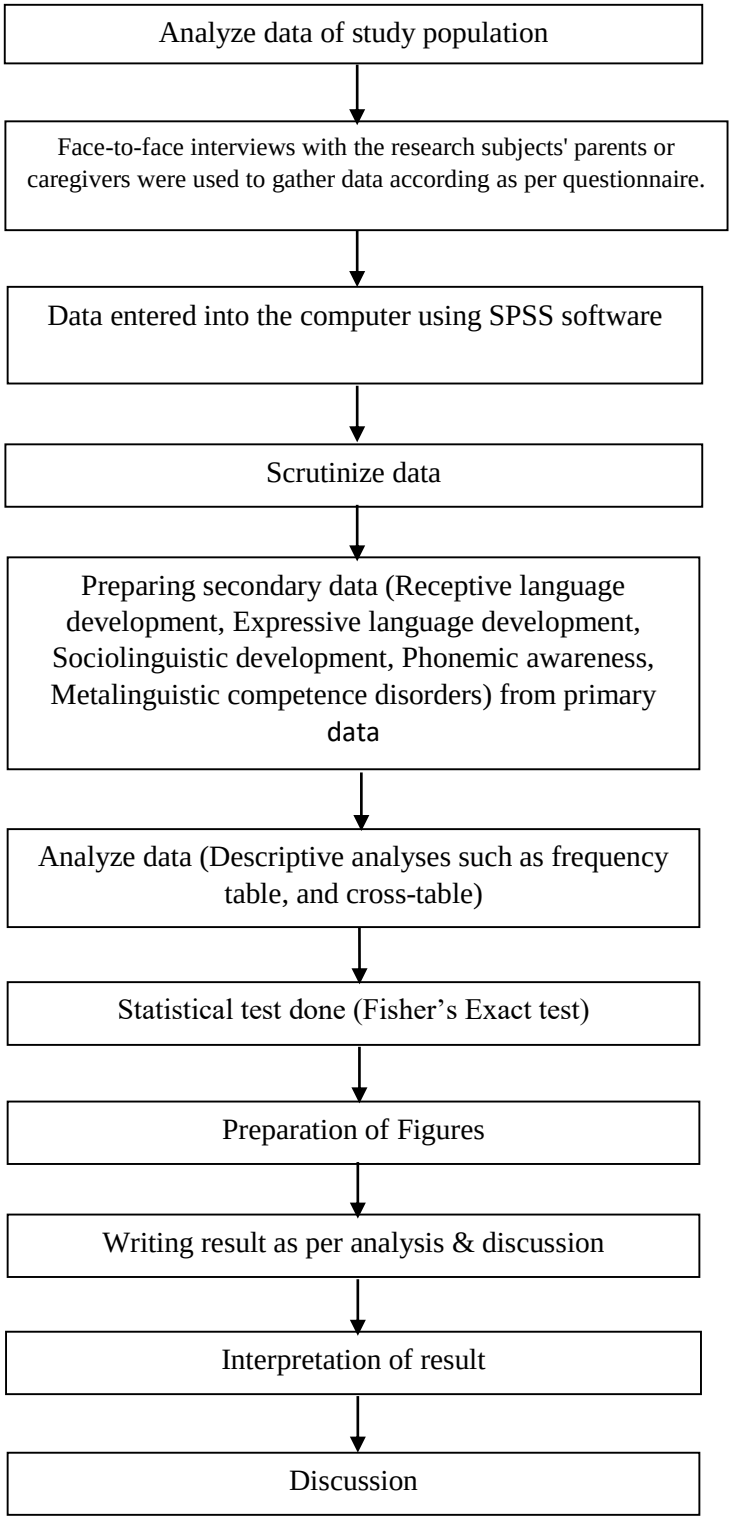

Figure 24 Analytical framework according to methodology

4.18 Operational definition:

- Expressive domain: This domain includes the encoding or construction of a text or utterance, as well as the expressing of ideas into verbal words. This portion of the frontal lobe (Broca's area or area 44,45) is responsible for language expression.
- Receptive domain: Perception of other verbal words, sentences, and nonverbal information fall under this domain. Wernicke's area of the temporal lobe is responsible for perceiving, interpreting, and comprehending visual and auditory linguistic information.
- Socialization/pragmatic domain: Using verbal and nonverbal skills according to social purposes.
- Phonemic awareness: It is the capacity to recognize and correlate specific sounds/phonemes in voiced words.
- Metalinguistic competencies: Ability to recognize, analyze, comprehend, and manipulate language in its most basic form.

CHAPTER 5

RESULTS

Neurolinguistic is the scientific methods and mechanisms of the human brain that represent how language is processed, integrated, and coordinated the linguistic information within the brain. Our research result evaluated scientifically the linguistic output of the neurodevelopmental disorders children.

5.1 Autism spectrum disorder (ASD)

Table 8 Demographic profile of the children with autism spectrum disorder (N=75)

	Frequency (f)	Percentage (%)
Age		
• 3 – 5	63	84.0
• 6 – 10	10	13.3
• >10	2	2.7
Mean ± SD	3.90 ± 2.17	3.83 – 13
Gender		
• Male	64	85.3
• Female	11	14.7
Parents educational status	Frequency (f)	Percentage (%)
Father		
• Illiterate	1	1.3
• Below SSC	5	6.7
• SSC	12	16.0
• HSC	9	12.0
• Graduate	15	20.0
• Postgraduate	33	44.0
Mother		
• Below SSC	8	10.7
• SSC	10	13.3
• HSC	11	14.7
• Graduate	17	22.4
• Postgraduate	29	38.7
Parents occupational status	Frequency (f)	Percentage (%)
Father		
• Day laborer	2	2.7
• Service	41	54.7
• Business	15	20.0
• Abroad	11	14.7
• Garments worker	1	1.3

• Unemployed	1	1.3
• Doctor	4	5.3
Mother		
• Housewife	61	81.3
• Service	7	9.3
• Doctor	3	4.0
• Teacher	4	5.3
Parents' monthly income (Taka)	Frequency (f)	Percentage (%)
• 10,000 - 20,000	25	33.3
• 21,000 - 50,000	31	41.3
• >50,000	19	25.3

Children with autism spectrum disorder (ASD) made up 84.0% of the population between the ages of 3 and 5, 13.3% between the ages of 6 and 10, and 2.7% older than 10 years. The average age of the ASD children was 3.90 ± 2.17 years ranging from 3.83 – 13 years. The majority of the children were boys (85.3 %). The boy-to-girl ratio was 6:1. Majority of the parents completed secondary school, and graduated or above. Among fathers of the children, the maximum was service holders, 41(54.7%) followed by businessmen, 15(20.0%), and working abroad, 11(14.7%). Among mothers of the children, most of them were housewives,61 (81.3%). Monthly family income ranged from 10,000 Tk. to 20,000 Tk. in 33.3% of cases, 21,000 Tk. to 50,000 Tk. in 41.3% of the cases, and >50,000 Tk. in 25.3% of cases.

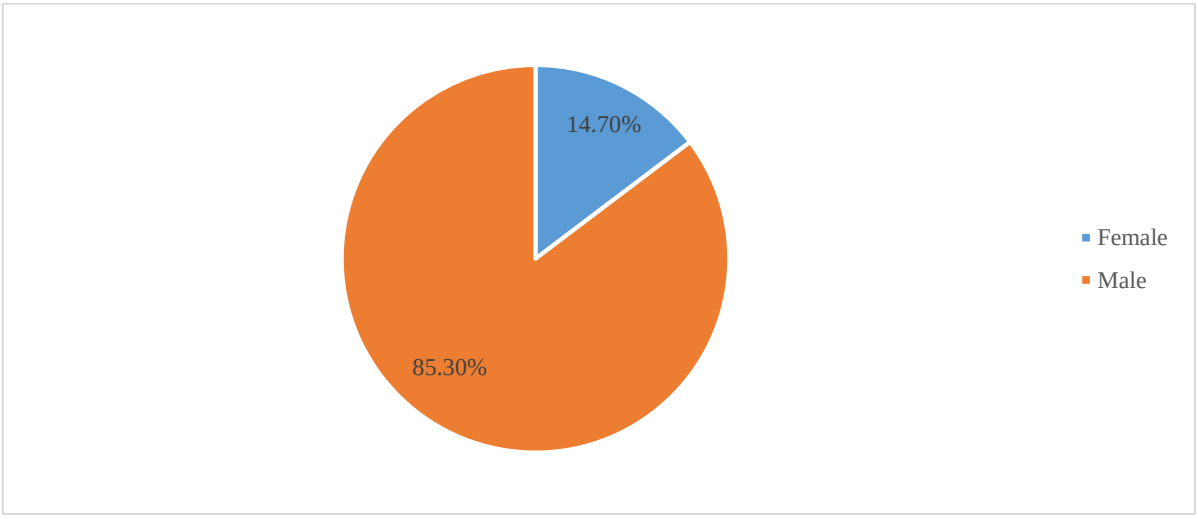

Figure 25 Pie chart showing the gender distribution of the study subjects

Table 9 Birth-related information of the children with autism spectrum disorder (N=75)

	Frequency (f)	Percentage (%)
Place of birth		
• Home by the untrained birth attendant	3	4.0
• Hospital/Clinic	72	96.0
Mode of delivery		
• Per vaginal	11	14.7
• Caesarian section	64	85.3
The child did not cry immediately after birth	09	12.0
Traumatic symptoms in the head after birth	03	4.0
Pathological findings in MRI of the brain (Hyper or Hypo intense area) (Absent)	75	100.0

Most autistic children with autism spectrum disorders were born in a hospital or clinic 72(96.0 %) and the majority of the births took place via caesarian section 64 (85.3 %). Nine (12.0%) children did not cry after birth and traumatic symptoms in the head were observed among 4.0% of children. Pathologically, no abnormalities were detected in the cranial MRI of the brain.

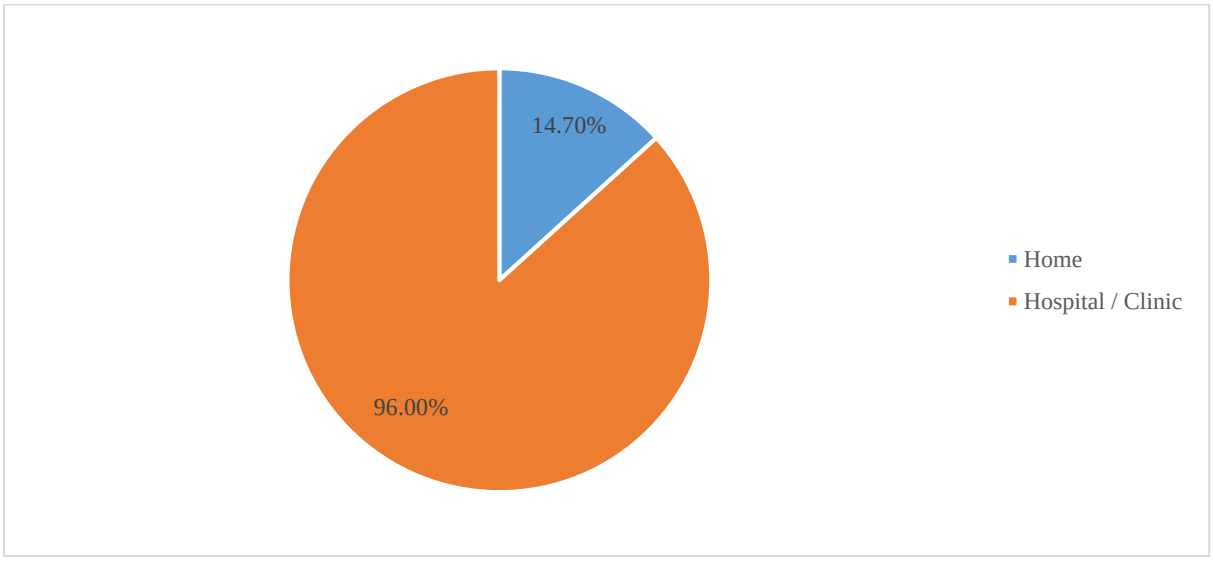

Figure 26 Pie chart showing place of birth distribution of the study subjects

Table 10 Domains of language disorder among the children with autism spectrum disorder (N = 75)

	Frequency (f)	Percentage (%)
Receptive/perceptive language development disorder		
• Present	38	50.7
• Absent	37	49.3
Expressive language development disorder		
• Present	48	64.0
• Absent	27	36.0
Socialization development disorder		
• Present	66	88.0
• Absent	9	12.0
Behavioral disorder		
• Present	60	80.0
• Absent	15	20.0
Phonemic awareness disorder		
• Present	75	100.0
• Absent	0	0.0
Metalinguistic competence disorder		
• Present	75	100.0
• Absent	0	0.0

All children were clinically diagnosed with ASD with language disorders. Among them, receptive/perceptive language development disorder was found in 38 children (50.7%), expressive language development disorder in 48 children (64.0%), socialization/sociolinguistic development disorder in 66 children (88.0%), the behavioral disorder in 60 children (80.0%), and phonemic awareness disorder and metalinguistic competence disorder in all children.

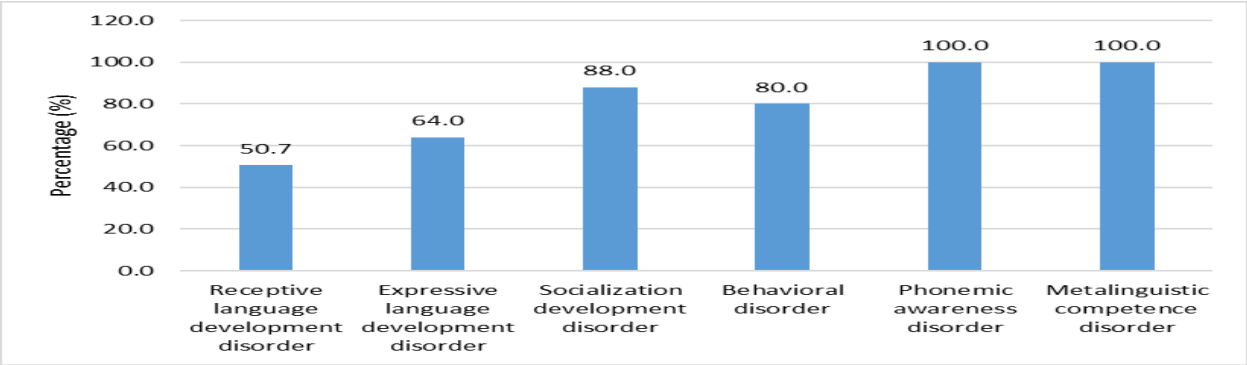

Figure 27 Bar diagram of domains of language disorder among ASD children

Table 11 Association of receptive/perceptive language disorder with expressive language disorder

Expressive language disorder	Receptive/perceptive language disorder		p-value
	Present (n=38)	Absent (n=37)	
Present(25+23) =48(64%)	25(65.8%) Receptive language disorder = Present Expressive language disorder = Present	23(62.2%) Receptive language disorder = Absent Expressive language disorder = Present	0.744
Absent (13+14) =27(36%)	(38-25) =13 (34.2%) Receptive language disorder = Present Expressive language disorder = Absent	(37-23) =14 (37.8%) Receptive language disorder = Absent Expressive language disorder = Absent	
Total = 75 (100,0%)	Total = 38	Total =37	

The Chi-square test is done. Among 38 receptive language disorder children, 25 children (65.8%) had receptive and expressive language disorders and among 37 children without receptive language disorder, 23 children (62.2%) had expressive language disorders. Receptive language development disorder and expressive language development disorder did not significantly correlate (p>0.05).

Table 12 Association of receptive/perceptive language disorder with a sociolinguistic developmental disorder

Socialization/ sociolinguistic development disorder	Receptive/perceptive language disorder		p-value
	Present (n=38)	Absent (n=37)	
Present (33+33)=66	33(86.8%) Receptive language disorder = Present Sociolinguistic disorder = Present	33(89.2%) Receptive language disorder = Absent Sociolinguistic disorder = Present	1.000
Absent (5+4)=9	(38-33) =05 (13.2%) Receptive language disorder = Present Sociolinguistic disorder = Absent	(37-33) =4 (10.8%) Receptive language disorder = Absent Sociolinguistic disorder = Absent	
Total = 75	Total =38	Total =37	

The Fisher's Exact test was done. Among 38 receptive language disorder children, 33 children (86.8%) had receptive and sociolinguistic disorders and among 37 children without

receptive language disorder, 33 children (89.2%) had sociolinguistic development disorder. Receptive language development disorder and sociolinguistic development disorder did not significantly correlate (p>0.05).

Table 13 Association between expressive language disorder and receptive language disorder

Receptive language disorder	Expressive language development disorder		p-value
	Present (n=48)	Absent (n=27)	
Present (25+13)=38	25(52.1%) Expressive language disorder = Present Receptive language disorder = Present	13(48.1%) Expressive language disorder = Absent Receptive language disorder = Present	0.744
Absent (23+14)=37	(48-25) =23 (47.9%) Expressive language disorder = Present Receptive language disorder = Absent	(27-13) =14 (51.9%) Receptive language disorder = Absent Expressive language disorder = Absent	
Total = 75	Total = 48	Total = 27	

The Chi-square test was done. Among 48 expressive language development disorder children, 25 children (52.1%) had receptive and expressive language development disorder and among 27 children without expressive language development disorder, 13 children (48.1%) had receptive language disorder. Receptive language development disorder and expressive language development did not significantly correlate (p>0.05).

Table 14 Association between expressive language disorder and sociolinguistic development disorder

Socialization/ sociolinguistic development disorder	Expressive language development disorder		p-value
	Present (n=48)	Absent (n=27)	
Present (43+23)=66	43(89.6%) Expressive language disorder = Present Sociolinguistic development disorder = Present	23(85.2%) Expressive language disorder = Absent Sociolinguistic disorder = Present	0.714
Absent (5+4)=9	(48-43) =5 (10.4%) Expressive language disorder = Present Sociolinguistic disorder = Absent	(27-23) =4 (14.8%) Expressive language disorder = Absent Sociolinguistic disorder = Absent	
Total = 75	Total =48	Total =27	

The Fisher's Exact test was done. Among 48 expressive language development disorder children, 43 children (89.6%) had expressive and sociolinguistic development disorders and among 27 children without expressive language development disorders, 23 children (85.2%) had sociolinguistic development disorders. Expressive language development disorder and socio-linguistic development disorder did not significantly correlate ($p>0.05$).

Table 15 Comparison among different disorders in ASD and IDD (N=150)

	ASD n (%)	IDD n (%)	p-value
Receptive/perceptive language development disorder	38 (50.7)	49 (65.3)	0.069
Expressive language development disorder	48 (64.0)	61 (81.3)	0.017
Sociolinguistic disorder	66 (88.0)	67 (89.3)	0.797

The Chi-Square test was done.

Expressive language development disorder was found significantly higher in IDD children than ASD children. But receptive language development disorder and sociolinguistic development disorder were found similar in both ASD and IDD children.

Table 16 Comparison among different disorders in ASD and CP (N=150)

	ASD n (%)	CP n (%)	p-value
Receptive /perceptive language development disorder	38 (50.7)	63 (84.0)	<0.001
Expressive language development disorder	48 (64.0)	74 (98.7)	<0.001
Sociolinguistic disorder	66 (88.0)	59 (78.7)	0.125

The Chi-Square test was done. Receptive language development disorder and expressive language development disorder were found significantly higher in CP children than in ASD children. But sociolinguistic development disorder was found similar in both CP and ASD children.

Table 17 Comparison among different disorders in ASD and ADHD (N=142)

	ASD n (%)	ADHD n (%)	p-value
Receptive /perceptive language development disorder	38 (50.7)	65 (97.0)	<0.001
Expressive language development disorder	48 (64.0)	66 (98.5)	<0.001
Sociolinguistic disorder	66 (88.0)	67 (100.0)	0.003

The Chi-Square test was done. Receptive language development disorder, expressive language development disorder, and sociolinguistic development disorder were found significantly higher in ADHD children than in ASD children.

5.2 Intellectual Developmental Disorder (IDD)

Table 18 Demographic profile of the children with Intellectual Developmental Disorder (N=75)

	Frequency (f)	Percentage (%)
Age		
• 4– 5	51	68.0
• 6 - 10	24	32.0
Mean ± SD	5.55 ± 3.43	
Gender		
• Male	46	61.3
• Female	29	38.7
Parents educational status	Frequency (f)	Percentage (%)
Father		
• Illiterate	5	6.7
• Below SSC	28	37.3
• SSC	13	17.3
• HSC	18	24.0
• Graduate	3	4.0
• Postgraduate	8	10.7
Mother		
• Below SSC	36	48.0
• SSC	16	21.3
• HSC	12	16.0
• Graduate	4	5.3
• Postgraduate	7	9.3
Parents occupation	Frequency (f)	Percentage (%)
Father		
• Day labor	6	8.0
• Service(Shopkeeper, Office peon)	37	49.3
• Business	15	20.0
• Driver	3	4.0
• Abroad	6	8.0
• Farmer	3	4.0
• Garments worker	2	2.7
• Unemployed	2	2.7
• Expired	1	1.3
Mother		
• Housewife	67	89.3
• Service	7	9.3
• Garments worker	1	1.3
Parents monthly income	Frequency (f)	Percentage (%)
<10,000	31	41.3
10,000 - 20,000	24	32.0
>20,000	20	26.7

The average age of children with intellectual development disorder(IDD) was 4.70 years, ranging from 4 to 9 years. Among 75 children, the maximum (68.0%) was 4 to 5 years old. 61.3% were male and 38.7% were female. Most of the parents were literate. Most of the mothers (89.3%) were housewives and most of the fathers were service holders (49.3%) followed by business (20.0%). The monthly family income of thirty-one (41.3%) of the children was≤10,000.

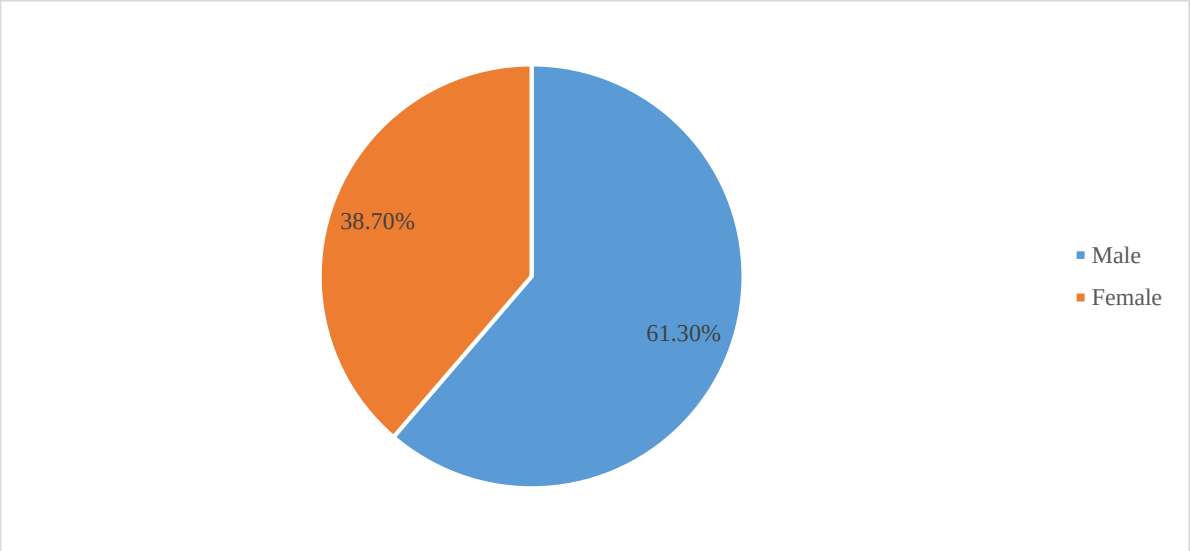

Figure 28 Pie diagram showing the gender distribution of the study subjects

Table 19 Birth-related information of the children with Intellectual Developmental Disorder(N=75)

	Frequency (f)	Percentage (%)
Place of birth		
• Home by the untrained birth attendant	46	61.3
• Hospital/Clinic	29	38.7
Mode of delivery		
• Per vaginal	43	57.3
• Caesarian section	32	42.7
• The child did not cry immediately after birth	27	36.0
• Symptoms of head trauma after birth	11	14.7
Pathological findings in MRI of the brain (Hyper or Hypo intense area)	Absent	Present
	75(100.0)	00

Regarding the place of delivery among intellectual development disorders, children were 61.3% at home by an untrained birth attendant and 38.7% at a hospital. Vaginal delivery was 57.3% and the cesarean section was 42.7%, the children did not cry after birth (36.0%) and head trauma symptoms were observed among 14.7% of children. There were no pathological abnormalities detected in cranial MRI of the brain in intellectual development disorder children.

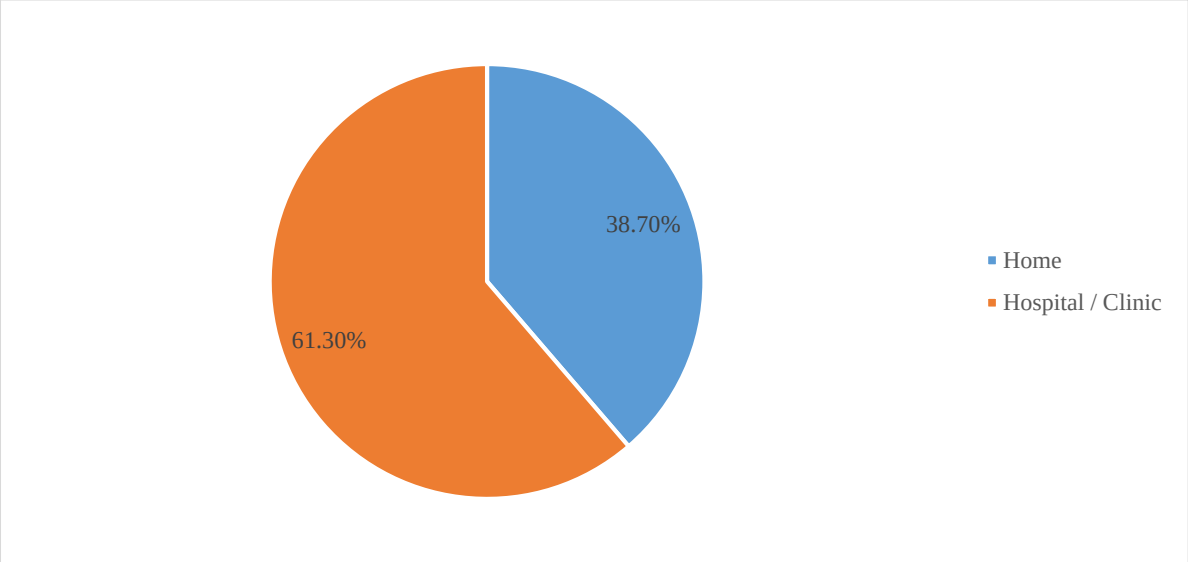

Figure 29 Pie diagram showing the place of birth distribution of the study subjects

Table 20 Domains of language disorder among children with Intellectual Developmental Disorder (N=75)

	Frequency (f)	Percentage (%)
Receptive/perceptive language development disorder		
• Present	49	65.3
• Absent	26	34.7
Expressive language development disorder		
• Present	61	81.3
• Absent	14	18.7
Sociolinguistic development disorder		
• Present	67	89.3
• Absent	8	10.7
Behavioral disorder		
• Present	48	64.0
• Absent	27	36.0

Phonemic awareness disorder		
• Present	58	77.3
• Absent	17	22.7
Metalinguistic competence disorder		
• Present	75	100.0
• Absent	0	0.0

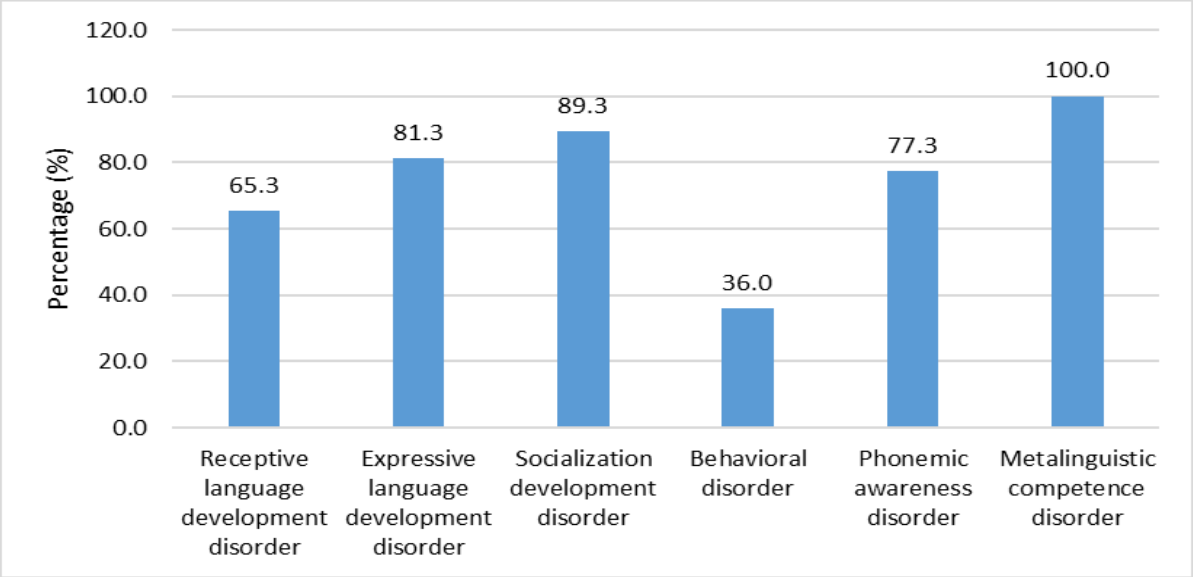

Figure 30 Bar diagram of domains of language disorder among children with Intellectual Developmental Disorder

All children were clinically diagnosed with intellectual development disorder with a language disorder. Among them, receptive language development disorder was found in 49 children (65.3%), expressive language development disorder in 61 children (81.3%), socialization development disorder in 67 children (89.3%), behavioral disorder in 48(64.0%) children, phonemic awareness disorder in 58 children (77.3%), and metalinguistic competence disorder in all children.

Table 21 Association of receptive language disorder with an expressive language development disorder

Expressive language development disorder	Receptive/perceptive language development disorder		p-value
	Present (n=49)	Absent (n=26)	
Present (38+23)=61	38 (77.6%) Receptive language disorder = Present Expressive language disorder = Present	23 (88.5%) Receptive language disorder = Absent Expressive language disorder = Present	0.248
Absent (11+3)=14	(49-38) =11(22.4%) Receptive language disorder = Present Expressive language disorder = Absent	(26-23) =3 (11.5%) Receptive language disorder = Absent Expressive language disorder = Absent	
Total = 75	Total = 49	Total =26	

The Fisher's Exact test was done. Among 49 children with receptive language disorder, receptive and expressive language disorders were present in 38 children (77.6%), and among 26 IDD children without receptive language disorder, expressive language disorder was present in 23 children (88.5%). There was no significant association between receptive language disorder with expressive language development disorder ($p > 0.05$).

Table 22 Association of receptive/perceptive language development disorder with a sociolinguistic development disorder

Sociolinguistic development disorder	Receptive/perceptive language development disorder		p-value
	Present (n=49)	Absent (n=26)	
Present (44+20) =64	44 (89.8%) Receptive language disorder = Present Sociolinguistic development disorder = Present	20 (76.9%) Receptive language disorder = Absent Sociolinguistic development disorder = Present	0.133
Absent (6 +5)= 11	(49- 44) =05 (10.2%) Receptive language disorder = Present Sociolinguistic development disorder = Absent	(26-20) =6 (23.1%) Receptive language disorder = Absent Sociolinguistic development disorder = Absent	
Total = 75 Children	Total = 49	Total = 26	

The Fisher's Exact test was done. Among 49 receptive language disorder children, both receptive and sociolinguistic development disorders were present among 44 children, receptive language disorder was present but expressive language disorder was absent in 05 children. Although receptive language disorder was absent but sociolinguistic development disorder was present in 20 children. Receptive language development disorder and sociolinguistic development disorder did not significantly correlate ($p>0.05$).

Table 23 Association of expressive language development disorder with receptive/perceptive language development disorder

Receptive/perceptive language development disorder	Expressive language development disorder		p-value
	Present (n=61)	Absent (n=14)	
Present (38+11)=49	38 (62.3%) Expressive language disorder = Present Receptive language disorder = Present	11 (78.6%) Expressive language disorder = Absent Receptive language disorder = Present	0.355
Absent (23+3)=26	(61-38) =23 (37.7%) Expressive language disorder = present Receptive language disorder =Absent	(14-11) = 3 (21.4%) Expressive language disorder = Absent Receptive language disorder = Absent	
Total = 75 Children	Total =61	Total = 14	

Fisher's Exact test was done. Among 61 IDD children with expressive language development disorder children, 38 children (62.3%) had receptive language development disorder and among 14 children without expressive language development disorder, 11 children (78.6%) had receptive language development disorder. Expressive language development disorder and Receptive language development disorder did not significantly correlate ($p>0.05$).

Table 24 Association of expressive language development disorder with a sociolinguistic development disorder

Sociolinguistic development Disorder	Expressive language development disorder		p-value
	Present (n=61)	Absent (n=14)	
Present (57+10) =64	54 (88.5%) Expressive language disorder = Present Sociolinguistic disorder = Present	10 (71.4%) Expressive language disorder = Absent Sociolinguistic disorder = Present	0.103
Absent (4+4)=11	(61-54) = 07 (11.5%) Expressive language disorder = Present Sociolinguistic disorder = Absent	(14-10) =4 (28.6%) Expressive language disorder = Absent Sociolinguistic disorder = Absent	
Total = 75 Children	Total =61	Total = 14	

The Fisher's Exact test was done. Among 61 IDD children with expressive language disorder, 54 children (88.5%) had sociolinguistic development disorder and among 14 children without expressive language development disorder, 11 children (71.4%) had sociolinguistic development disorder. Expressive language development disorder and Sociolinguistic development disorder did not significantly correlate (p>0.05)

Table 25 Comparison among different disorders in IDD and ASD (N=150)

	IDD n (%)	ASD n (%)	p-value
Receptive/perceptive language development disorder	49 (65.3)	38 (50.7)	0.069
Expressive language development disorder	61 (81.3)	48 (64.0)	0.017
Sociolinguistic disorder	67 (89.3)	66 (88.0)	0.797

The Chi-Square test was done. Expressive language development disorder was found significantly higher in IDD children than in ASD children. Even though receptive language development disorder was higher in IDD than in ASD, the variance was not statistically substantial. Sociolinguistic development disorder was almost identical both in ASD and IDD children.

Table 26 Comparison among different disorders in IDD and CP (N=150)

	IDD n (%)	CP n (%)	p-value
Receptive /perceptive language development disorder	49 (65.3)	63(84.0)	0.009
Expressive language development disorder	61 (81.3)	74(98.7)	0.001
Sociolinguistic disorder	67 (89.3)	59 (78.7)	0.075

The Chi-Square test was done. Receptive language development disorder and expressive language development disorders were found significantly higher in CP children than in IDD children. Even sociolinguistic development disorder was higher in IDD than in CP, but no statistically significant difference existed.

Table 27 Comparison among different disorders in IDD and ADHD (N=142)

	IDD n (%)	ADHD n (%)	p-value
Receptive /perceptive language development disorder	49 (65.3)	65 (97.0)	<0.001
Expressive language development disorder	61 (81.3)	66 (98.5)	0.001
Sociolinguistic disorder	67 (89.3)	67 (100.0)	0.007

The Chi-Square test was done. Receptive/perceptive language development disorder, expressive language development disorder, and sociolinguistic development disorders were found significantly higher in ADHD children than in IDD children.

5.3 Cerebral palsy (CP)

Table 28 Demographic profile of the children with cerebral palsy(N=75)

		Frequency (f)	Percentage (%)
Age	3 – 5	65	86.7
	6 – 9	10	13.3
	Mean ± SD	4.77±0.85 (4-9)	
Gender	Male	47	62.7
	Female	28	37.3
Fathers' education	Illiterate	8	10.7
	Class V	22	29.3
	Class VIII	21	28.0
	SSC	12	16.0
	HSC	4	5.3
	Graduate/above	8	10.7
Mothers' education	Illiterate	2	2.7
	Class V	20	26.7
	Class VIII	21	28.0
	SSC	17	22.7
	HSC	9	12.0
	Graduate/above	6	8.0
Fathers' occupation	Day-by-day labor	9	12.0
	Office Assistant	20	26.7
	Shopkeeper	17	22.7
	Driver	4	5.3
	Abroad	9	12.0
	Farmer	11	14.7
	Tailor	3	4.0
	Rickshaw puller	2	2.7
Mothers' occupation	Housewife	74	98.7
	Service	1	1.3
Monthly family income (Tk.)	≤10,000	37	49.3
	10,000 - 20,000	26	34.7
	>20,000	12	16.0

The average age of children with cerebral palsy was 4.77 years, ranging from 4 to 9 years. Among 75 children, the majority (86.7%) were 4 to 5 years old.62.7% were male and 37.3% were female. Most mothers (57.4%) did not complete SSC and (98.7%) were

housewives. Most fathers were office assistants (26.7%) followed by shopkeepers (22.7%) and farmers (14.7%). The majority (49.3%) of the parent's monthly income was ≤10,000.

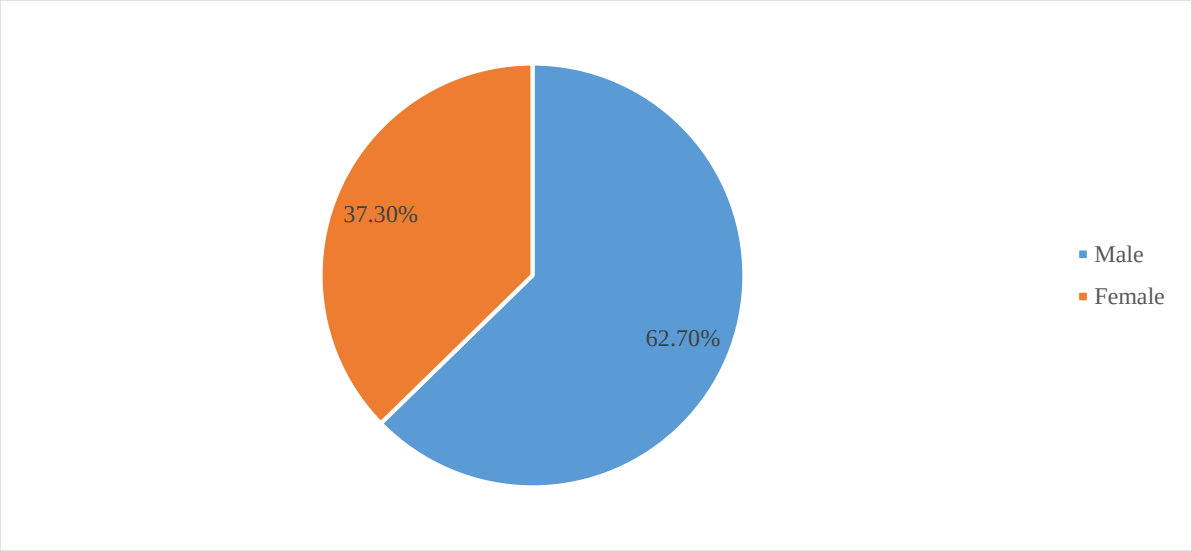

Figure 31 Pie chart showing the gender distribution of the study subjects

Table 29 Birth-related information of the children with cerebral palsy (N=75)

		Frequency (f)	Percentage (%)
Place of birth	Hospital/Clinic	32	42.7
	Home by untrained birth attended.	43	57.3
Mode of delivery	Per vaginal	55	73.3
	Caesarian section	20	26.7
The child didn't cry immediately after birth		59	78.7
Traumatic symptoms in the head after birth		26	34.7

Regarding the place of delivery of the cerebral palsy children, 57.3% were at home by an untrained birth attendant and 42.7% at a hospital. The mode of delivery was vaginal in 73.3% and cesarean section in 26.7% of cases. The majority (78.7%) of the children did not cry after birth due to perinatal asphyxia and traumatic symptoms in the head were observed among 34.7% of children.

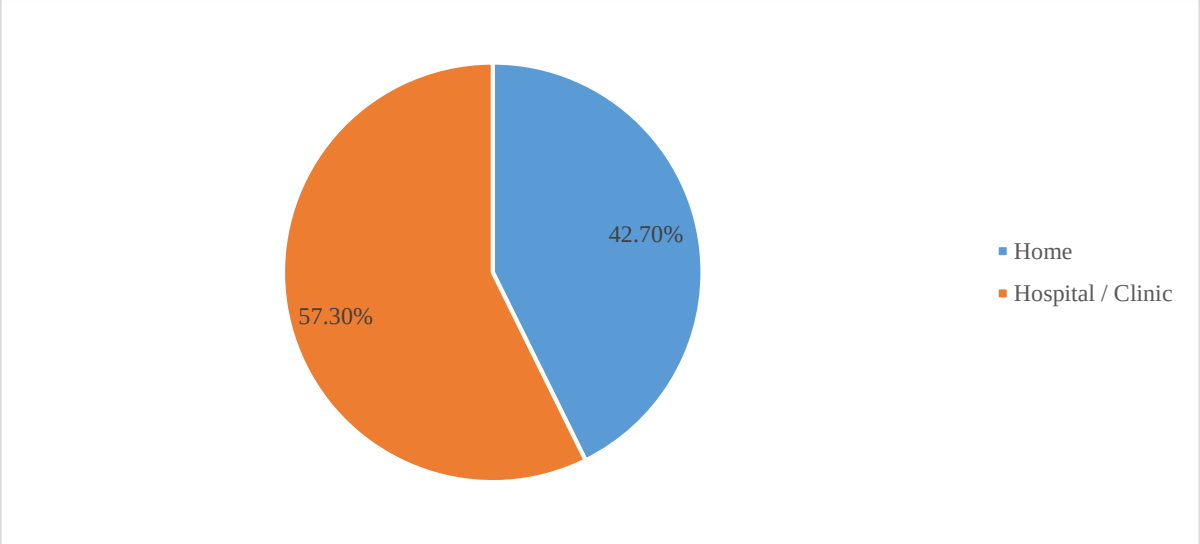

Figure 32 Pie chart showing the distribution of place of birth of the study subjects

Table 30 Brain area pathology found in MRI of children with cerebral palsy(CP), N=75

Hyperintense & Hypo intense areas present in MRI of the Brain	Frequency (f)	Percentage (%)
Frontal lobe & basal ganglia	42	56.0
Basal ganglia & temporal lobe	15	20.0
Frontal lobe, temporal lobe, basal ganglia	12	16.0
No abnormal findings present	6	8.0

All children have a clinical diagnosis of cerebral palsy with a language disorder. The radiological finding of the anatomical location of hyper intense or hypo intense area found in the frontal lobe (Broca's area) and basal ganglia (56%), in the temporal lobe (Wernicke's area) and basal ganglia (20%) and the frontal, temporal lobes & basal ganglia (16%) and no abnormality was observed in 8.0% cases.

Table 31 (A) Association between pathological findings in brain MRI and domain of language disorder

Receptive/perceptive language development disorder	MRI of Brain		p-value
	Pathological finding Present (n=69)	Pathological finding Absent (n=06)	
Present (57+2)=59	57 (82.6) Receptive language disorder = Present Pathological finding in MRI = Present	2 (33.3) Receptive language disorder = Present Pathological finding in MRI = Absent	0.015
Absent (12+4)=16	(69-57) =12 Receptive language disorder = Absent Pathological finding in MRI =Present	(06-02) =04 Receptive language disorder = Absent Pathological finding in MRI = Absent	
Total Children =75	Total Children =69	Total Children =06	

The Fisher's Exact test was done. All children were clinically diagnosed with CP. Among 69 children with pathological findings present in MRI, 57 (82.6%) children had receptive language developmental disorder. Receptive language development disorder was found significantly higher among CP children with positive pathological findings ($p<0.05$).

Table 32 (B) Association between pathological findings in brain MRI and domain of language disorder

Expressive language development disorder	MRI of Brain		p-value
	Pathological finding Present (n=69)	Pathological finding Absent (n=06)	
Present (68+4)= 72	68 (98.6) Expressive language disorder = Present Pathological finding in MRI = Present	4 (66.7) Expressive language disorder = Present Pathological finding in MRI = Absent	0.0001
Absent (02+01)= 03	(69 – 68) = 01 Expressive language disorder = Absent Pathological finding in MRI = Present	(06 – 04) =02 Expressive language disorder = Absent Pathological finding in MRI = Absent	
Total Children =75	Total Children =69	Total Children =06	

The Fisher's Exact test was done. All the children were clinically diagnosed with CP. Among 69 children with pathological findings present in MRI, 68 (98.6%) children had expressive language developmental disorder. Expressive language development disorder was found significantly higher among the CP children with positive pathological findings ($p<0.05$).

Table 33 (C) Association between pathological findings in brain MRI and domain of language disorder

Sociolinguistic development disorder	MRI of Brain		p-value
	Pathological finding Present (n=69)	Pathological finding Absent (n=06)	
Present (54+02)= 56	54 (78.3) Sociolinguistic development disorder = Present Pathological finding in MRI = Present	2 (33.3) Sociolinguistic development disorder = Present Pathological finding in MRI = Absent	0.015
Absent (15+04)= 19	(69 – 54) = 15 Sociolinguistic development disorder = Absent Pathological finding in MRI = Present	(06 - 02) = 04 Sociolinguistic development disorder = Absent Pathological finding in MRI = Absent	
Total Children =75	Total Children =69	Total Children =06	

The Fisher's Exact test was done. All children were clinically diagnosed with CP. Among 69 children with pathological findings present in MRI, 54 (78.3%) children had sociolinguistic development disorder. Sociolinguistic development disorder was found significantly higher among the CP children with positive pathological findings ($p<0.05$).

Table 34 Domains of language disorders among the children with cerebral palsy (N=75)

	Frequency (f)	Percentage (%)
Receptive/perceptive language development disorder		
• Present	63	84.0
• Absent	12	16.0
Expressive language development disorder		
• Present	74	98.7
• Absent	1	1.3
Sociolinguistic development disorder		
• Present	59	78.7
• Absent	16	21.3
Behavioral disorder		
• Present	47	62.7
• Absent	28	37.3
Phonemic awareness disorder		
• Present	75	100.0
• Absent	0	0.0
Metalinguistic competence disorder		
• Present	75	100.0
• Absent	0	0.0

All children were clinically diagnosed with cerebral palsy. Among 75 cerebral palsy children, receptive/perceptive language development disorder was observed in 63 children (84.0%), expressive language development disorder in 74 children (98.7%), sociolinguistic development disorder in 59 children (78.7%), the behavioral disorder in 47 children (62.7%), and phonemic awareness disorder & metalinguistic competence disorder in all children.

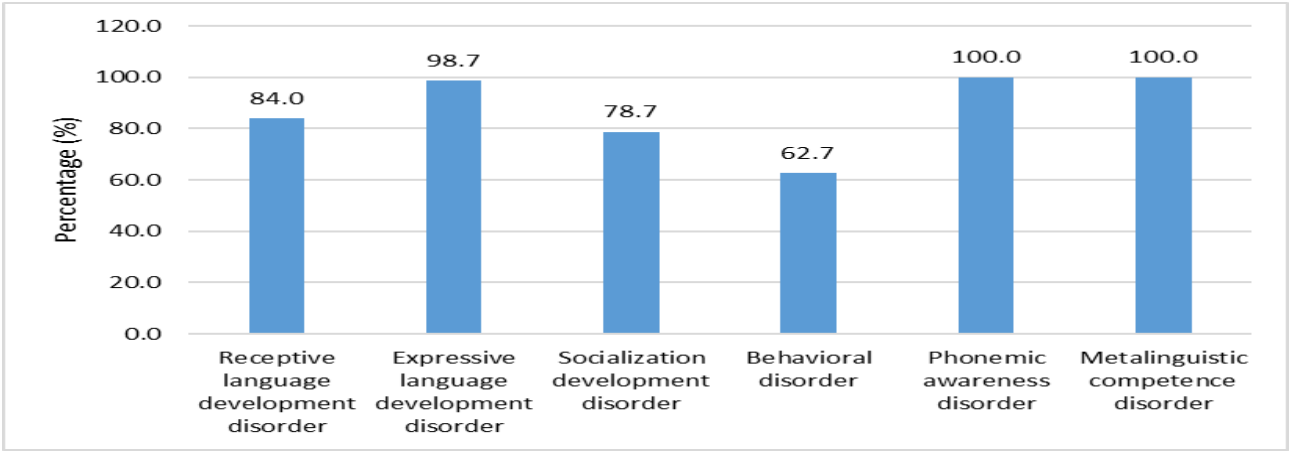

Figure 33 Bar diagram showing domains of language disorder among the children with cerebral palsy

Table 35 Association of receptive language disorder with other linguistic disorders

Expressive language disorder	Receptive/perceptive language disorder		p-value
	Present (n=63)	Absent (n=12)	
Present (62+12)=74	62(98.4%) Receptive language disorder = Present Expressive language disorder = Present	12(100.0%) Receptive language disorder = Absent Expressive language disorder = Present	0.744
Absent (1+0)=01	(63-62) =1 (1.6%) Receptive language disorder = Present Expressive language disorder = Absent	(12-12) =0 Receptive language disorder = Absent Expressive language disorder = Absent	
Total= 75	Total = 63	Total = 12	

The Fisher's Exact test was done. Among 75 cerebral palsy children, receptive language development disorder was present in 63 children. Among 63 receptive language development disorder children, 62 (98.4%) children had receptive and expressive language disorders, 12 children without receptive language disorder had expressive language development disorder**.** Receptive language disorder and Expressive language development disorder did not significantly correlate ($p > 0.05$).

Table 36 Association of receptive language disorder with a sociolinguistic developmental disorder

Sociolinguistic development disorder	Receptive/perceptive language disorder		p-value
	Present (n=63)	Absent (n=12)	
Present (48+11) =59	48 (76.2%) Receptive language disorder = Present Sociolinguistic disorder = Present	11 (91.7%) Receptive language disorder = Absent Sociolinguistic disorder = Present	0.442
Absent (15+1)=16	(63-48) =15 (23.8%) Receptive language disorder = Present Sociolinguistic disorder = Absent	(12-11) =1 (8.3%) Receptive language disorder = Absent Sociolinguistic disorder = Absent	
Total = 75	Total = 63	Total = 12	

The Fisher's Exact test was done. Among 63 receptive language development disorder children,48 (76.2%) children had a sociolinguistic developmental disorder and among 12 children without receptive language disorder, 11 (91.7%) had sociolinguistic developmental disorder**.** Receptive language disorder and expressive language development disorder did not significantly correlate ($p > 0.05$).

Table 37 Association of expressive language disorder with other linguistic disorders

Receptive/perceptive language disorder	Expressive language development disorder		p-value
	Present (n=74)	Absent (n=1)	
Present (62+1) =63	62 (83.8%) Expressive language disorder = Present Receptive language disorder = Present	1 (100.0%) Expressive language disorder = Present Receptive language disorder = Absent	1.000
Absent (1+11)=12	(74-62) =12(16.2%) Expressive language disorder = Absent Receptive language disorder = Present	(1-1) =0 (0.0%) Expressive language disorder = Absent Receptive language disorder = Absent	
Total =75	Total =63	Total =12	

The Fisher's Exact test was done. Among 74 expressive language development disorder children, 62 (83.8%) children had receptive language development disorder and all children without expressive language disorder had receptive language development disorder**.** Receptive language disorder and expressive language development disorder did not significantly correlate. (p> 0.05).

Table 38 Association of receptive language disorder with a sociolinguistic developmental disorder.

Sociolinguistic development disorder	Expressive language development disorder		p-value
	Present (n=74)	Absent (n=12)	
Present (58+1) =59	58 (78.4%) Expressive language disorder = Present Receptive language disorder = Present	1 (100.0%) Expressive language disorder = Absent Receptive language disorder = Present	1.000
Absent (16+0)=16	(74-58) =16 (21.6%) Expressive language disorder = Present Sociolinguistic disorder = Absent	(1-1) = 0 (0.0%) Expressive language disorder = Absent Sociolinguistic disorder = Absent	
Total = 75	Total = 63	Total =12	

The Fisher's Exact test was done. Among 74 expressive language development disorder children,58 (78.4%) children had sociolinguistic development disorder and all children without expressive language disorder had sociolinguistic development disorder**.** There was no significant association between receptive language disorder and expressive language development disorder. (p> 0.05).

Table 39 Comparison among different disorders in CP and ADHD (N=142)

	CP n (%)	ADHD n (%)	p-value
Receptive/perceptive language development disorder	63 (84.0)	65 (97.0)	0.011
Expressive language development disorder	74 (98.7)	66 (98.5)	1.000
Sociolinguistic disorder	59 (78.7)	67 (100.0)	<0.001

The Chi-Square test was done. Receptive language development disorder and sociolinguistic development disorder were found significantly higher in ADHD children than in CP children. But expressive language development disorder was found similar in both CP and ADHD children.

Table 40 Comparison among different disorders in CP and ASD (N=150)

	CP n (%)	ASD n (%)	p-value
Receptive/perceptive language development disorder	63 (84.0)	38 (50.7)	<0.001
Expressive language development disorder	74 (98.7)	48 (64.0)	<0.001
Sociolinguistic disorder	59 (78.7)	66 (88.0)	0.125

The Chi-Square test was done. Receptive language development disorder and expressive language development disorders were found significantly higher in CP children than in ASD children. But sociolinguistic development disorder was found similar in both CP and ASD children.

Table 41 Comparison among different disorders in CP and IDD (N=150)

	CP n (%)	IDD n (%)	p-value
Receptive /perceptive language development disorder	63 (84.0)	49 (65.3)	0.009
Expressive language development disorder	74 (98.7)	61 (81.3)	0.001
Sociolinguistic disorder	59 (78.7)	67 (89.3)	0.075

The Chi-Square test was done. Receptive language development disorder and expressive language development disorders were found significantly higher in CP children than in IDD children. But sociolinguistic development disorder was found higher in IDD children than in CP children, but the difference was not statistically significant.

5.4 Attention deficit hyperactivity disorder (ADHD)

Table 42 Demographic profile of the children with attention deficit hyperactivity disorder (ADHD), N=67

	Frequency (f)	Percentage (%)
Age		
• 3 – 5	38	56.7
• 6 - 10	29	43.3
Mean ±SD	5.81 ± 2.91	(3.83 - 10)
Gender		
• Male	57	85.1
• Female	10	14.9
Parents educational status		
Father		
• Illiterate	13	19.4
• Below SSC	25	37.3
• SSC	10	14.9
• HSC	11	16.4
• Graduate	08	11.9
Mother		
• Below SSC	12	17.9
• SSC	25	37.3
• HSC	11	16.4
• Graduate	8	11.9
• Illiterate	11	16.4
Parents occupational status		
Father		
• Day labor	1	1.5
• Service(peon in office)	36	53.7
• Shopkeeper	23	34.6
• Teacher	2	3.0
• Driver	2	3.0
• Abroad	3	4.5
Mother		
• Housewife	65	97.0
• Teacher	2	3.0
Parent’s monthly income (Taka)		
• 10,000	12	17.9
• 20,000 - 30,000	41	61.2
• >30,000	14	20.9

The average age of ADHD children was 5.81 years, ranging from (3.83 to 10) years. Among 67 children, a maximum (56.7%) were 3 to 5 years old. Males were predominant 85.1% and 14.9% were female. Most of the parent’s education level was below SSC (37.3%).

Most of the mothers (97.0%) were housewives and most of the fathers were service holders (53.7%) followed by shopkeepers (34.6%). More than half (61.2%) of the children's monthly family income was (20,000 - 30,000) Tk.

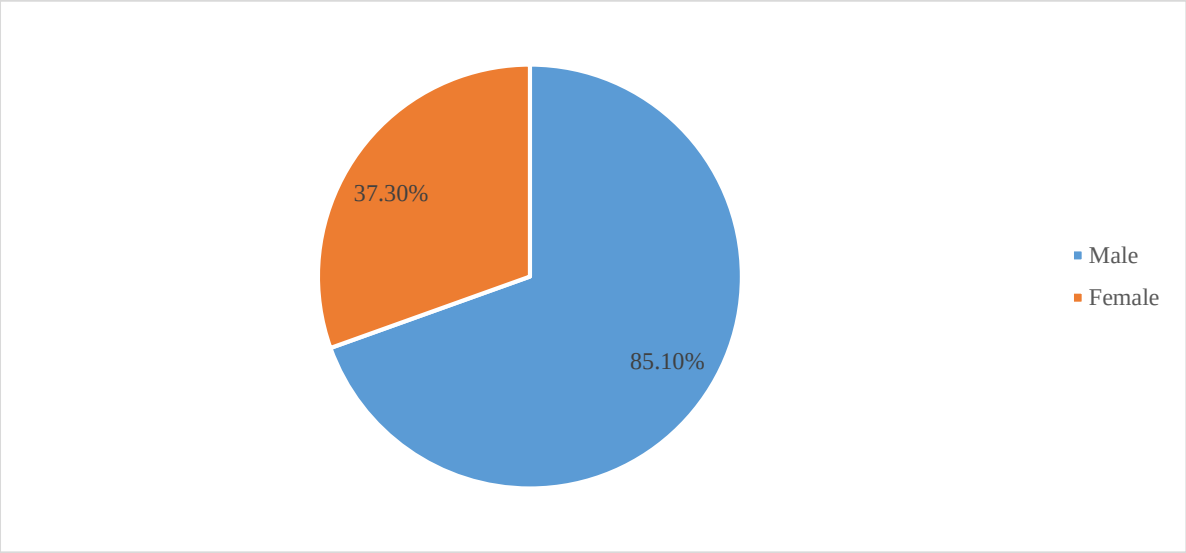

Figure 34 Pie chart showing the gender distribution of the study subjects

Table 43 Birth-related information of the attention deficit hyperactivity disorder children (ADHD), N=67

	Frequency (f)	Percentage (%)
Place of birth		
• Home by the untrained birth attendant	52	77.6
• Hospital/Clinic	15	22.4
Mode of delivery		
• Per vaginal	38	56.7
• Caesarian section	29	43.3
The child did not cry immediately after birth	11	16.4
Traumatic symptoms in the head after birth	02	3.0
Pathological findings in MRI of the brain (Hyper or Hypo intense area) Absent	67	100.0

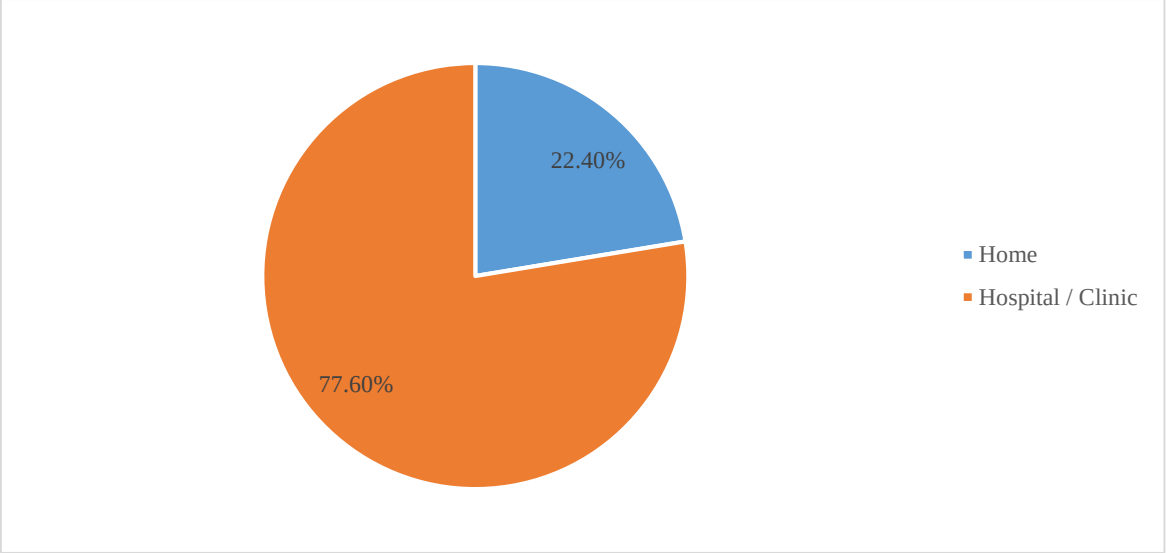

Figure 35 Pie chart showing the place of birth distribution of the study subjects

Regarding the place of delivery of the ADHD children, 22.4% were delivered in a hospital and 77.6% by an untrained birth attendant at home. Vaginal delivery was 56.7% and cesarean section was 43.3%. 11(16.4%) of the children did not cry after birth and traumatic symptoms in the head were observed among 3.0% of children but no abnormality was detected pathologically in an MRI of the brain.

Table 44 Domains of language disorder among the children with attention deficit hyperactivity disorder(ADHD), N=67

	Frequency (f)	Percentage (%)
Receptive/perceptive language development disorder		
• Present	65	97.0
• Absent	2	3.0
Expressive language development disorder		
• Present	66	98.7
• Absent	1	1.5
Socialization development disorder		
• Present	67	100.0
• Absent	0	0.0
Behavioral disorder		
• Present	65	97.0
• Absent	2	3.0

Phonemic awareness disorder		
• Present	57	85.1
• Absent	10	22.3
Metalinguistic competence disorder		
• Present	67	100.0
• Absent	0	0.0

Among the 67 ADHD children, receptive/perceptive language development disorder was found in 65 children (97.0%), expressive language development disorder in 66 children (98.7%), sociolinguistic development disorder in 67 children (100.0%), a behavioral disorder in 65 children (97.0%), phonemic awareness disorder in 57 children (85.1%), and metalinguistic competence disorder in all children.

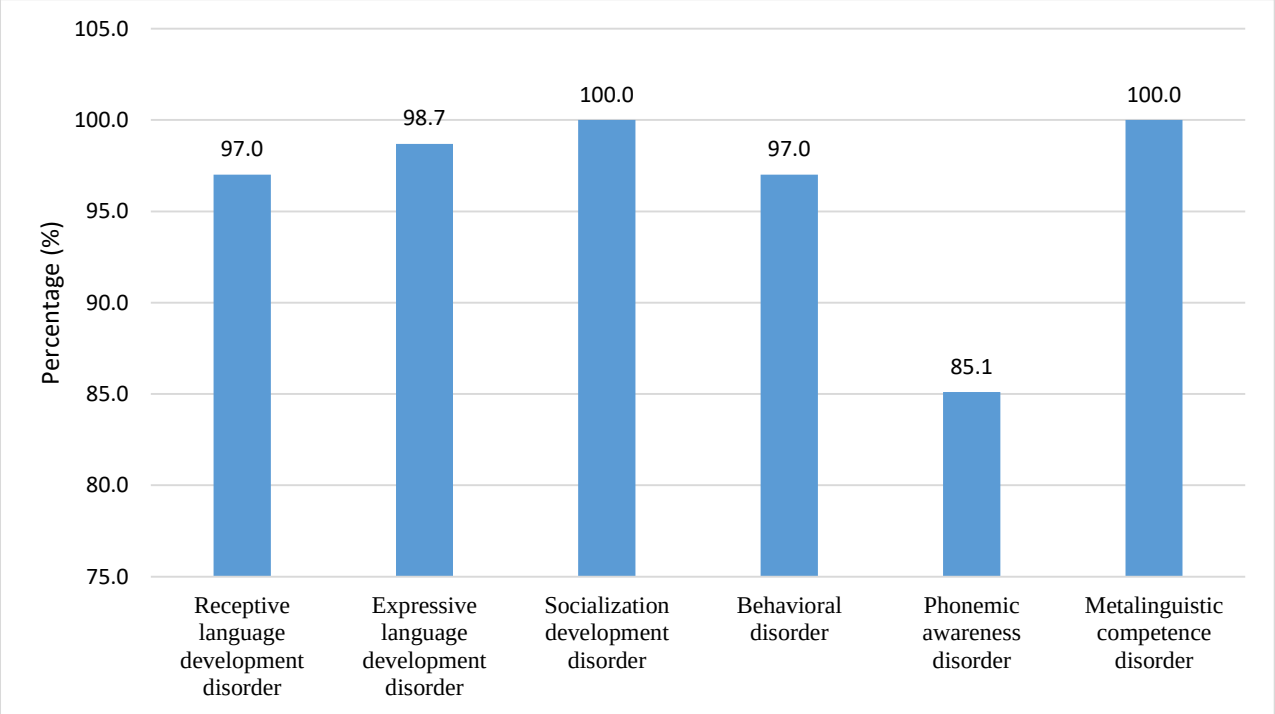

Figure 36 Bar diagram of domains of language disorder among children with attention deficit hyperactivity disorder

Table 45 Association of receptive/perceptive language disorder with expressive language disorder

Expressive language development disorder	Receptive/perceptive language development disorder		p-value
	Present (n=65)	Absent (n=02)	
Present (64+2)=66	64 (98.5) Receptive language disorder = Present Expressive language disorder = Present	2(100.0) Receptive language disorder = Absent Expressive language disorder = Present	1.000
Absent (1+0)=1	(65-64)=1 (1.5) Receptive language disorder = Present Expressive language disorder = Absent	(2-2)=0 (0.0) Receptive language disorder = Absent Expressive language disorder = Absent	
Total = 67 Children	Total=65 Children	Total= 02 Children	

The Fisher's Exact test was done. Among 65 receptive language disorder children, receptive and expressive language disorder 64 (98.5%) and 2 children without receptive language disorder also had expressive language disorder. Receptive language disorder and expressive language disorder did not significantly correlate ($p > 0.05$).

Table 46 Association of receptive/perceptive language disorder with Sociolinguistic developmental disorder

Sociolinguistic development Disorder	Receptive/perceptive language development disorder		p-value
	Present (n=65)	Absent (n=02)	
Present (65+2)=67	65 (100.0) Receptive language disorder = Present Sociolinguistic disorder = Present	2(100.0) Receptive language disorder = Absent Sociolinguistic disorder = Present	1.000
Absent 0	(65-65) =0 Receptive language disorder = Present Sociolinguistic disorder = Absent	(2-2) =0 Receptive language disorder = Absent Sociolinguistic disorder = Absent	
Total=67 Children	Total=65 Children	Total=02 Children	

The Fisher's Exact test was done. 65 children had receptive/perceptive language disorder and sociolinguistic development disorder and 2 children without receptive language disorder also had sociolinguistic development disorder. There was no significant relationship between receptive language disorder with expressive language disorder ($p > 0.05$).

Table 47 Association of expressive language development disorder with a receptive language development disorder

Receptive/perceptive language development disorder	Expressive language development disorder		p-value
	Present (n=66)	Absent (n=01)	
Present (64+1)=65	64 (97.0) Receptive language disorder = Present Expressive language disorder = Present	1(100.0) Receptive language disorder = Present Expressive language disorder = Absent	1.000
Absent(2+0) =2	(66-64) = 2 Receptive language disorder = Present Expressive language disorder = Absent	(1-1) = 0 Receptive language disorder = Absent Expressive language disorder = Absent	
Total=67 Children	Total=66 Children	Total=01 Children	

The Fisher's Exact test was done. Among 66 expressive language disorder children, with receptive and expressive language disorder was 64 (97.0%) and 01 children without expressive language disorder had receptive language disorder. Expressive language disorder and receptive language disorder did not significantly correlate ($p > 0.05$).

Table 48 Association of expressive language development disorder with a sociolinguistic development disorder

Sociolinguistic development disorder	Expressive language development disorder		p-value
	Present (n=66)	Absent (n=01)	
Present (66+1) =67	66 (100.0) Expressive language disorder = Present Sociolinguistic disorder = Present	1(100.0) Expressive language disorder = Absent Sociolinguistic disorder =Present	1.000
Absent 0	(66-66) =0 Expressive language disorder = Present Sociolinguistic disorder = Absent	(1-1) =0 Expressive language disorder = Absent Sociolinguistic disorder = Absent	
Total=67 Children	Total=66 Children	Total=01 Children	

The Fisher's Exact test was done. All 66 children had expressive and sociolinguistic development disorders, and among them, only one (1) child without expressive language disorder had also a sociolinguistic development disorder. There was no significant relationship between receptive language disorder with expressive language disorder ($p > 0.05$).

Table 49 Comparison between different disorders in ADHD and ASD (N=142)

	ADHD n (%)	ASD n (%)	p-value
Receptive /perceptive language development disorder	65 (97.0)	38 (50.7)	<0.001
Expressive language development disorder	66 (98.5)	48 (64.0)	<0.001
Sociolinguistic disorder	67 (100.0)	66 (88.0)	0.003

The Chi-Square test was done. Receptive language development disorder, expressive language development disorder, and sociolinguistic development disorder were found significantly higher in ADHD children than in ASD children.

Table 50 Comparison of different disorders between ADHD and IDD (N=142)

	ADHD n (%)	IDD n (%)	p-value
Receptive/perceptive language development disorder	65 (97.0)	49 (65.3)	<0.001
Expressive language development disorder	66 (98.5)	61 (81.3)	0.001
Sociolinguistic disorder	67 (100.0)	67 (89.3)	0.007

The Chi-Square test was done. Receptive language development disorder, expressive language development disorder, and sociolinguistic development disorder were found significantly higher in ADHD children than in IDD children.

Table 51 Comparison of different disorders in CP and ADHD (N=142)

	CP n (%)	ADHD n (%)	p-value
Receptive /perceptive language development disorder	63 (84.0)	65 (97.0)	0.011
Expressive language development disorder	74 (98.7)	66 (98.5)	1.000
Sociolinguistic disorder	59 (78.7)	67 (100.0)	<0.001

The Chi-Square test was done. Receptive language development disorder and sociolinguistic disorder were found significantly higher in ADHD children than in CP children. But expressive language development disorder was found almost similar in both CP and ADHD children.

CHAPTER 6
DISCUSSION

6.1 Discussion on autism spectrum disorder (ASD)

167 million populations lived in the developing country of Bangladesh (Bangladesh Population, 2022). As stated by the world health organization contributed survey conducted in March 2022, the prevalence of children with autism spectrum disorder (ASD) is estimated to be around one in 100 (World Health Organization, 2022). Language is a vital part of emotional reciprocity. Developmental language disorder is the most predominant disorder in children with autism spectrum disorder, but their language problems are still under-attended in Bangladesh. As a result, in our Ph.D. research findings, we provide insightful techniques to improve their well-being by diagnosing linguistic morbidity using a neurolinguistics approach paired with linguistic interventions/speech-language therapy. This can help children develop their language skills while also putting less pressure on the family and the government. According to the research information, this is the first clinical neurolinguistics investigation in Bangladesh.

According to the inclusion criteria, 75 children with ASD (as defined by the DSM-5) were considered for this research. Lord et al. (2018) used DSM-5 to diagnose ASD in their study. They also stated in their study that except for the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, based entirely on behavior, there are no valid indicators for the diagnosis of ASD.

In this research, most (84.0%) of the children with autism spectrum disorder (ASD) were aged between three and five years. Fountain et al. (2012) and Woynaroski et al. (2016)

described in their research that 87% of 3-year-old children are thought to have language delays. In this study, males were predominant (85.3 %), and the male and female ratio was 6:1 which was resembling the research of Bertrand et al. (2001). In their research, male to female ratio was 2.2. According to a study by Lai et al. (2015), the male-to-female ratio for ASD was 4.5:1 universally. Majority of the parents were graduates or above, and the maximum number of fathers of the children were service holders (54.7%), followed by businesspersons (20.0%) and most mothers of the children were housewives (81.3%). The majority of the children's family income ranged from 21,000Tk. to 50,000Tk. (41.3%). The majority of the children were born in a hospital or clinic 72 (96.0 %) and maximum birth took place by caesarian section (85.3 %). (Table: 8, 9)

Receptive/perceptive language development disorder was found in 38 children (50.7%), expressive language development disorder in 48 children (64.0%), socialization/sociolinguistic development disorder in 66 children (88.0%), a behavioral disorder in 60 children (80.0%), and phonemic awareness disorder and metalinguistic competence disorder in all children. (Table: 10) Arif et al. (2015) described that dissimilarity between linguistic age and chronological age exhibit red flag signs of language development, such for example; according to chronological age naming response is present within 6- 8 month of age but most of the children are unable to respond to their name. Hakim & Nasrin (2013) mentioned that ASD children could not use (I, He/She, you) according to situation and context.

Receptive language development disorder and expressive language development disorder did not significantly correlate ($p>0.05$) (Table: 11) among 38 receptive language disorder children, 25 children (65.8%) had expressive language disorder and among

37children without receptive language disorder, 23 children (62.2%) had an expressive language disorder

Among 38 receptive language disorder children, 33 children (86.8%) had a sociolinguistic disorder and among 37 children without receptive language disorder, 33 children (89.2%) had a sociolinguistic development disorder. Receptive language development disorder and sociolinguistic development disorder did not significantly correlate ($p>0.05$). (Table: 12)

(Table: 13) represented that Receptive language development disorder and expressive language development disorder did not significantly correlate ($p>0.05$). Among 48 expressive language development disorder children, 25 children (52.1%) had receptive language development disorder and among 27 children without expressive language development disorder, 13 children (48.1%) had expressive language disorder.

The association between expressive language development disorder and sociolinguist development disorder did not identify in (Table: 14) p-value found (>0.05). Our finding was comparable with Authors Mulé et al. (2022) researching there who found that children had two kinds of language disorders: receptive and expressive and both at the same time. Severity is based on language (communication) involvement (American Psychiatric Association, 2013**).**

Expressive language development disorder was found significantly higher in IDD children than in ASD children, due to limitations to express meaningful speech to others (example: *Tumar bondu koyzon* (How many friends do you have?) The child answered:

Bondu (Friend)…….*mona ni* (Can't remember) But receptive language development disorder and sociolinguistic development disorder were found similar in both ASD and IDD children. (Table: 15)

Receptive language development disorder and expressive language development disorder were found significantly higher in CP than in ASD children, due to language perception and speech production area injury (organic injury) during delivery. Speech production organs need coordination for the articulation of the phonemes. But sociolinguistic development disorder was found similar in both CP and ASD children. (Table: 16) Receptive language development disorder, expressive language development disorder, and sociolinguistic development disorder were found significantly higher in ADHD children than in ASD children. (Table: 17)

6.2 Discussion on the intellectual developmental disorder (IDD)

Intellectual developmental disorder, also identified as intellectual disability, is a neurodevelopmental disorder that manifests as intellectual and self adaptively deficiency in the (theoretical) receptive/perceptive domain, (pragmatic) expressive domain, and (social) sociolinguistic domain during the stages of the developmental period (American Psychiatric Association 2013). According to WHO, the frequency of IDD worldwide is 1 in every 8 people (WHO, 2022), and language disorders are a very significant co-morbidity among children with IDD. Although this condition goes unnoticed most of the time in Bangladesh, our research findings provide insightful techniques for recognizing linguistic morbidity through a neurolinguistics approach paired with linguistic interventions/speech-language therapy to improve their well-being. This can lessen the harmful influence on children's language development while also reducing the burden of responsibility faced by the family and the state. As far as we know, this is the first clinical neurolinguistics doctorate research in Bangladesh.

In our research (Table: 18) the average age of children with an intellectual developmental disorder(IDD) was 4.70 years, maximum (68.0%) was 4 to 5 years old. Males were more predominant (61.3%) than females (38.7%). Most of the parents were below SSC [according to the Bangladesh education system]. Most of the mothers (89.3%) were housewives and most of the fathers were service holders (office peon), (49.3%) followed by business(shopkeeper) (20.0%), and most (41.3%) of the children had monthly family income of≤10,000. Our research finding was similar to Hinde et al. (2022) research. They discovered that intellectual disability was a serious health issue that was more expensive for low- and middle-income families to deal with. The World Bank also calculated that 85% of the world's population with intellectual developmental disorder lived in low- and middle-income

countries. Due to low socio-economic status, (Table: 19) 61.3% of IDD children were born at home and 38.7% at a hospital. Vaginal delivery was 57.3% and cesarean section was 42.7%. 36.0% of children did not cry after birth and traumatic symptom in the head was observed among 14.7% of children. No pathological abnormality was detected in the cranial MRI of the brain. Nemerimana et al. (2018) observed in their research children were 5.6 (3.6) years old on average, with a predominance of males (62%). Risk factors associated with non-genetic intellectual disability were antenatal, intrapartum complications as well as postnatal care. Deficits in intellectual functioning and language(communication) disorder must be confirmed by clinical assessment (American Psychiatric Association, 2013). Among the IDD children, receptive language development disorder was found in 49(65.3%) children, expressive language development disorder in 61(81.3%) children, sociolinguistic development disorder in 67 (89.3%) children, behavioral disorder in 48 (64.0%) children, phonemic awareness disorder in 58 children (77.3%), and metalinguistic competence disorder in all children (Table 20). Authors Marrus and Hall (2017) observed that 40% to 75% of children had language disorders among the children with IDD. The severity level of intellectual disability depends on (Theoretical) receptive domain, (pragmatic) expressive domain, and (social) sociolinguistic domain involvement (American Psychiatric Association, 2013). Among 49 children with perceptive language disorder, verbal language disorder was present in 38 children (77.6%) and among 26 IDD children without perceptive language disorder, verbal language disorder was present in 26 children (88.5%). Three (03) IDD children had neither receptive language development disorder nor expressive language development disorder. There was no significant association between receptive language disorder with expressive language development disorder ($p > 0.05$). (Table: 21)

There was no remarkable relationship between receptive language development disorder with sociolinguistic development disorder ($p > 0.05$). (Table: 22) because among (49) IDD children had receptive language development disorder but 44 children (89.8%) also had sociolinguistic development disorder. Among 26 children without receptive language development disorder,20 children (76.9%) had sociolinguistic development disorder. Six children had none of these two disorders.

There was no indeed connection between expressive language development disorder and perceptive language development disorder because (p-value>0.05). (Table: 23) had pointed out to us that among (61) IDD children with expressive language development disorder, 38 children (62.3%) had receptive language development disorder and among 14 children without expressive language development disorder,11 children (78.6%) had receptive language development disorder.

Among (61) IDD children with expressive language disorder, 54 children (88.5%) had sociolinguistic development disorder and among 14 children without expressive language development disorder, 11 children (71.4%) had sociolinguistic development disorder. Sociolinguistic development disorder and expressive language disorders did not significantly correlate (p-value > 0.05). (Table: 24)

Because of the normal physiology of phonetic impairment, verbal/expressive language development disorder was found to be significantly more common in IDD children than in children with ASD. Even though receptive language development disorder was higher IDD than ASD difference was not statistically significant. Sociolinguistic development disorder was found almost similar both in ASD and IDD children. (Table: 25)

Perceptive language development disorder and Verbal/expressive language development disorder were found significantly higher in CP children than in IDD children because morphosyntactic (Sultana et al., 2016) part of the language affected by organic brain injury of the children. Even though sociolinguistic development disorder was higher IDD than CP difference was not statistically significant. (Table: 26)

Perceptive language development disorder, expressive language development disorder, and sociolinguistic development disorder were found significantly higher in ADHD children than in IDD children. (Table: 27)

6.3 Discussion on Cerebral Palsy (CP)

Cerebral palsy children are significantly suffering from effective communication and correspondingly impaired language domains, which are the causes of speech and motor disorders or dysarthria (Straub & Obrzut, 2009). The physiology of Cerebral palsy is most likely multivariate. Respective research has demonstrated that verbal/expressive abilities and receptive/perceptive linguistic processing deficits in brain pathology may manifest sparing of linguistic domains (Raghavendra, 2007). The prevalence of CP is not about two point five (2.5) per one thousand (1000) live births. Universally, there n counted seventeen (17) million people habitant with cerebral palsy (World Health Organization, 2018). Any type of CP in children can cause language disorders, which can lead to social isolation and negatively impact nearly every area of development (Parkes, 2010). Thus, diagnosing and giving treatment to speech and language disorders as early as possible is very significant for preventing disability. But language disorders in children with CP are still undertreated in Bangladesh. Our research outcomes propose insightful strategies to identify linguistic morbidity based on a neurolinguistics approach combined with linguistic interventions / speech-language therapy to improve their well-being. That can reduce the negative impact on children's language development while also reducing the burden of responsibility carried by the family and the state. So far, to our knowledge, this is the first doctoral study in clinical neurolinguistics to be conducted in Bangladesh.

The average age of CP children found was 4.77 years, ranging from 4 – 9 years and a majority (86.7%) were 4 to 5 years. Other studies reported that the mean age of the Cerebral palsy children was 5.4 ± 0.5 years ranged 3 – 6.5 years. Males were predominant in our study. Sigurdardottir and Vik (2011) also reported that males (61.9%) were predominant. Most of the mothers were housewives, 74 (98.7%) and fathers were office assistants,

20(26.7%) followed by shopkeepers 17(22.7%) and farmers 11(14.7%). The majority 37(49.3%) of the parents' monthly income was <10,000 (Table 28). Maximum delivery was done at home (57.3%). Most of the delivery was vaginal (73.3%) and the caesarian section was 26.7%. The majority 59 (78.7%) of the children did not cry after birth and traumatic symptom in the head was observed in 26(34.7%) children. (Table: 29)

According to Forthun et al. (2018), the parent's socioeconomic status was a risk factor for the child's cerebral palsy. In our research, the children's receptive/perceptive language development was not co-related with their chronological age 63 (84.0%) and facial muscles were unable to articulate the phonemes, vowel words, semi-vowel words, consonant words, and complex sentences. For this reason, expressive language development disorder (dysarthria) was in 74 (98.7%) children, and were unable to create and maintain peer-relationship. Sociolinguistic development disorder in 59 (78.7%), a behavioral disorder in 47 (62.7%), and phonemic awareness disorder and metalinguistic competence disorder were found in all children.

In our research, the radiological findings of the anatomical architectural parts of the brain represented in MRI as hyperintense and hypointense areas found in the frontal lobe (Broca's area) were 56%, in the temporal lobe (Wernicke's area) was 20%, and in the frontal, temporal lobes and basal ganglia, 16%of the children. During the developmental period, this finding had a strong correlation with receptive and perceptive language development disorders in 63 (84.0%), expressive language (dysarthria) development disorders in 74 (98.7%), sociolinguistic development disorders in 59 (78.7%), a behavioral disorder in 47 (62.7%), and phonemic awareness disorder and metalinguistic competence disorder in all CP children (Table: 30, 31, 32, 33 & 34).

Bax et al. (2006) found in their research that the pathologic basis of cranial MRI had a strong correlation with clinical findings. In their research, they observed white matter damage (42.5%), damage of basal ganglia (12.8%), cortical and damage of sub-cortical area (9.4%), focal infraction in frontal and temporal lobes (7.4%), normal (11.7%), and communication (language) disorders were existing in 58% of the cerebral palsy children. Martinez et al. (2014), also observed a relationship between language difficulties (84.63%) and sociolinguistic disorder (86.50%), and another research, Geytenbeek (2015) observed that the fact of being prevalent that verbal and conversation(Communication) disorders in children with Cerebral palsy were 92.4%.

Among 75 cerebral palsy children, receptive language development disorders were present in 63 children. Among 63 receptive language development disorders children, 62 (98.4%) children had expressive language disorder and all of the children without perceptive/receptive linguistic disorder had expressive/Verbal language development disorder**.** There was no significant association between receptive/perceptive language disorder with expressive/verbal language development disorder ($p > 0.05$). (Table: 35) Among 63 receptive language development disorder children, 48 (76.2%) children had a sociolinguistic developmental disorder and among 12 children without receptive language disorder, 11 (91.7%) had a sociolinguistic developmental disorder**.** There was no notable interconnection between perceptive language disorder and sociolinguistic development disorder ($p > 0.05$). (Table: 36)

(Table: 37) described 62 (83.8%) children had perceptive language development disorder and all children without expressive language disorder had receptive language development disorder**.** Receptive/perceptual language disorders and verbal/expressive

language development disorders did not significantly correlate. ($p > 0.05$). Receptive language disorders and expressive language development disorders did not significantly correlate ($p > 0.05$) (Table: 38) because among 74 expressive language development disorder children, 58 (78.4%) children had sociolinguistic development disorder, and all children without expressive language disorder had sociolinguistic development disorder**.**

Receptive/Perceptive language development disorder and sociolinguistic development disorder were found significantly higher in ADHD children than in CP children due to inattention and hyperactivity, normal processing of speech Begum (2012-13) impaired among ADHD children such for example: *Ball nia aso* (Bring the ball). The child can't follow the instruction because due to inattention and hyperactivity, the speech sound not decoding in the brain. But expressive language development disorder was found similar in both CP and ADHD children. (Table: 39)

Receptive language development disorder and expressive language development disorder were found significantly higher in CP children than in ASD children. For example, Organic brain injury affects both the position and manner of articulation. But sociolinguistic development disorder was found similar in both CP and ASD children (Table: 40).

Receptive language development disorder and expressive language development disorder were found significantly higher in CP children than in IDD children. But sociolinguistic development disorder was found higher in IDD children than CP children, but the association was not statistically accountable. (Table: 41)

6.4 Discussion on Attention Deficit Hyperactivity Disorder (ADHD)

The language problem in ADHD expressed in the neurodevelopmental period at different intensities could have negative consequences on everyday activities and the learning process, which depend on language acquisition during the child's development period. Language disorder is the most typical comorbidity in ADHD. Language acquisition anomalies lead to more unsatisfactory evolution and numerous issues in the verbal/expressive, nonverbal/receptive/perceptive, and combined domains. The manifestation interferes with or brings down the status of the personal, educational, and sociolinguistic domains. As a result, the children are unable to maintain a meaningful life (Brites,2020). Worldwide, the prevalence of ADHD is 5 - 8% (WHO, 2019) and in Bangladesh, it is 5.29%(Islam et al 2022). The most prevalent disorder in children with ADHD is developmental language disorder, although this phenomenon goes unnoticed in Bangladesh most of the time. Our research findings propose insightful strategies aimed at reducing the deleterious effects of language disorders. We suggest early diagnosis and intervention with linguistic assessment and speech-language therapy. These measures reduce the deleterious effects on children with ADHD with language disorder on the brain by increasing the brain's ability to self-regenerate, ultimately bringing a better quality of life for these disorder children, after the groundwork of neurolinguistics point of view so far, our words of knowledge this is the first clinical doctoral research in this time of Bangladesh.

In our research, the average age of ADHD children was 5.81 years, ranging from (3.83 to 10) years. Among 67 children, a maximum (56.7%) were 3 to 5 years old. Males were more predominant (85.1%) than females (14.9%) (Table I). Male predominance was observed in the study of Perlovsky et al. (2007) and Nigget al. (2010). Most of the parent's education level was below SSC (37.3%) and most of the mothers (97.0%) were housewives

and most of the fathers were service holders (office peon) (53.7%) followed by shopkeepers (34.6%). More than half (61.2%) of the children's family monthly income was (20.000 - 30,000) Tk (Table 42). For most of the children, 44(65.6%) the birth took place at home with untrained birth attendants. Vaginal delivery was 40(59.7%) and cesarean section was 27(40.2%). 11 (16.4%) of the children did not cry after birth and traumatic symptom in the head was observed among 3.0% of children but there was no abnormal pathology detected (hyper or hypo intense area) in MRI of the brain (Table 43). Russell et al. (2015) observed that low socioeconomic status had an association with the risk of ADHD. In our research, receptive/perceptive language development disorder was found in 65 children (97.0%), expressive language development disorder in 66 children (98.7%), sociolinguistic development disorder in 67 children (100.0%), a behavioral disorder in 65 children (97.0%), phonemic awareness disorder in 57 children (85.1%), and metalinguistic competence disorder in all children (Table 44). Rohde et al. (2019) observed in their research that the symptoms of behavioral disorder among ADHD children were due to neurobiological conditions, abnormalities in several neural connections in both cortical and sub-cortical regions were affected. The anterior cingulated gyrus, pre-frontal cortex, amygdala, striatum, and ventral integumentary areas of the brain regulate the intensity of attention. These regions are interconnected with each other by the action of nor-adrenergic and dopaminergic neurotransmitters. Deficits of these neurotransmitters are also responsible for inattention. These neurobiological dysfunctions also affect the neural language development process responsible for the receptive/perceptive integration of visual and auditory linguistic information and also expressive language structure in different situations and contexts. In their research, they also found language disorders in 30 to 40% of children with ADHD. A remarkable relationship was not found between the domain of receptive/perceptive language disorder with verbal/expressive language disorder ($p > 0.05$) (Table 45) cause of among 65

receptive/ perceptive language disorder children, verbal /expressive language disorder was 64 (98.5%) and among 2 children without receptive language disorder, had expressive language disorder.

Among 65 receptive language disorder children, sociolinguistic development disorder was found in all cases and among 2 children without receptive language disorder, had sociolinguistic development disorder. There was no significant relationship between receptive language disorders with expressive language disorders ($p > 0.05$). (Table 46)

A relationship was not found between domains of perceptive/expressive and verbal/ expressive language disorder cause of p-value > 0.05 (Table 47) it was established that among 66 expressive language disorder children, receptive language disorder was 64 (97.0%) and 1 child without expressive language disorder had receptive language disorder.

A significant relationship was not established between the domain of perceptive language disorder with expressive language disorder ($p > 0.05$). (Table 48) purpose of among 66 verbal language disorder children, sociolinguistic development disorder was found in all cases and 1 child without expressive language disorder had sociolinguistic development disorder.

All children were clinically diagnosed with ADHD, the observation of different domains of language disorders of ADHD children with other neurodevelopmental (ASD, IDD, CP) disorders represented: perceptive/receptive language development disorder, verbal/expressive language development disorder, and sociolinguistic development disorder was found considerably more in ADHD children than in ASD children. Receptive language development disorder, expressive language development disorder, and sociolinguistic development disorder were found considerably more in ADHD children than in IDD children. Receptive language development disorder and sociolinguistic disorder were found

considerably more in ADHD children than in CP children cause of the sensory processing of speech sound Begum (2012-13) impaired, but expressive language development disorder was found almost similar in both CP and ADHD children (Table: 49, 50. 51).

CHAPTER 7

RECOMMENDATION

7.1 General Recommendations:

- It is recommended that the physician and the health care provider focus on the domain of language disorders among NDD children (ASD, CP, IDD, ADHD). If the focus is placed on the beginning of the child's language development period, an early linguistic evaluation can help in the indication of specific care that attenuates the deleterious effects of the disorders. This reduces the family, social and state burden.
- Our findings propose insightful strategies aimed at reducing the negative effects of language disorders through early diagnosis, using a scientific form of language assessment. These measures reduce the deleterious effects of language disorders, increasing the brain's self-regeneration capacity, improving the patients' quality of life.

7.2 Specific Recommendations:

- Maternal health deserves special attention because it refers to women's reproductive health, their well-being during pregnancy and also their physical, mental, emotional and social well-being. The world health organization defines maternal health as: women's health during pregnancy, childbirth and the postnatal period. Researchers have proven that healthy mothers are linked to healthier babies, healthier communities, and healthier nations. Some studies have illustrated that the health condition of mothers can affect fetal growth, the size of the baby at birth and delivery. Our research concludes that non-genetic atypical

neurolinguistic development between Intellectual Development Disorder and Cerebral Palsy is a serious health problem among families that have medium or low income, which may configure risk factors associated with prenatal and natal complications.

- Demonstration through relationships between language development domains (receptive/perceptual, verbal/expressive, and social/sociolinguistic) and MRI findings explored children's atypical neurolinguistic impairment in more accurate and authentic ways.
- Atypical neurolinguistic development among children is overlooked by service providers due to lack of research, academic practice and awareness. These are the reasons why the aspect of neurolinguistic health is still not properly applied to medical science for the benefit of patients.
- The recommendation of our neurolinguistic research should be considered as a complement to medical science. It is intended to put in place an adequate assessment that confirms the diagnosis of neurodevelopmental disorders. It will also be a tool for health professionals to intervene usefully in their patients' lives. This perspective of action is multidisciplinary, involving governmental and non-governmental hospitals, medical schools, departments such as medicine, pediatrics, gynecology, radiology and neurologists, as well as teachers (schools) and health professionals, tuning everything under a collaboration worthy of be referenced.

CHAPTER 8

CONCLUSION

This clinical research keeps pace with modern research by focusing on children with significant language and neurodevelopmental disorders. Neurolinguistics is taken as a basis for evaluating and assuming that the observed children have atypical neural development, which interferes with their linguistic development. Neurodevelopmental disorders associated with language disorders had their diagnostic category, divided into expressive language disorders (child unable to express thought, or ideas according to the rules of phonetics and phonology); receptive/perceptive language disorder (child incapable of understanding the discursive process of the semantics of visual and auditory linguistic information); sociolinguistic disorders (child unable to express their emotions and thoughts to others). It was theoretically and practically verified that the language disorder affects one or more fundamental elements of language, such as form (phonology, morphology, syntax); content (semantics); function/use (pragmatics). Linguistic acquisition starts from intrauterine life through the nervous system growth and sensory skills develop in the environmental exposure after birth.

There is an important neurodevelopmental period at the age of 5 to 6 years old when language development disorders are diagnosed, and impairments are observed in the sensory process of learning a language that would be awaited according to the child's chronological age. Language disorders in different domains should be assessed with a combination of anamnesis, observation, assessment, and analysis tools, to circumvent the linguistic particulars of the observed children. The domains of language disorders were related to the behavioral disorder presented by the patient. Challenging behaviors are strongly associated

with language disorders. The psychiatrist often finds mood disorders, psychosis, anxiety disorders, and physical aggression in the children towards themselves or others. To identify comorbidities relevant to managing signs and symptoms arising from language disorders, a psychiatrist plays a crucial part in addressing the description of these behavioral circumstances and optimizing the functional correctness and better outcome of self-reliance.

The psychopharmacological evidence base is relatively limited in children with language disorders, but justifying the use of medications for behavioral problems and psychiatric co-morbidities is necessary for effective functional outcomes combined with speech therapy. It is assumed that language development has an interconnection between the neural network and the language area according to the chronological age of children. This research also focuses on particular genetic factors such as the FOXP2 gene and interconnection on chromosomes 3,6 and 19 as the causes of developmental language disorders and acquired language disorders secondary to brain injury. Structural brain injury must be excluded by MRI. MRI is a valuable technique for the neurolinguistics study of the brain delineating disorders related to language processing areas due to neurological causes (brain trauma) and may explain the clinical presentation in a new way. MRI is the imaging modality of choice due to its ability to portray neuroanatomy, making excellent white and gray matter differentiation, myelination, and detection of focal structural brain lesions and classify subtypes of language disorders. MRI is a useful tool to predict certain types of deficits in language ability, especially lesions of the basal ganglia. Basal ganglia are related nuclei placed at the base of the forebrain and the top of the middle brain. They are interconnected with the cerebral cortex and linked with a variety of functions, especially control of voluntary movements, motor learning (procedural learning and habit), cognition, executive function, appropriate prefrontal association behavior, and emotion. In these cases,

dopamine neurons act as guardians, controlling the progress of striatal messages to other nuclei in the basal ganglia during the course of the activity preference procedure. Through the action of these dopamine neurons, the basal ganglia also come up with the motivation to execute the behaviors necessary to analyze, interrelationship with the environment and acquire knowledge from the surrounding during observation - which is known as existential/observational learning through sociolinguistics - and the execution of appropriate behaviors based on the prefrontal association of emotion according to the situation and context. These functions have a strong relationship with motor impairment, especially in speech, and, therefore, would predominantly affect expressive language measures. Cortical injury would probably affect language learning, resulting in a receptive language deficit. Before the chronological age of five years, speech and language testing and intervention through speech-language therapy should be done.

Several conditions can be co-morbid with language disorders, such as hearing impairment, selective mutism, anemia, lead poisoning, and seizure disorders. Screening testing should be done to diagnose whether the child has language disorders excluding these other comorbidities. If persistent language disorders arise in children during the developmental period, then a thorough evaluation and intervention through speech therapy are required. Impaired domains of receptive, expressive, and sociolinguistic development co-occur with phonemic awareness and metalinguistic competence disorder and this is a warning sign for chronic language disorders. Although early childhood language disorders among children with neurodevelopmental disorders are progressively accepted, impediments in diagnosis are of concern. The evolution of enhanced triggers and extensive training for those people who provide services are valid public health contemplation to beneficial early diagnosis and intervention. The long-duration effect and early appearance of these disorders

are principally challenging for families. Surveillance must be carried out in a multidisciplinary way. Keeping care and communication sensitive to culture and the family is a perspective that strengthens the implementation of speech therapy, which can promote continuous learning and provide gains in adaptive functions. This research shows that the early detection of language disorders in children with neurodevelopmental impairments, through the neurolinguistics approach, is significant, and scientific and makes it possible for the speech therapy intervention to play its role in increasing the brain's self-regeneration capacity, stimulating the child to develop according to social needs and the context in which they live. These actions improve patients' quality of life while lightening the load on families, society, and the country.

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APPENDIX I: DATA COLLECTION SHEET

Socio-Demographic History (Attention deficit Hyperactivity Disorder)

1. ID, No (নাম)

2. Age (বয়স)

3. Sex (লিঙ্গ- ছেলে/মেয়ে)

4. Date of Birth (জন্ম তারিখ)

5. Father Education (বাবার শিক্ষাগত যোগ্যতা)

6. Mother Education (মায়ের শিক্ষাগত যোগ্যতা)

7. Father Occupation (বাবার পেশা)

8. Mother Occupation (মায়ের পেশা)

9. Monthly Family Income (পরিবারের মাসিক আয়)

10. Place of Delivery (কোথায় জন্মগ্রহণ করেছিল?)

(i) Home (বাসায়) (ii) Hospital (হাসপাতালে)

11. Mode of Delivery (কিভাবে জন্ম হয়েছিল?)

(i) Per Vaginal (জননালী / যোনিপথ) (ii) Caesarian Section (সিজার করে)

12. Presence or absence of child's crying immediately after birth (জন্মের পর পর শিশু কান্না করেছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

13. Any traumatic symptoms in the head after birth (জন্মের পর মাথায় কোন আঘাতের চিহ্ন ছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

14. MRI finding: I) Normal II) Abnormal

অতিচঞ্চল অমনোযোগী শিশুদের জন্য প্রশ্ন

(Attention deficit Hyperactivity Disorder)

মস্তিষ্কের ধারনক্ষম ভাষার দক্ষতা (Receptive language development)

১) আপনার কি কখনো মনে হয়েছে আপনার শিশুটি কানে শুনেনা? (Ever consider the possibility that your child might be deaf?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশু কি তার নাম ধরে ডাকলে সাড়া দেয়? (Does your child answer when called by name?)

(i) Yes/হ্যা (ii) No/না

৩)অন্যের কথা শোনার সময় আপনার শিশু কি মনোযোগ ধরে রাখতে পারেনা? (Does your child cannot remain attentive when listening or when some one talks to him directly?)

(i) Yes/হ্যা (ii) No/না

৪) আপনার শিশুকে কোন কাজের নির্দেশ দিলেকি মেনে চলতে পারে/কোন নির্দেশ দিলে কাজ শুরু করে শেষ না করেই অতিরিক্ত ছুটোছুটি করে? (Is your child unable to follow instruction/Does he / she follow instructions or fail to complete a task? Is he / she excessively hyperactive or does he / she act inappropriately?)

(i) Yes/হ্যা (ii) No/না

অর্থপূর্ণরুপে কথা অন্যের কাছে প্রকাশদক্ষতা (Expressive Language development)

১) আপনার শিশু কি অতিরিক্ত কথা বলে? (Does your child talk excessively?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশু কি কোন সহপাঠীর প্রশ্নের উত্তর সম্পূর্ণ করার পূর্বেই সে প্রশ্নের উত্তর দিয়ে দেয়। /তার পালা আস াপর্যন্ত অপেক্ষা করতে পারে না? (Does your child in the classroom usually give an answer before his/her classmates complete the answer/ can't wait for his/her turn?)

(i) Yes/হ্যা (ii) No/না

৩) আপনার শিশু প্রায়ই কি অন্যদের কথোপকথনে ব্যাঘাত তৈরী করে? (Does your child frequently interrupt or meddle in other people's conversations?)

(i) Yes/হ্যা (ii) No/না

সামাজিক ভাষাবিকাশের দক্ষতা Sociolinguistic Development

১) আপনার শিশু কি তার সমবয়সীদের সাথে বন্ধুত্ব তৈরী করতে এবং ধরে রাখতে পারে? (Does your child create and maintain peer-relationship?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশু কি স্কুল ও বাসায় বিশৃঙ্খল এবং অগোছালো।? (Is your child messy or disorganized at home and at school?)

(i) Yes/হ্যা (ii) No/না

৩) আপনার শিশুকে দোকানে অথবা বাজারে নিয়ে গেলে কি তাকে নিয়ন্ত্রন রাখা কঠিন? (Is it difficult to control your child in malls or grocery stores?)

(i) Yes/হ্যা (ii) No/না

আচরনগত সমস্যা Behavioral problems

১) আপনার শিশু কি প্রায়ই নিজের মেজাজের উপর নিয়ন্ত্রণ হারিয়ে ফেলে? (Does your child often lose his temper?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশুকি, স্কুলে অথবা খেলতে গেলে, তর্কে অথবা মারামারিতে জড়িয়ে পড়ে? (At school or during play, does your child get involved in arguments or fights?)

(i) Yes/হ্যা (ii) No/না

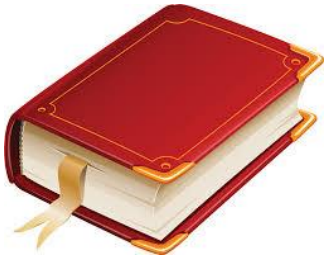
৩) আপনার শিশু কি প্রায়ই বড়দের কোন আদেশ বা অনুরোধ পালন করতে অস্বীকৃতি জানায় এবং বড়দের সাথে তর্কে জড়িয়ে পড়ে? (Does your child often refuse to comply with an adult's request or engage in arguments with the adult?)

(i) Yes/হ্যা (ii) No/না

Child part

Phonemic awareness: ভাষার লিখিত রুপের সাথে পঠনরুপের সাদৃশ্য

১। দেখাও এখানে কোনটা দিয়ে লিখতে পারি? (Show me by which we cut?)



২। দেখাও এখানে কোনটা মিয়াও বলে ডাকে? (Show me which call “maio”?)



৩। দেখাও এখানে কোনটা পানিতে ভাসে? (Show me which one is floating on water?)



৪) মিল/অমিল (Odd and out)




৫। তোমার কানকয়টি? (How many ears you have?)

৬। মানুষ কি দিয়ে খাবার চিবায়? (By what means can humans chew food?)

৭। মানুষ বৃষ্টিতে ভিজে না যাওয়ার জন্য কি ব্যবহার করে? (What is the object that human beings use to protect themselves from the rain?)

Meta linguistic competence: অধি ভাষাগত যোগ্যতা

১। গাড়ি কি? (Which one is the car?)

২। ঘড়ি কি? (Which one is the watch?)

৩। ব্যাঙ কী? (Which one is the frog?)

৪। মোবাইল ফোন বলতে কি বুঝ? (What do you mean by mobile phone?)

৫। তুমি যদি গরম হাড়িতে হাত দাও তাহলে কি হবে? (If you touch the hot pot what willhappen?)

৬। আমরা কেন জুতা পড়ি। (Why do we use shoes?)

৭। আমাদের নাম থাকে কেন? (Why do we have a name?)

Interpretation of the questionnaire of ADHD children for the diagnosis of domains of language disorders.

Receptive/perceptive language development disorder:
A child was diagnosed receptive language development disorder if: among 4 questions, the answers of any of the questions were "No" and question no#4 must be found 'Yes': 1. Ever consider the possibility that your child might be deaf? 2. Does your child answer when called by name? 3. Does your child cannot remain attentive when listening or when someone talks to him directly? 4. Is your child unable to follow instructions/Does he/she follow instructions or fail to complete a task? Is he/she excessively hyperactive or does he/she act inappropriately?
Expressive language development disorder:
There were three questions in the expressive domain; if anyone answerwas"Yes" the child was diagnosed as having a language disorder in the expressive domain. 1. Does your child talk excessively? 2. (Does your child in the classroom usually give an answer before his/her classmates complete the answer or can't wait for his/her turn?) 3. Does your child frequently interrupt or meddle in other people's conversations?
Sociolinguistic development disorder:
There were three questions in the domain of socialinguistic disorder. Among them, if question#1 answer was "No" or question no#2, 3 answers were "Yes" then the child was diagnosed with language disorder in the socialinguistic domain. 1.Does your child create and maintain peer-relationship? 1. Is your child messy or disorganized at home and at school? 2. Is it difficult to control your child in malls or grocery stores?
Behavioral disorder:
There were three questions in the behavioral domain; if any question answered was "Yes," the child was diagnosed as having a language disorder in the behavioral domain. 1. Does your child often lose his temper? 2. At school or during play, does your child get involved in arguments or fights? 3. Does your child often refuse to comply with an adult's request or engage in arguments with the adult?
Phonemic awareness disorder:
There were seven questions in the phonemic awareness domain, and if at least three of them answered were "No," the child was diagnosed as having a language disorder in the phonemic awareness domain.
Metalinguistic competence disorder:

Socio-Demographic History (Cerebral palsy)

1. ID, No (নাম)

2. Age (বয়স)

3. Sex (লিঙ্গ- ছেলে/মেয়ে)

4. Date of Birth (জন্ম তারিখ)

5. Father Education (বাবার শিক্ষাগত যোগ্যতা)

6. Mother Education (মায়ের শিক্ষাগত যোগ্যতা)

7. Father Occupation (বাবার পেশা)

8. Mother Occupation (মায়ের পেশা)

9. Monthly Family Income (পরিবারের মাসিক আয়)

10. Place of Delivery (কোথায় জন্মগ্রহণ করেছিল?)

(i) Home (বাসায়) (ii) Hospital (হাসপাতালে)

11. Mode of Delivery (কিভাবে জন্ম হয়েছিল?)

(i) Per Vaginal (জননালী / যোনিপথ) (ii) Caesarian Section (সিজার করে)

12. Presence or absence of child's crying immediately after birth (জন্মের পর পর শিশু কান্না করেছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

13. Any traumatic symptoms in the head after birth (জন্মের পর মাথায় কোন আঘাতের চিহ্ন ছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

14. MRI finding: I) Normal II) Abnormal

সেরিব্রাল পাল্‌সি শিশুদের জন্য প্রশ্ন (Cerebral palsy)

মস্তিষ্কের ধারনক্ষম ভাষার দক্ষতা (Receptive/ Perceptive language development)

১)্ আপনার কি মনে হয়, বয়স অনুযায়ী আপনার শিশুর ভাষাবিকাশ পর্বটি স্বাভাবিক? (According to chronological agedoes your child language development was normal?)

(i) Yes/হ্যা (ii) No/না

২) পরিবেশ ও পরিস্থিতি অনুযায়ী আপনার শিশু কয় শব্দের অর্থ বুঝতে পারে? (Depending on the situation and context, sentences made by how many meaningful words does your child Understand to others?)

ক) ঈশারা, ইঙ্গিত এবং ছবি দিয়ে/একটি অর্থবহ শব্দ বুঝতে পারা? (Sign language, pictures/By one meaningful word)

খ) দুই বা ততোধিক অর্থবহ শব্দবুঝতে পারা? (sentences made by two or more meaningful words)

অর্থপূর্ণরুপে কথা অন্যের কাছে প্রকাশদক্ষতা (Expressive Language development)

১) আপনার শিশু কি নিম্নোক্ত শব্দগুলো উচ্চারণ করতে পারে (স্বরধ্বনি)? (Can your child speak the words below? (vowel)?

(i) (It) ইট (ii) (Onek) অনেক (iii) (Alu) আলু

২) আপনার শিশু কি নিম্নোক্ত শব্দগুলো উচ্চারণ করতে পারে অধস্বরধ্বনি? (Can your child speak the words below? (semi-vowel)?

(i) (Paya) পায়া (ii) (Moa) মোয়া (iii) (Piu) পিউ

৩) আপনার শিশু কি নিম্নোক্ত শব্দগুলো উচ্চারণ করতে পারে? Can your child speak the words below? (consonant)?

(i) (Pata) পাটা (ii) (Jal) জাল (iii) (Kak) কাক

(i) Yes / হ্যা (ii) No / না

৪) আপনার শিশু কি নিম্নোক্ত বর্ণগুলো উচ্চারণ করতে পারে ? (Does your child articulate the following alphabet/letter phoneme?)

(i) (Pa) প (ii) (Cha) চ (iii) (E) ই (iv) (Sa) স (v) (Jha) ঝ (vi) (Ja) জ

(vii) (Ta) ত

৫) আপনার শিশু কি জটিল বাক্য বলতে পারে? (Does your child articulate complex sentences?)

যেমন ঃ আমরা নানা বাড়িতে অনেক মজার খেলা খেলেছিলাম। (Amra Nana Barita giaatto mojar kala kalasilam)

সামাজিক ভাষাবিকাশের দক্ষতা Sociolinguistic Development

১) আপনার শিশু কি তার সমবয়সীদের সাথে বন্ধুত্ব তৈরী করতে এবং ধরে রাখতে পারে? (Does your child create and maintain peer-relationship?)

(i) Yes/হ্যা (ii) No/না

আচরনগত সমস্যা Behavioral problems

১) আপনার শিশু কি নিজের শারিরীক যত্ন, খাবার টাকাপয়সা লেনদেন এ কোন কিছুর সিদ্ধান্তের জন্য অন্যের উপর নির্ভর করে? (Does your child depend on other people to take care of himself, eat, ask for money, and make any decisions?)

(i) Yes/হ্যা (ii) No/না

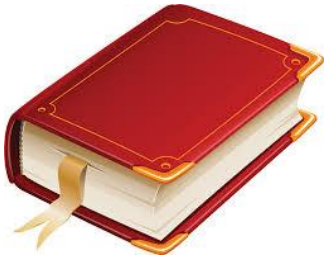
২) আপনার শিশু কি পরিবেশ পরিস্থিতি অনুযায়ী কথা নাবলতে পারার কারণে প্রায়ই তার সমবয়সীদের অথবা বড়দের সাথে দ্বন্দ তৈরী হয়? (Does your child often develop conflict with peers or adults due to an inability to deliver a speech according to the situation & context?)

(i) Yes/হ্যা (ii) No/না

Child part

Phonemic awareness: ভাষার লিখিত রুপের সাথে পঠনরুপের সাদৃশ্য

১। দেখাও এখানে কোনটা দিয়ে লিখতে পারি? (Show me by which we cut?)



২। দেখাও এখানে কোনটা মিয়াও বলে ডাকে? (Show me which call “maio”?)



৩। দেখাও এখানে কোনটা পানিতে ভাসে? (Show me which one is floating on water?)



৪) মিল/অমিল (Odd and out)




৫। তোমার কান কয়টি? (How many ears you have?)

৬। মানুষ কি দিয়ে খাবার চিবায়? (By what means can humans chew food?)

৭। মানুষ বৃষ্টিতে ভিজে না যাওয়ার জন্য কি ব্যবহার করে? (What is the object that human beings use to protect themselves from the rain?)

Meta linguistic competence: অধি ভাষাগত যোগ্যতা

১। গাড়ি কি? (Which one is the car?)

২। ঘড়ি কি? (Which one is the watch?)

৩। ব্যাঙ কী? (Which one is the frog?)

৪। মোবাইল ফোন বলতে কি বুঝ? (What do you mean by mobile phone?)

৫। তুমি যদি গরম হাড়িতে হাত দাও তাহলে কি হবে? (If you touch the hot pot what willhappen?)

৬। আমরা কেন জুতা পড়ি। (Why do we use shoes?)

৭। আমাদের নাম থাকে কেন? (Why do we have a name?)

Interpretation of the questionnaire of cerebral palsy(CP) children for the diagnosis of domain language disorders.

Receptive language development disorder:
A child was diagnosed with receptive language development disorder if the answer to question 2(b) was found 'No': 1. According to chronological age, was your child language development normal? 2. Depending on the situation and context, sentences made by how many meaningful words does your child understand to others? a) One meaningful word/ sign language, pictures b)Sentences made by 2 or more meaningful words
Expressive language development disorder:
There were five questions in the expressive language development domain; if anyone answer was "No", the child was diagnosed as having a language disorder in the expressive domain. 1. Can your child speak the words below? (vowel)? 2. Can your child speak the words below? (semi-vowel)? 3. Can your child speak the words below? (consonant)? 4. Does your child articulate following alphabet/letter phoneme? 5. Does your child articulate complex sentences?
Sociolinguistic development disorder:
There was one question in the domain of socialization. If answer was "No", then the child was diagnosed with language disorder in the socialization domain. 1. Does your child create & maintain peer relationship?
Behavioral disorder:
There were two questions in the behavioral domain; if any question answered was "Yes," the behavioral domain of the child revealed a language disorder. 1. Does your child depend on others for self-care, eating, money & to take any decision? 2. Often developed conflict with his/her peers or adults for being unable to deliver speech according to situation & context?
Phonemic awareness domain:
There wereseven questions in the phonemic awareness domain, and if at least three of the questions were answered "No," the phonemic awareness domain of the child revealed a language disorder.
Metalinguistic competence:
In the metalinguistic competence domain, there were seven questions, and if at least three of them were answered "No," the child was identified as having language disorder in the metalinguistic competence domain.

Socio-Demographic History (Intellectual development disorder)

1. ID, No (নাম)

2. Age (বয়স)

3. Sex (লিঙ্গ- ছেলে/মেয়ে)

4. Date of Birth (জন্ম তারিখ)

5. Father Education (বাবার শিক্ষাগত যোগ্যতা)

6. Mother Education (মায়ের শিক্ষাগত যোগ্যতা)

7. Father Occupation (বাবার পেশা)

8. Mother Occupation (মায়ের পেশা)

9. Monthly Family Income (পরিবারের মাসিক আয়)

10. Place of Delivery (কোথায় জন্মগ্রহণ করেছিল?)

(i) Home (বাসায়) (ii) Hospital (হাসপাতালে)

11. Mode of Delivery (কিভাবে জন্ম হয়েছিল?)

(i) Per Vaginal (জননালী / যোনিপথ) (ii) Caesarian Section (সিজার করে)

12. Presence or absence of child's crying immediately after birth (জন্মের পর পর শিশু কান্না করেছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

13. Any traumatic symptoms in the head after birth (জন্মের পর মাথায় কোন আঘাতের চিহ্ন ছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

14. MRI finding: I) Normal II) Abnormal

বুদ্ধি প্রতিবন্ধি শিশুদের জন্য প্রশ্ন

(Intellectual development disorder)

মস্তিষ্কের ধারনক্ষম ভাষার দক্ষতা (Receptive language development)

১) বয়স অনুযায়ী আপনার শিশুর বুদ্ধির বিকাশ কি তার সমবয়সীদের সাথে সমাঞ্জস্যপূর্ণ? (Does you think your childunderstanding ability is similar according chronological age and linguistic age his / her friends of the same age?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশু কি পরিবেশ ও পরিস্থিতি অনুযায়ী আপনার, তার সমবয়সী এবং বড়দের কথা বুঝতে পারে? (Does your child understand the words of his / her companions and his / her friends of the same age, according to the situation & context?)

(i) Yes/হ্যা (ii) No/না

অর্থপূর্ণরুপে কথা অন্যের কাছে প্রকাশদক্ষতা (Expressive Language development)

১) আপনার শিশুর কি অর্থপূর্ণ রূপে কোন কথা অন্যের কাছে বলতে সমস্যা দেখা যায়? (Does your child have limitation to express meaningful speech to others?)

(i) Yes/হ্যা (ii) No/না

সামাজিক ভাষাবিকাশের দক্ষতা Sociolinguistic Development

১) আপনার শিশু কি তার সমবয়সীদের সাথে বন্ধুত্ব তৈরী করতে এবং ধরে রাখতে পারে? (Does your child create and maintain peer-relationship?)

(i) Yes/হ্যা (ii) No/না

আচরনগত সমস্যা Behavioral problems

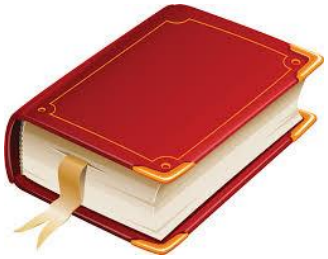
১) আপনার শিশুর কি অন্যকে অথবা নিজেকে আঘাত করার প্রবনতা আছে? অথবা অন্য কোন আচরনগত সমস্যা আছে? (Does your child have self-harm behavior? or other significant behavioral problems?)

(i) Yes/হ্যা (ii) No/না

Child part

Phonemic awareness: ভাষার লিখিত রুপের সাথে পঠনরুপের সাদৃশ্য

১। দেখাও এখানে কোনটা দিয়ে লিখতে পারি? (Show me by which we cut?)



২। দেখাও এখানে কোনটা মিয়াও বলে ডাকে? (Show me which call “maio”?)



৩। দেখাও এখানে কোনটা পানিতে ভাসে? (Show me which one is floating on water?)



৪) মিল/অমিল (Odd and out)




৫। তোমার কান কয়টি? (How many ears you have?)

৬। মানুষ কি দিয়ে খাবার চিবায়? (By what means can humans chew food?)

৭। মানুষ বৃষ্টিতে ভিজে না যাওয়ার জন্য কি ব্যবহার করে? (What is the object that human beings use to protect themselves from the rain?)

Meta linguistic competence: অধি ভাষাগত যোগ্যতা

১। গাড়ি কি? (Which one is the car?)

২। ঘড়ি কি? (Which one is the watch?)

৩। ব্যাঙ কী? (Which one is the frog?)

৪। মোবাইল ফোন বলতে কি বুঝ? (What do you mean by mobile phone?)

৫। তুমি যদি গরম হাড়িতে হাত দাও তাহলে কি হবে? (If you touch the hot pot what willhappen?)

৬। আমরা কেন জুতা পড়ি। (Why do we use shoes?)

৭। আমাদের নাম থাকে কেন? (Why do we have a name?)

Interpretation of the questionnaire of intellectual development disorder (IDD) children for the diagnostic domains of language disorders:

Receptive/Perceptive language development disorder :
A child was diagnosed with receptive language development disorder if answer of any one question was found 'No': 1. According to situation & context, how many meaningful words does your child understand? 2. Do you think your child's understanding ability is similar according to the chronological age and linguistic age of his/her friends of the same age? 3. Does your child understand the words of his/her companions and friends of the same age, according to the situation & context?
Expressive language development disorder:
There was one question in the expressive language development domain; if answered "Yes", the child was diagnosed as having a language disorder in the expressive domain. Does your child have limitations in expressing meaningful speech to others?
Sociolinguisticdevelopment disorder:
There was one question in the sociolinguistic domain. If answered "No", then the child was diagnosed with language disorder in the sociolinguistic domain. 1. Does your child create & maintain peer relationship?
Behavioral disorder:
There was one question in the domain of socialization. If answer was "Yes", the behavioral domain of the child revealed a language disorder. 1. Does your child have self-injuriousbehaviour and other significant behavioral problems?
Phonemic awareness disorder:
There are seven questions in the phonemic awareness domain, and if at least three of them were answered "No," the phonemic awareness domain of the child revealed a language disorder.
Metalinguistic competence disorder:
In the metalinguistic competence domain, there were seven questions, and if at least three of them were answered "No," the child was identified as having language disorder in the metalinguistic competence domain.

Socio-Demographic History (Autism Spectrum Disorder)

1. ID, No (নাম)

2. Age (বয়স)

3. Sex (লিঙ্গ- ছেলে/মেয়ে)

4. Date of Birth (জন্ম তারিখ)

5. Father Education (বাবার শিক্ষাগত যোগ্যতা)

6. Mother Education (মায়ের শিক্ষাগত যোগ্যতা)

7. Father Occupation (বাবার পেশা)

8. Mother Occupation (মায়ের পেশা)

9. Monthly Family Income (পরিবারের মাসিক আয়)

10. Place of Delivery (কোথায় জন্মগ্রহণ করেছিল?)

(i) Home (বাসায়) (ii) Hospital (হাসপাতালে)

11. Mode of Delivery (কিভাবে জন্ম হয়েছিল?)

(i) Per Vaginal (জননালী / যোনিপথ) (ii) Caesarian Section (সিজার করে)

12. Presence or absence of child's crying immediately after birth (জন্মের পর পর শিশু কান্না করেছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

13. Any traumatic symptoms in the head after birth (জন্মের পর মাথায় কোন আঘাতের চিহ্ন ছিল কিনা?)

(i) Yes (হ্যাঁ) (ii) No (না)

14. MRI finding: I) Normal II) Abnormal

অটিজম স্পেক্ট্রাম ডিজঅর্ডার শিশুদের জন্য প্রশ্ন

(Autism Spectrum Disorder)

মস্তিষ্কের ধারনক্ষম ভাষার দক্ষতা (Receptive language development)

1. ১) আপনার কি কখনো মনে হয়েছে আপনার শিশুটি কানে শুনেনা? (Ever consider the possibility that your child might be deaf?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশু কি তার নাম ধরে ডাকলে সাড়া দেয়? (Does your child answer when called by name?)

(i) Yes/হ্যা (ii) No/না

৩) আপনার শিশু কি কোন কিছুর দিকে তর্জুনি অঙ্গুলি নির্দেশ করে নাম বললে তা দেখাতে পারে? যেমন: কান কোথায়, খেলনাটা কোথায়, ইত্যাদি। (Does your child usually ask for something like, for example: where is the ear, toy etc?)

(i) Yes/হ্যা (ii) No/না

অর্থপূর্ণরুপে কথা অন্যের কাছে প্রকাশদক্ষতা (Expressive Language development)

১) আপনার শিশুকি অর্থপূর্ণ রূপে কোন কথা অন্যের কাছে বলতে সমস্যা দেখা যায়? (Does your child have problem in expressing noun and pronoun (I, You, mine) also meaningful words and sentences?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশুকি কোন অস্বাভাবিক শব্দ উচ্চারন করে যার কোন অর্থ নেই? (Can your child say idiosyncratic words / neologisms?)

(i) Yes/হ্যা (ii) No/না

সামাজিক ভাষাবিকাশের দক্ষতা Sociolinguistic Development

১) আপনার শিশু কি অন্য শিশুদের সাথে ছড়া ও গানে অংশ নিতে পারে? (Does your child sing or recite rhymes with other children?)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশ ুকি কারো সাথে সংক্ষিপ্ত কথোপকথন চালাতে পারে? (Does your child participate in conversations with other people?)

(i) Yes/হ্যা (ii) No/না

৩) আপনার শিশু কি চোখে চোখ রাখতে পাওে এবং মুখভঙ্গি দেখে বক্তার মনোভাব বুঝতে পারে? (Can your child understand other facial expressions and maintain eye contact?)

(i) Yes/হ্যা (ii) No/না

৪) আপনার শিশু কি অন্যজনের সঙ্গে একই সাথে কোন জিনিস নির্দেশ করতে পাওে বা দেখাতে পারে? (Does your child point or examine thing with others?)

(i) Yes/হ্যা (ii) No/না

আচরনগত সমস্যা Behavioral problems

১) আপনার শিশু কি একই কাজ বিরামহীন ভাবে বারবার করতে থাকে? যেমন ঃ একই নিয়মে খেলনাগুলোকে সাজানো অথবা যে কোনবাক্যাংশ বারবার পুনরাবৃত্তি করা। (Does your child have restricted, repetitive behavior patterns, interests or activities? Example: lining up toys or idiosyncratic phrases)

(i) Yes/হ্যা (ii) No/না

২) আপনার শিশু কি যে কোন বিষয়ে সীমাবদ্ধ এবং অস্বাভাবিকভাবে অনড় থাকে? যেমন ঃ প্রতিদিন একই ভাবে খাবার খেতে অথবা অভিবাদনে সীমাবদ্ধ। (Is your child restricted or fixated on any subject? e.g- Fixed and restricted to eating the same food, having rituals every day)

(i) Yes/হ্যা (ii) No/না

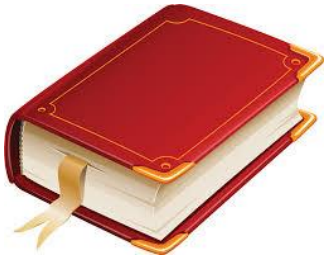
৩) আপনার শিশুর কি নিজেকে আঘাত করার প্রবনতা আছে? (Does your child have self injurious behavior?)

(i) Yes/হ্যা (ii) No/না

Child part

Phonemic awareness: ভাষার লিখিত রুপের সাথে পঠনরুপের সাদৃশ্য

১। দেখাও এখানে কোনটা দিয়ে লিখতে পারি? (Show me by which we cut?)



২। দেখাও এখানে কোনটা মিয়াও বলে ডাকে? (Show me which call “maio”?)



৩। দেখাও এখানে কোনটা পানিতে ভাসে? (Show me which one is floating on water?)



৪) মিল/অমিল (Odd and out)




৫। তোমার কান কয়টি? (How many ears you have?)

৬। মানুষ কি দিয়ে খাবার চিবায়? (By what means can humans chew food?)

৭। মানুষ বৃষ্টিতে ভিজে না যাওয়ার জন্য কি ব্যবহার করে? (What is the object that human beings use to protect themselves from the rain?)

Meta linguistic competence: অধি ভাষাগত যোগ্যতা

১। গাড়ি কি? (Which one is the car?)

২। ঘড়ি কি? (Which one is the watch?)

৩। ব্যাঙ কী? (Which one is the frog?)

৪। মোবাইল ফোন বলতে কি বুঝ? (What do you mean by mobile phone?)

৫। তুমি যদি গরম হাড়িতে হাত দাও তাহলে কি হবে? (If you touch the hot pot what willhappen?)

৬। আমরা কেন জুতা পড়ি। (Why do we use shoes?)

৭। আমাদের নাম থাকে কেন? (Why do we have a name?)

Interpretation of the questionnaire of Autism Spectrum Disorder children (ASD) for the diagnosis of domain of language disorders.

Receptive/ Perceptive language development disorder:
If "No" was selected as the response to the following three questions, a child was diagnosed with receptive language development disorder.: 1. Ever consider the possibility that your child might be deaf? 2. Does your child answer when called by name? 3. Does your child usually ask for something like, for example: where is the ear, toy etc.?
Expressive language development disorder:
There were two questions in the expressive language development domain; if both answers were "No", then the child was diagnosed as having a language disorder in the expressive language development domain. 1. Does your child have problem in expressing noun & pronoun (I, you, mine) and meaningful words and sentences? 2. Does your child say idiosyncratic/ neologism words?
Sociolinguistic development disorder:
There were four questions in the domain of sociolinguistic development domain. If any three questions were answered “No”, then the child was diagnosed with language disorder in the sociolinguistic domain. 1. Does your child sing or recite rhymes with other children? 2. Does your child take part in conversation with others? 3. Can your child understand other facial expressions and maintain eye contact? 4. Does your child point or examine thing with others?
Behavioral disorder:
There were three questions in the behavioral domain; if questions 1 and 2 were answered "Yes," the child was identified as having a language disorder in the behavioral domain. 1. Does your child have restricted, repetitive patterns of behaviour, interest, or activities? (Example: lining up toys or idiosyncratic phrases) 2. Does your child have highly restricted habits and fixate in any subject? (e.g- fixated and restricted to eating same food, performing rituals every day) **3.** Does your child have self harm behaviour?
Phonemic awareness disorder:
There were seven questions in the phonemic awareness domain, and if at least three of them were answered “No," then the child was diagnosed as having a language disorder in the phonemic awareness domain.
Metalinguistic Competence disorder :
In the phonemic awareness domain, there were seven questions, and if at least three of them were answered "No," the child was identified as having language disorder in the Metalinguistic competence domain.

APPENDIX II: CONSENT FORM FOR THE PARENTS

Greeting,

Purpose of the study: Department of linguistics, University of Dhaka is conducting research on "The language of Bengali Children with Neurodevelopmental disorders: A Neurolinguistic study".

Nature of Participation: You are kindly asked to take part in this study. You have the right to be informed that participation in research is completely voluntary, that permission to do so may be withdrawn at any time, and that you are free to stop all or some of your participation without it having an impact on your current or future medical care. Before enrolling yourself in this study, you should read this document for important information. Please review this form carefully. Before you decide, feel free to discuss it with your family, friends, or other relevant parties.

Objectives: The study's objective is to make observations on "The language of Bengali Children with Neurodevelopmental disorders: A Neurolinguistic study".

Type of participation and participants: Theparents with their NDD children will voluntarily take part in this study.

Procedure of the study: Following enrollment, you have to answers few questions regarding socio-demographic characteristics. You have to respond Bangla versions of language disorders assessment questionnaires. The entire interview will last between 20 and 30 minutes.

Benefits: Your information and language disorders assessment data will be part of this research study and use for to advance clinical care and medical science. However, you will not be directly personally getting any benefit from it**.**

Risk, hazards and discomfort: There is no physical, social, occupational or legal risks associated with the study. Some of the questions are personal, but not traumatic or distressing in nature. If you feel, you can abstain from responding to any particular questions.

Date:

Address:

Phone number:

APPENDIX III: CONSENT FORM FOR THE CHILDREN

Dear boy / girl,

Purpose of the study: Department of linguistics, University of Dhaka is conducting research on “The language of Bengali Children with Neurodevelopmental disorders: A Neurolinguistic study”.

Nature of Participation: You are kindly asked to take part in this study. You have the right to be informed that participation in research is completely voluntary, that permission to do so may be withdrawn at any time, and that you are free to stop all or some of your participation without it having an impact on your current or future medical care. Before enrolling yourself in this study, you should read this document for important information. Please review this form carefully. Before you decide, feel free to discuss it with your family, friends, or other relevant parties.

Objectives: The study's objective is to make observations on “The language of Bengali Children with Neurodevelopmental disorders: A Neurolinguistic study”.

Type of participation and participants: Theparents with their NDD children will voluntarily take part in this study.

Procedure of the study: Following enrollment, you have to answers few questions. You have to respond Bangla versions of language disorders assessment questionnaires. The entire interview will last between 20 and 30 minutes.

Benefits: Your information and language disorders assessment data will be part of this research study and use for to advance clinical care and medical science. However, you will not be directly personally getting any benefit from it.

Risk, hazards and discomfort: There is no physical, social, occupational or legal risks associated with the study. Some of the questions are personal, but not traumatic or distressing in nature. If you feel, you can abstain from responding to any particular questions.

Date:

Address:

Phone number:

APPENDIX IV: CONSENT FORM IN BENGLA FOR THE PARENTS

অবহিতমূলক সম্মতি পত্র শিশুর বাবা ও মায়েদের জন্য

আস্‌সলামু আলাইকুম / আদাব

গবেষণায় অংশগ্রহনের আবেদন: ঢাকা বিশ্ববিদ্যালয়ে অধীনে "ভাষাবিজ্ঞান বিভাগে" নিউরডেভালাপ মেন্টাল ডিজ্‌অর্ডারে আক্রান্ত শিশুদের ভাষা বৈকল্য পর্যবেক্ষণ বিষয়ক গবেষণা কার্যক্রম চলছে। আপনাকে এ গবেষণা প্রকল্পে অংশগ্রহণ করার জন্য অনুরোধ জানানো হচ্ছে।

অংশগ্রহণের ধরণ: আপনার স্বেচ্ছায় এ গবেষণায় অংশ নিতে পারেন এবং আপনার সম্মতি যেকোন সময় প্রত্যাহার করতে পারেন। এই সম্মতিপত্র পর্যালোচনা করতে আপনি সময় নি। আপনি আপনার সিদ্ধান্ত নেয়ার আগে পরিবারের সদস্য, বন্ধু-বান্ধব বা অন্য কারো সঙ্গে নির্দ্বিদায় আলোচনা করতে পারেন।

গবেষণার উদ্দেশ্য: নিউরডেভালাপমেন্টাল ডিস্‌অর্ডার (অটিজম, বুদ্ধিপ্রতিবন্ধী, অতিচঞ্চল অমনোযোগী, সেরিব্রালপাল্‌সি) আক্রান্ত শিশুদের ভাষা বৈকল্যের ধরণ পর্যবেক্ষণ, এই গবেষণার উদ্দেশ্য।

এই গবেষণায় অংশগ্রহণ কারীর সংখ্যা: এই গবেষণায় ২৯২ জন শিশু ও তাদের পিতা-মাতারা অংশগ্রহণ করবেন।

গবেষণায় অংশগ্রহণের প্রাপ্ত সুবিধা: এই গবেষণায় অংশ নিলে আপনি কোন ব্যক্তিগত সুবিধা অধিকারি হবেন না বা কোন আর্থিক সাহায্য লাভ করবেন না। এই গবেষণায় আপনার অবদান শুধু মাত্র গবেষণার উদ্দেশ্যে কাজে লাগবে।

গবেষণার ঝুঁকি: এই গবেষণায় বাড়তি কোন ঝুঁকি নেই। আপনার কিছু ব্যক্তি তথ্য নেয়া হবে। সম্পূর্ণ গোপনীয়তা বজায় রেখে। আপনি চাইলে যে কোন প্রশ্নের উত্তর নাও দিতে পারেন।

গোপনীয়তা সংরক্ষণ: আপনার সমস্ত তথ্য কম্পিউটার ডাটাবেসে সংরক্ষণ করা হবে এবং সকল ধরনের গোপনীয়তা রক্ষা করা হবে। এই তথ্য শুধু মাত্র গবেষণার কাজে ব্যবহার করা হবে। কোথাও আপনার নাম বা পরিচয় বুঝা যায় এমন কোন তথ্য ব্যবহার করা হবে না। গবেষনা শেষে ফলাফল সম্পূর্ণ গোপনীয়তা বজায় রেখে বৈজ্ঞানিক রিপোর্ট হিসাবে প্রকাশ করা হবে।

তারিখ:

ঠিকানা:

ফোন নম্বর:

APPENDIX V: CONSENT FORM IN BENGLA FOR THE CHILDREN

অবহিতমূলক সম্মতি পত্র শিশুদের জন্য

প্রিয় খোকা/খুকু

আস্‌সলামু আলাইকুম/আদাব

গবেষণায় অংশগ্রহনের আবেদন: ঢাকা বিশ্ববিদ্যালয়ে অধীনে "ভাষাবিজ্ঞান বিভাগে" নিউরডেভালাপ মেন্টাল ডিজ্‌অর্ডারে আক্রান্ত শিশুদের ভাষা বৈকল্য পর্যবেক্ষণ বিষয়ক গবেষণা কার্যক্রম চলছে। আপনাকে এ গবেষণা প্রকল্পে অংশগ্রহণ করার জন্য অনুরোধ জানানো হচ্ছে।

অংশগ্রহণের ধরণ: আপনার স্বেচ্ছায় এ গবেষণায় অংশ নিতে পারেন এবং আপনার সম্মতি যেকোন সময় প্রত্যাহার করতে পারেন। এই সম্মতিপত্র পর্যালোচনা করতে আপনি সময় নি। আপনি আপনার সিদ্ধান্ত নেয়ার আগে পরিবারের সদস্য, বন্ধু-বান্ধব বা অন্য কারো সঙ্গে নির্দ্বিদায় আলোচনা করতে পারেন।

গবেষণার উদ্দেশ্য: নিউরডেভালাপমেন্টাল ডিস্‌অর্ডার (অটিজম, বুদ্ধিপ্রতিবন্ধী, অতিচঞ্চল অমনোযোগী, সেরিব্রালপাল্‌সি) আক্রান্ত শিশুদের ভাষা বৈকল্যের ধরণ পর্যবেক্ষণ, এই গবেষণার উদ্দেশ্য।

এই গবেষণায় অংশগ্রহণ কারীর সংখ্যা: এই গবেষণায় ২৯২ জন শিশু ও তাদের পিতা-মাতারা অংশগ্রহণ করবেন।

গবেষণায় অংশগ্রহণের প্রাপ্ত সুবিধা: এই গবেষণায় অংশ নিলে আপনি কোন ব্যক্তিগত সুবিধা অধিকারি হবেন না বা কোন আর্থিক সাহায্য লাভ করবেন না। এই গবেষণায় আপনার অবদান শুধু মাত্র গবেষণার উদ্দেশ্যে কাজে লাগবে।

গবেষণার ঝুঁকি: এই গবেষণায় বাড়তি কোন ঝুঁকি নেই। আপনার কিছু ব্যক্তি তথ্য নেয়া হবে। সম্পূর্ণ গোপনীয়তা বজায় রেখে। আপনি চাইলে যে কোন প্রশ্নের উত্তর নাও দিতে পারেন।

গোপনীয়তা সংরক্ষণ: আপনার সমস্ত তথ্য কম্পিউটার ডাটাবেসে সংরক্ষণ করা হবে এবং সকল ধরনের গোপনীয়তা রক্ষা করা হবে। এই তথ্য শুধু মাত্র গবেষণার কাজে ব্যবহার করা হবে। কোথাও আপনার নাম বা পরিচয় বুঝা যায় এমন কোন তথ্য ব্যবহার করা হবে না। গবেষনা শেষে ফলাফল সম্পূর্ণ গোপনীয়তা বজায় রেখে বৈজ্ঞানিক রিপোর্ট হিসাবে প্রকাশ করা হবে।

তারিখ:

ঠিকানা:

ফোন নম্বর:

APPENDIX VI: ETHICAL BOARD PERMISSION FOR DATA COLLECTION

Dr. Shahryar Nabi
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DEAN
FACULTY OF MEDICINE
UNIVERSITY OF DHAKA
DHAKA-1000, BANGLADESH

Ref : D·U-2020/138 Date :.....
তারিখ : ২৭ অক্টোবর ২০২০

বরাবর
পরিচালক,
ঢাকা মেডিকেলকলেজ ও হাসপাতাল, ঢাকা।

বিষয়: ঢাকা বিশ্ববিদ্যালয়ের "ভাষাবিজ্ঞান" বিভাগের অধীনে পি. এইচ.ডি. গবেষণার উপাত্ত সংগ্রহের অনুমতি প্রদান প্রসঙ্গে।

মহোদয়,

সবিনয়ে নিবেদন এই যে জনাব ডা: ফাহমিদা ফেরদৌস রেজিষ্ট্রেশননং-১০,২০১৭-২০১৮ ঢাকা বিশ্ববিদ্যালয়ের "ভাষাবিজ্ঞান বিভাগের" অধীনে The Language of Bengali Children with Neurodevelopmental Disorders: A Neurolinguistic Study শীর্ষক বিষয়ে পিএইচ ডি গবেষণা করছেন। তার গবেষণার মূল বিষয় হলো "নিউরডেভালাপমেন্টাল ডিস্অর্ডার(অটিজম,বুদ্ধিপ্রতিবন্ধী,অতিচঞ্চল অমনোযোগী, সেরিব্রালপাল্সি) এ আক্রান্ত শিশুদের ভাষার বিকাশ পর্যবেক্ষণ। গবেষণার কাজ সম্পন্ন করার লক্ষ্যে আপনার প্রতিষ্ঠানের মনোরোগ বিদ্যা বিভাগের শিশু রোগীদের কাছ থেকে উপাত্ত সংগ্রহ করা প্রয়োজন।

অতএব, এ বিষয়ে প্রয়োজনীয় অনুমতি প্রদানের জন্য আপনাকে বিশেষভাবে অনুরোধ করছি।

৭.১১.২০২০
ডা: শাহরিয়ার নবী
ডিন ও চেয়ারম্যান, পরীক্ষা কমিটি, চিকিৎসা অনুষদ,
ঢাকা বিশ্ববিদ্যালয় ।

Dr. Shahryar Nabi
Dean
Faculty of Medicine
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ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়
Department of Linguistics
University of Dhaka

তারিখ : ১/১/২০১৯

পরিচালক
জাতীয় মানসিক স্বাস্থ্য ইনস্টিটিউট ও হাসপাতাল
ঢাকা।

03-01-2019
Prof. Dr. Md. Faruq Alam
Director-cum-Professor
National Institute of Mental Health & Hospital
Sher-e-Bangla Nagar, Dhaka-1207.

বিষয় : ঢাকা বিশ্ববিদ্যালয়ের ভাষাবিজ্ঞান বিভাগের অধীনে পিএইচ ডি গবেষণার উপাত্ত সংগ্রহের অনুমতি প্রার্থনা।

মহোদয়,
সবিনয়ে নিবেদন এই যে জনাব ডা. ফাহমিদা ফেরদৌস (রেজিস্ট্রেশন নম্বর : ১০, ২০১৭-২০১৮) ঢাকা বিশ্ববিদ্যায়ের ভাষাবিজ্ঞান বিভাগের অধীনে "The Language of Bengali Children with Neurodevelopmental Disorders : A Neurolinguistic Study" শীর্ষক বিষয়ে পিএইচ ডি গবেষণা করছেন। তাঁর গবেষণায় মূল বিষয় হলো "নিউরডেভালাপমেন্টাল ডিস্‌অর্ডার (অটিজম, বুদ্ধিপ্রতিবন্ধী, অতিচঞ্চল অমনোযোগী, সেরিব্রালপাল্‌সি)-এ আক্রান্ত শিশুদের ভাষার বিকাশ পর্যবেক্ষণ। গবেষণার কাজ সম্পন্ন করার লক্ষ্যে আপনার প্রতিষ্ঠানের শিশু বিকাশ কেন্দ্রের শিশু রোগীদের কাছ থেকে উপাত্ত সংগ্রহ করা প্রয়োজন।

অতএব, এ বিষয়ে প্রয়োজনীয় অনুমতি প্রদানের জন্য আপনাকে বিশেষভাবে অনুরোধ করছি।

আন্তরিকতা ও ধন্যবাদসহ

তত্ত্বাবধায়ক

অধ্যাপক (অব.) ড. জীনাত ইমতিয়াজ আলী
ভাষাবিজ্ঞান বিভাগ, ঢাকা বিশ্ববিদ্যালয়
এবং
মহাপরিচালক
আন্তর্জাতিক মাতৃভাষা ইনস্টিটিউট
বাংলাদেশ

অধ্যাপক (অব.)
ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ড. জীনাত ইমতিয়াজ আলী
মহাপরিচালক
আন্তর্জাতিক মাতৃভাষা ইনস্টিটিউট
শিক্ষা মন্ত্রণালয়
২/ক সেগুনবাগিচা, ঢাকা।

যুগ্ম তত্ত্বাবধায়ক

অধ্যাপক ড. সৈয়দ শাহরিয়ার রহমান
ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়

অধ্যাপক
ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়

যুগ্ম তত্ত্বাবধায়ক

ডাঃ ফারুক আলম
অধ্যাপক ও পরিচালক
জাতীয় মানসিক স্বাস্থ্য
ইনস্টিটিউট ও হাসপাতাল, ঢাকা

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তারিখ : ২৭ অক্টোবর ২০২০

অধ্যক্ষ
জেড. এইচ. সিকদার ওমেন্স মেডিকেল কলেজ ও হাসপাতাল
ঢাকা

Prof. Dr. Md. Sazzuddin
Principal (In-Charge)
Z.H. Sikder Women's Medical College & Hospital
Dhanmondi, Dhaka-1209.

বিষয় : ঢাকা বিশ্ববিদ্যালয়ের ভাষাবিজ্ঞান বিভাগের অধীনে পিএইচ ডি গবেষণার উপাত্ত সংগ্রহের অনুমতি প্রদানের

মহোদয়,
সবিনয়ে নিবেদন এই যে জনাব ডা. ফাহমিদা ফেরদৌস (রেজিস্ট্রেশন নম্বর : ১০, ২০১৭-২০১৮) ঢাকা বিশ্ববিদ্যায়ের ভাষাবিজ্ঞান বিভাগের অধীনে "The Language of Bengali Children with Neurodevelopmental Disorders : A Neurolinguistic Study" শীর্ষক বিষয়ে পিএইচ ডি গবেষণা করছেন। তাঁর গবেষণায় মূল বিষয় হলো "নিউরডেভালাপমেন্টাল ডিস্‌অর্ডার (অটিজম, বুদ্ধিপ্রতিবন্ধী, অতিচঞ্চল অমনোযোগী, সেরিব্রালপাল্‌সি)-এ আক্রান্ত শিশুদের ভাষার বিকাশ পর্যবেক্ষণ। গবেষণার কাজ সম্পন্ন করার লক্ষ্যে আপনার প্রতিষ্ঠানের মনোরোগ বিদ্যা বিভাগের শিশু রোগীদের কাছ থেকে উপাত্ত সংগ্রহ করা প্রয়োজন।

অতএব, এ বিষয়ে প্রয়োজনীয় অনুমতি প্রদানের জন্য আপনাকে বিশেষভাবে অনুরোধ করছি।

আন্তরিকতা ও ধন্যবাদসহ

তত্ত্বাবধায়ক
অধ্যাপক (অব.) ড. জীনাত ইমতিয়াজ আলী
ভাষাবিজ্ঞান বিভাগ, ঢাকা বিশ্ববিদ্যালয়
এবং
মহাপরিচালক
আন্তর্জাতিক মাতৃভাষা ইনস্টিটিউট
বাংলাদেশ

অধ্যাপক (অব.)
ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ড. জীনাত ইমতিয়াজ আলী
মহাপরিচালক
আন্তর্জাতিক মাতৃভাষা ইনস্টিটিউট
শিক্ষা মন্ত্রণালয়
১/ক সেগুনবাগিচা, ঢাকা।

যুগ্ম তত্ত্বাবধায়ক
অধ্যাপক ড. সৈয়দ শাহরিয়ার রহমান
ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়

অধ্যাপক
ভাষাবিজ্ঞান বিভাগ
ঢাকা বিশ্ববিদ্যালয়

যুগ্ম তত্ত্বাবধায়ক
ডাঃ ফারুক আলম
অধ্যাপক ও পরিচালক (অবঃ)
জাতীয় মানসিক স্বাস্থ্য
ইনস্টিটিউট ও হাসপাতাল, ঢাকা
Prof. (Dr.) Md. Faruq Alam
Ex-Director-Cum-Professor
National Institute of Mental Health
Dhaka.

Arts Building (2nd Floor), Dhaka-1000, Bangladesh, Phone: +880-(2)-9661900-60/6410, 6411
Fax: +880-(2)-9667222; E-mail:chair.ling@du.ac.bd, registrar@du.ac.bd, Website: www.du.ac.bd

APPENDIX VII: ETHICAL BOARD PERMISSION FOR RESEARCH

ঢাকা বিশ্ববিদ্যালয়

বিজ্ঞপ্তি

এতদ্বারা সংশ্লিষ্ট সকলকে জানানো যাচ্ছে যে, বোর্ড অব এ্যাডভান্সড স্টাডিজের (২৩/১০/২০১৭) সুপারিশ এবং একাডেমিক পরিষদের (৩১/১০/২০১৭) সিদ্ধান্ত অনুযায়ী ভুলত্রুটি যাচাই ও সংশোধন এবং তত্ত্বাবধায়কের কোটা খালি থাকা সাপেক্ষে নিম্নলিখিত প্রার্থীদেরকে নামের পাশে বর্ণিত গবেষণার শিরোনামে ও তত্ত্বাবধায়কের অধীনে ২০১৭-২০১৮ শিক্ষাবর্ষে শুন্তকালীন পিএইচ.ডি প্রোগ্রামে রেজিস্ট্রেশনের অনুমতি প্রদান করা হয়েছে। প্রার্থীকে আগামী ২১/১/২০১৮ তারিখের মধ্যে হিসাব পরিচালকের দপ্তরের (কক্ষ নং-১২৪) মাধ্যমে জনতা ব্যাংকের ঢাকা বিশ্ববিদ্যালয় শাখায় (টি,এস,সি) রেজিস্ট্রেশনের প্রয়োজনীয় ফিস জমা দিতে হবে।

ক্রমনং	নাম ও বিভাগ	গবেষণার শিরোনাম	তত্ত্বাবধায়ক
১.	মুহাম্মদ আবু বকর ছিদ্দিক (ইসলামিক স্টাডিজ) প্রভাষক টি এন্ড টি মহিলা কলেজ, ঢাকা	ইসলামে বাজার ব্যবস্থাপনা : একটি পর্যালোচনা (Market Management in Islam ; An Analysis)	ড. মো. রফীকুল ইসলাম সহকারী অধ্যাপক ইসলামিক স্টাডিজ বিভাগ, ঢাকা বিশ্ববিদ্যালয়
২.	ফাহমিদা ফেরদৌস (ভাষাবিজ্ঞান)	The Language of Bengali Children with Neurodevelopmental Disorders : A Neurolinguistic Study	Professor Dr. Jinat Imtiaz Alj Dept. of Linguistics, University of Dhaka যুগ্ম-তত্ত্বাবধায়ক: 1 Dr. Syed Shahrier Rahman Professor Dept. of Linguistics, University of Dhaka 2. Dr. Md. Faruq Alam Professor & Head Adolescent & Family Psychiatry National Institute of Mental Health & Hospital Sher-E-Bangla, Dhaka
৩.	মোঃ ওবাইদুল ইসলাম (ইলেকট্রিক্যাল এন্ড ইলেকট্রনিক ইঞ্জিনিয়ারিং) প্রভাষক, ই.ই.ই. বিভাগ, হামদর্দ বিশ্ববিদ্যালয় বাংলাদেশ	Design of a Non-Invasive Medicine Authentication System using Nuclear Quadruple Resonance Spectroscopy.	অধ্যাপক ড. মোহাম্মদ শফিউল আলম, ইলেকট্রিক্যাল এন্ড ইলেকট্রনিক ইঞ্জিনিয়ারিং বিভাগ, ঢাকা বিশ্ববিদ্যালয় যুগ্ম-তত্ত্বাবধায়ক: অধ্যাপক ড. এ.টি এম জাফরুল আজম, ফার্মাসিউটিক্যাল কেমিস্ট্রি বিভাগ, ঢাকা বিশ্ববিদ্যালয়
৪.	কাওসার পারভীন চৌধুরী (রসায়ন) সহকারী অধ্যাপক বাংলাদেশ টেক্সটাইল বিশ্ববিদ্যালয় তেজগাঁও, ঢাকা	Multifunctional Nanomaterials for Textile Finishing: Synthesis, Characterization and Application	Professor Dr. Md. Abu Bin Hasan Susan, , Department of Chemistry, DU যুগ্ম-তত্ত্বাবধায়ক: Professor Dr. Md. Zulhash Uddin, Bangladesh University of Textiles, Tejgaon I/A, Dhaka
৫.	মোছাঃ জান্নাতুল ফেরদৌস (পদার্থ বিজ্ঞান) মুখ্য বৈজ্ঞানিক কর্মকর্তা বাংলাদেশ পরমাণু শক্তি কমিশন, ঢাকা	Developing a methodology to measure radioactivity in human body using a bioassay technique and to evaluate internal radiation doses therefrom	Professor Dr. Naureen Ahsan Department of Physics, DU যুগ্ম-তত্ত্বাবধায়ক: Professor Dr. Abdus Sattar Mollah, Department of Nuclear Science & Engineering, MIST, Mirpur Cantonment, Dhaka 1216

২৪.১২.২০১৭

Dhaka University Institutional Repository

University of Dhaka

Bachelor of Medicine and Surgery

This is to Certify that
Fahmida Ferdous
of Dhaka National Medical College
obtained the Degree of Bachelor of Medicine and Surgery in this University at the Examination of September, 2003

Administrative Building
Ramna, Dhaka
The 2nd Nov. 2003

Vice-Chancellor

Controller of Examinations

Dhaka University Institutional Repository

বিভাগ শিশু
স্যার সলিমুল্লাহ মেডিকেল কলেজ
মিটফোর্ড হাসপাতাল
ঢাকা, বাংলাদেশ

Department of PAEDIATRICS
Sir Salimullah Medical College
Mitford Hospital
Dhaka, Bangladesh

No. MMH 382

Date 09/4/14

TO WHOM IT MAY CONCERN

This is to certify that **Dr. Fahmida Ferdous,** D/O. Md. Mahmudur Rahman Chisty, served at "**SISHU BIKASH KENDRO**" Sir Salimullah Medical College Mitford Hospital as a Child Health Physician from 01.02.2010 to 31/01/2014 under my supervision.

I found her punctual, sincere,honest and hard working. She has practiced academic exercise regularly during her working period. She is maintaining very cordial and harmonic relationship with her colleagues. Her performance is excellent.

To the best of my knowledge she bears a good moral character. I wish her bright future in life.

Countersigned

Brig Gen Md. Zakir Hassan
Director 9.4.14
S S M C Mitford Hospital, Dhaka.

8/4/14
Prof. Dr. Syeda Afroza
MBBS, FCPS, FRCP ((Edin)
DMEd (UK) MMED(UK)
Professor & Head of Paediatrics
S S M C Mitford Hospital, Dhaka.

Dhaka University Institutional Repository

State University of Bangladesh

Dhaka, Bangladesh

Provisional Certificate

This is to Certify that

Dr. Fahmida Ferdous

has been conferred the degree of

Master of Public Health

In testimony whereof, the seal of the University is hereto affixed.

Given at Dhaka, Bangladesh, this 19th *day of* Sept.

two thousand and ten

Identification No. PG 11 13 08 004

She/He has obtained CGPA 3.53 / 4.00

Vice-Chancellor

77, Satmasjid Road
Dhanmondi, Dhaka-1205

Controller of Examinations

N.B. This provisional certificate is to be surrendered at the time of taking delivery of the original certificate

Dhaka University Institutional Repository

BANGLADESH COLLEGE OF PHYSICIANS AND SURGEONS (BCPS)
Examinations Department

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9856617, 9884194, 989186
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Website : www.bcpsbd.org

CPS No.355/Exam-2016/
Dated: 10/08/2016

DR. FAHMIDA FERDOUS
36, West Dholipar, Faridabad, Dhaka-1204

Roll No : 430002
Registration No.: E-2016-1-43-0001
Specialty : **Psychiatry**

EXAMINATION RESULT

DEAR DR. FAHMIDA FERDOUS

I have the privilege to congratulate you on being successful in the **MCPS** examination of July 2016 in the above mentioned specialty. The results are subject to confirmation by the Council of the Bangladesh College of Physicians and Surgeons (BCPS).

Welcome to the College as our new Member.

We look forward to your active participation in the future years.

Your faithfully,

(Prof. Md. Azizul Kahhar)
Controller of Examinations

Checked By:....

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