

Language impairment among children with Neurodevelopmental Disorders

Jyoti Prajapati¹, Praveen Suman², Payal Mushre³

Authors and Highest Academic Degree:

1- Dr Jyoti Prajapati, MD Pediatrics, FIAP-NDBP

2- Dr Praveen Suman, MD Pediatrics, FIAP

3- Payal Mushre MSc Clinical Psychology, PGDRP

Affiliations(s)

1-Assistant Professor, Paediatrics, MGMMC Indore; Developmental paediatrician and clinical head, NeuroNest Childneurodevelopment clinic, Indore.

2- Developmental Paediatrician and Director, CDC, Sir Ganga Ram Hospital, New Delhi

3- Rehabilitation psychologist at NeuroNest Child NeuroDevelopment clinic, Indore

Address for correspondence

Dr Jyoti Prajapati

Assistant professor pediatrics

MGM Medical College, Indore

drjyotimdpedia108@gmail.com

Mob. 9179547508



Received : 01 JULY 2026; Accepted: 21 SEPTEMBER 2026

Abstract

How to cite this article:

Prajapati J, Suman P, Mushre P. Language impairment among children with Neurodevelopmental Disorders. Indian J DevBehavPediatri. 2026;Vol 4(3): 21-33. DOI: <https://doi.org/10.5281/zenodo.23021984>

Keywords:

- Children
- Neurodevelopmental disorders (NDDs)
- Pragmatic
- Structural
- language impairments
- ASD
- SLI

Background: Children with neurodevelopmental disorders (NDDs) often face language impairments. Children with neurodevelopmental disorders (NDDs) often develop language impairments as a comorbid condition. Language and communication skills are significantly associated with cognitive and social skills. The present study investigated and identified language impairment (LI) among verbal children with NDDs.

AIMS: To identify the proportion of children with LI among children with NDDs and identify NDDs with the most significant structural and pragmatic Communication delays.

Methods: This study aimed to identify LI among children with NDDs aged 6 to 16 years. We included verbal children and recorded details of their medical and psychological assessments; we assessed their language profile using the Children's Communication Checklist 2 (CCC-2). The principal investigator recorded information on a CCC-2 caregiver response form, and we analysed the data for communication and psychological profiles. We identified language impairments (LI) using a General Communication Composite (GCC <55). We assessed pragmatic (PLS <10%) and structural language impairment (SLS <10%) using the Pragmatic Language Score (PLS) and Structural Language Score (SLS).

Results and conclusions: We enrolled 135 children (males 112, females 23) with NDDs using a consecutive sampling method over four months. The present study found that 65.7% of children (n=89) had lower GCC scores (GCC<55), and 60% of children had GCC<5. In the study population, pragmatic LI (79%) was more common than structural LI (68.8%). Children with ASD showed the most severe pragmatic and structural LI as compared to non-ASD children. LI was more common among males, children with speech onset after 5 years of age, with h/o speech regression, and with severe and multiple NDDs. Our results indicate that evaluating Language skills may help assess children with NDDs and further inform the development of an adequate intervention plan for language skills.

Introduction

Neurodevelopmental disorders (NDDs) affect brain development and impair developmental domains such as cognition, communication, social functioning, and motor functioning. Executive function (EF) encompasses the neurocognitive processes that regulate thoughts and actions towards a goal. Any disruption to these processes reflects neurodevelopmental and/or executive dysfunctions. Children with these dysfunctions face challenges related to their cognitive, emotional, behavioural, psychosocial, and adaptive abilities^[1-3].

Neurodevelopmental disorders are characterised by impairments in one or more developmental domains, such as gross and fine motor functioning, Cognition, and social and communication skills, due to neurobiological changes during critical brain development^[1]. Many children with NDD have language difficulties, including using language in social interactions. Language abilities are often overlooked in clinical settings because these children present with other, more prominent symptoms such as hyperactivity, aggression, or other behavioural issues, and language problems may go undiagnosed^[2].

Language consists of form (phonology, morphology, syntax), content (semantics), and use in social settings. Language form and content represent structural language skills, while appropriate use of language in a social setting is called Pragmatic language skill. Impairments in Pragmatic language are seen in many NDDs, specifically ASD. However, pragmatic language impairment is a known feature of ASD, irrespective of language ability. However, language abilities are given a different importance than social communication. Little is known about structural language impairment among children with NDDs^[2].

Children with ASD have abnormal development of socialisation, communication, and imaginative play, along with rigid and repetitive patterns of interests and activities. These symptoms significantly affect a child's ability to interact with others. Although

language development and communication skills are highly variable in children with ASD and depend on cognitive skill and level of ASD, all show difficulties with the pragmatic component of language skills, irrespective of their level of ASD severity^[3].

There is limited information regarding language impairment in Indian children suffering from neurodevelopmental disorders. Nevertheless, these children are often disadvantaged in the absence of adequate intervention, and a lack of proper communication can further exacerbate the existing behavioural issues. This study will identify language impairment among these children to highlight the need for language intervention.

AIMS & OBJECTIVE: To identify the proportion of children with language impairments among verbal children with NDDs and identify NDDs with the most structural and pragmatic delays.

Primary objective:-

We identified language impairments among children with NDDs using CCC2 by deriving a General Communication Composite (GCC < 55). We assessed pragmatic and structural language deficits using the Structural Language Score (SLS) and Pragmatic Language Score (PLS) to identify NDDs with the most pronounced Structural or Pragmatic language delay.

Secondary objective:-

- a) We compared pragmatic and structural language impairments across neurodevelopmental disorders (mean GCC, SLS, and PLS). We identified NDDs based on the most pronounced structural or pragmatic impairments.
- b) We examined gender differences in language impairments among study participants in a post hoc analysis.

Materials & Methods:

Study Design: Prospective cross-sectional study.,

Study duration: Data were collected after obtaining informed parental consent and after institutional ethical committee permission. The hospital's

scientific and ethical committee approved the study protocol on 8 April 2024. The study was conducted from 15 April to July 2024 on children attending the child development clinic at a tertiary care hospital.

Participants: Children aged 6 to 16 years diagnosed with a neurodevelopmental disorder who attended a tertiary care child development clinic.

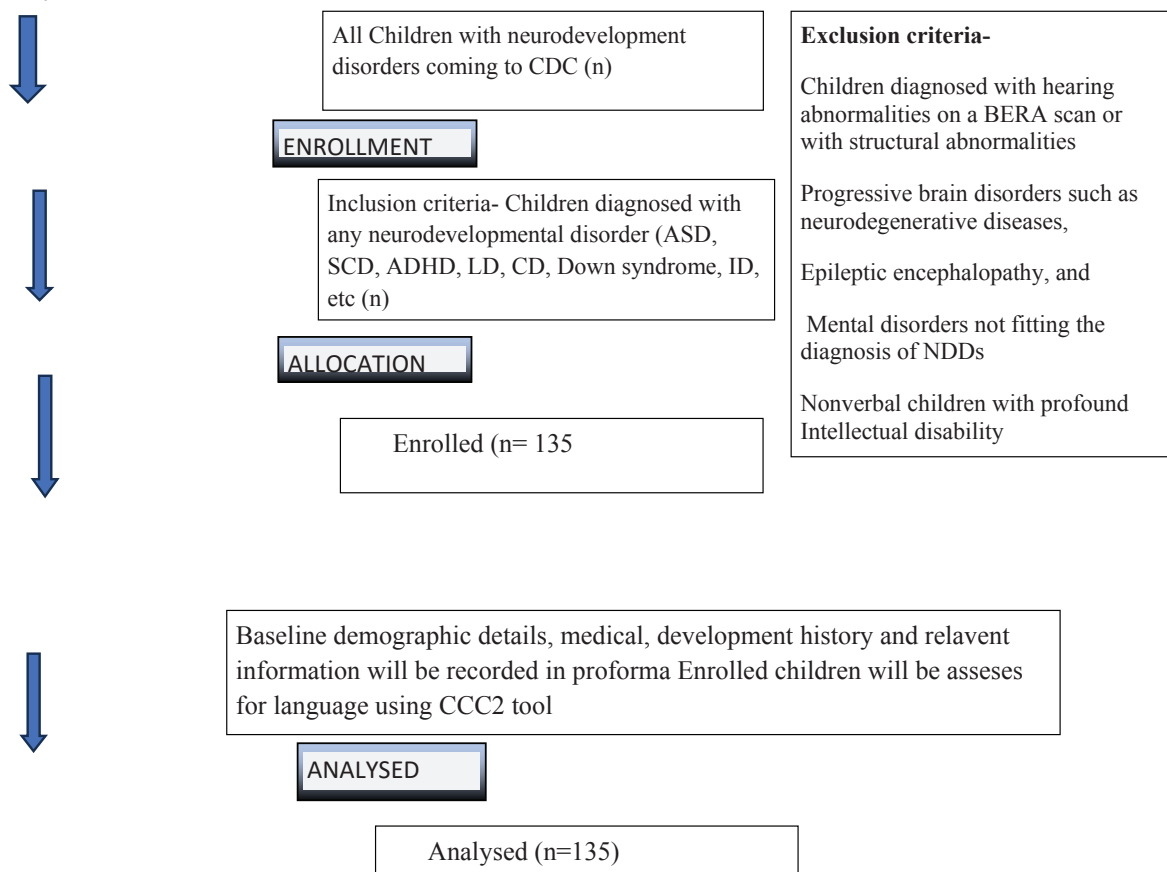
Sample size: Minimum 120 children meeting the inclusion criteria.

Inclusion Criteria: Children diagnosed with any neurodevelopmental disorder (ASD, SCD, ADHD, LD, CD, Down syndrome, ID, etc)

Exclusion Criteria: Non-verbal children with profound intellectual disability, children diagnosed with hearing abnormality on BERA scan, or children with structural/progressive brain disorders such as neurodegenerative diseases, epileptic encephalopathy, and mental disorders not fitting the diagnosis of NDD will be excluded from the study.

Materials & Methods: Data were collected from parents of children coming to the child development clinic after obtaining informed consent from parents and informed assent from children before enrolment in the study, and detailed information regarding the child will be recorded in a pre-designed proforma as speech and language profile, IQ, Sensory profile, psychological assessment information, and other relevant information. Study participants will be assessed using standard scales in accordance with routine IAP guidelines and the child development clinic protocol of a tertiary care hospital. After the principal investigator recorded all essential information and psychological assessment records, the language profile was assessed using the CCC-2 to identify structural and pragmatic language problems at no additional cost to parents. Parents completed the caregiver response form with the principal investigator's help and received a copy of the assessment results after scoring. This process took parents only 10 to 15 minutes, in addition to routine assessments and consultation.

Study Flowchart



Language assessment Tool: The speech and language profile of the child will be assessed using the CCC-2 caregiver response form by the interviewer^[4]

Childhood Communication Checklist 2:

The Children's Communication Checklist (CCC-2) is a clinical assessment tool that identifies structural and pragmatic language abnormalities that other neurodevelopmental and psychological tests may not consider. An adult familiar with child development and speech abilities must complete the test. The interviewer completes the caregiver response form to reduce observer bias.

The CCC-2 comprises 70 items in a detailed, interview-based questionnaire distributed across 10 scales. The A-D scales assess the structural aspects of language, and the E-H scales assess pragmatic language. The I and J scales record information about social communication. (A: speech, B: syntax, C: semantics, D: coherence), pragmatic language skills (E: inappropriate initiation, F: stereotyped language, G: use of context, H: nonverbal communication), and two scales measuring social aspects (I: social relations and J: interests)^[4]

Based on these 10 scales, the General Communication Composite (GCC) measures overall communication abilities by adding the subscale scores of A-H. A high score indicates typical language; a low score indicates a significant language impairment characterised by atypical communication abilities. A GCC below 55 is the cutoff for distinguishing children with significant language impairment from typically developing children^[4].

The structural language score (SLS) is obtained by adding the structural scales (A+B+C+D), and the General Pragmatic Score (GPS) is obtained by adding the pragmatic scale scores (E+F+G+H) without the two social non-linguistic subscales (I, J). We used SICD (Social Interaction) and the General Pragmatic Score (GPS) to detect discrepancies between pragmatic and grammatical skills, which are common in ASD, SCD, and PLI. We assessed language impairments using the CCC-2 by deriving a General Communication Composite (GCC), a Structural Language Score (SLS), and a Pragmatic

Language Score (PLS). Children scoring <55 on the GCC were considered to have language impairment. SICD (Social Interaction Communication Deficit) will be derived by subtracting SLS from GPS. NDDs were also identified as having the most structural or pragmatic language delay^[4].

Psychological assessment tools to diagnose neurodevelopmental disorders among affected children before enrolment in the study-

1. IQ was assessed using the MISIC (Malins Intelligence Scale for Indian Children) IQ scale. For Children unable to perform on IQ tests, the Vineland Social Maturity Scale (VSMS) will be used to assess adaptive functioning level^[5,6].
2. Learning disabilities were assessed in school-going children using the GLAD scale and curriculum-based educational assessment^[7].
3. The Conners parent scale/ DSM5 criteria assessed the behavioural profile and ADHD^[8].
4. ISAA (Indian Scale for Autism Assessment) was used to evaluate the severity of Autism Spectrum Disorder^[9].

Sample Size Calculation: Minimum 120. Previously, researchers^[10] have conducted studies to assess impairment using the GCC in children with speech delay and neurodevelopmental disorders. The prevalence of GCS < 55 in other studies was 81%. Therefore, assuming the same (p)=81% with a 10% margin of error, the minimum required sample size at a 5% significance level is 120 patients.

$$\text{Formula used: } n = \frac{Z^2 \cdot p \cdot q}{d^2} = \frac{1.96^2 \cdot 0.81 \cdot 0.19}{(0.07)^2} = 120.65$$

Where p is the observed prevalence of GCC < 55 in children with speech delay and neurodevelopmental disorders, q = 1 - p, and d is the margin of error. It is the ordinate of the standard normal distribution at the α% significance level.

Statistical Analysis

We analysed descriptive statistics using SPSS version 28.0. Continuous variables will be presented as mean ± SD. We expressed categorical variables as frequencies and percentages. We compared

normally distributed continuous variables between groups (by GCC score) using Student's t-test. We compared non-normally distributed continuous variables using the Mann-Whitney U test. We compared nominal categorical data between groups using the appropriate Chi-square or Fisher's exact test. A p-value less than 0.05 will be considered significant for all statistical tests.

Ethical permission:

The hospital's scientific and ethical committee approved the study protocol on 8 April 2024. We conducted the study from 15 April to July 2024. All participants' parents provided written and oral consent for enrollment. Pictorial assent was taken from children 7-11 years of age, and simple assent was also taken from children 12-16 years of age.

Results:

Table 1 – Baseline characteristics of the total study population. n= 135

	Variable		N	%
1	Gender	Female	23	17
		Male	112	83
2	Age at assesment	6- 8yr	62	45.9
		9-11yr	35	25.9
		12to 16year	38	28.2
3	Mean Age at Diagnosis	M	112	83%
		F	23	17%
4	h/o Prematurity	Term	109	80.7
		Preterm	26	19.3
5	h/o Speech delay(early language milestone)	Speech delay	121	89.6
		No speech delay	14	10.3
	H/o speech regression	Yes(all ASD)	22	16.2
		No	113	83.7
6	Development history	Normal	25	18.5
		Typical motor	94	69.6
		Delayed	16	11.8
8	NDD Diagnosis	ASD	82	60.7
		Non ASD	53	39%

Table 2 - Language outcome of total study population (N135)

Mean GCC	72.9
GCC <55	89(65.9%)
GCC<5 %	82(60.7%)
SLS <10%	93(68.8%)
PLS <10%	107(79.2%)
ID (IQ <70)	42(31.1%)

BIQ(71-84)	36(26.6%)
Normal IQ(>85)	57(42.2%)

GCC- General Communication Composite, SLS= Structural Language Score, PLS = Pragmatic Language Score

GCC <55= Language impairment, GCC<5 = Significant language impairments

AS- autistic score

SLS<10%= >2 subscales in A to D are scoring <10%

PLS <10%= >2 subscales in E to H are scoring <10%

ASD- number of children with ASD

Non-ASD: children with other NDDs, such as ADHD, LD,ID, SCD.

Table 3 - Comparison of Language impairment among ASD and Other NDDs(Primary NDD)

	ASD (n=82)		Non ASD(n=53)		p-value
	N	%	N	%	
Mean GCC	40.2		55.5		
GCC <55	64	75.6%	25	47.1%	<0.001
GCC<5 %	62	75%	20	37.7%	<0.001
SLS <10%	66	80.4%	27	50.9%	<0.001
PLS <10%	77	93.9%	30	56.6%	<0.001
ID (IQ <70)	34	41.4%	8	15%	0.149

Mean GCC , SLS and pragmatic subscales were significantly lower in ASD as compared to non-ASD.

Children with ASD exhibited the most severe pragmatic and structural language impairments compared to those without ASD.

Table 4 - Correlation of early speech Milestones with Language outcome

Speech MILESTONE	N	%	Mean GCC	GCC <55 (N)	P
No speech delay(SD- N)	14	10.3%	60.50	4	0.005(s) FE test
Speech delay (SD- Y)	121	89.6%	43.42	85	
1st word at <18 month(Y)	14	10.3	63.64	3	<0.001(s)
1st word at 18-24 month	16	11.8	64.44	5	
1st word at 2-3 year	55	40.7	47.27	36	
1st word at >3 yr	50	37	31.58	45	
3 word sentence by 3 yr	31	22.9	62.16	10	<0.001(s)
3 word sentence by 4 yr	40	29.6	52.43	23	
3 word sentence by 5 yr	41	30.3	34.20	35	
3 word sentence by >6 yr	23	17	29.35	21	

Earlier ages of language milestones (1-word and 3-word sentences) were significantly associated with higher IQ and better communication skills, as assessed by mean GCC, SLS, and GPS scores. These differences were statistically significant.

Children speaking 3-word sentences after age 3 had a significantly lower mean GCC than those who acquired 3-word sentences earlier. Mean GCC decreased as the age of speech milestones attainment increased ($p^* < 0.001$).

Table 5 - early language marker and correlation of IQ

		Mean IQ	ID(IQ <70)	P	95%CI
3 word sentence	At 3 year	91.35± 11.13	1	<0.001(s)* KW test	86.85-95.84
	At 3-4 year	87.31±10.16	1		84.22-90.39
	At 4- 5year	68.25±13.65	17		63.63-72.87
	>5 year	58.31±12.05	24		53.73-62.89
h/o Speech delay(early language milestone)	18m -2 yr	84.38±12.16	5	<0.001(s)* KW test	81.24-87.52
	>2 yr	65.48±16.03	38		61.38-69.59
	No speech delay	93.36±11.73	0		86.58-100.13
H/o speech regression	Yes	56.86±10.99	19	<0.001(s)* MW test	51.99-61.74
	No	80.65±15.83	24		77.69-83.60
Bi/multi lingual	1	72.48±18.92	14	0.309 KW test	65.54-79.42
	2	78.08±17.07	28		74.65-81.49
	>2	77.67±16.11	1		60.76-94.57

Children speaking 3-word sentences after age 3 had a significantly lower mean IQ than those with earlier acquisition of 3-word sentences. Mean IQ decreased as the age of early speech milestones increased ($p^* < 0.0001$)

Children presenting without speech delay had a mean IQ of 93.35, while children presenting with delayed speech had a mean IQ of 74.86($*p < 0.001$)

Results:

A total of 89(65.9%) participants had language impairments (GCC<55), while 82(60.7%) participants had significant language impairments (GCC<5%)

93 participants (68.8) had structural language impairments, while 107(79.2%) had pragmatic language impairments.

121 (89.6%) participants had a history of speech delay, while only 14 (10.3%) children had achieved meaningful full 1-word speech before 16 months.

Children presenting without speech delay had a mean IQ of 93.35, while children presenting with delayed speech had a mean IQ of 74.86($*p < 0.001$)

Children speaking 3-word sentences after age 3 had a significantly lower mean IQ than those with earlier acquisition of 3-word sentences. Mean IQ decreased as the age of early speech milestones increased ($p^* < 0.0001$)

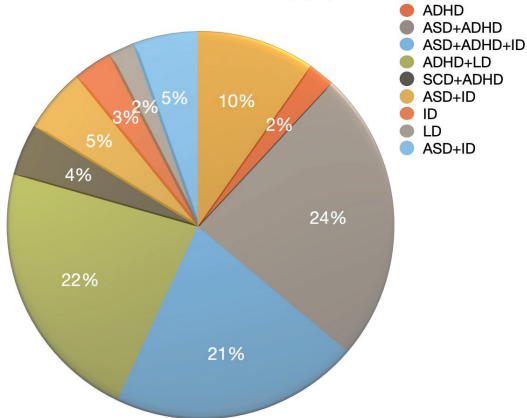
A total of 57 participants had average intelligence (IQ >85). 26.6% scored at a borderline IQ value, while 36 participants scored <70 in IQ or SQ scoring

Children with ASD had significantly lower GCC

scores, PLS, SLS and IQ scores as compared to non-ASD participants.

More males (34%) had lower GCC scores (< 55) than females (12%). However, this difference was not statistically significant because of the high proportion of male participants.

Chart - 1 Distribution of NDD in study population



No difference was noted in mean PLS scores between the genders, but a significant difference was observed in the SLS subscale mean value, with females scoring better (25.5) than males (19.29) (Table 1 to Table 5; Chart 1 to Chart 4).

Chart- 2 Early language milestone History and GCC<55 comparison

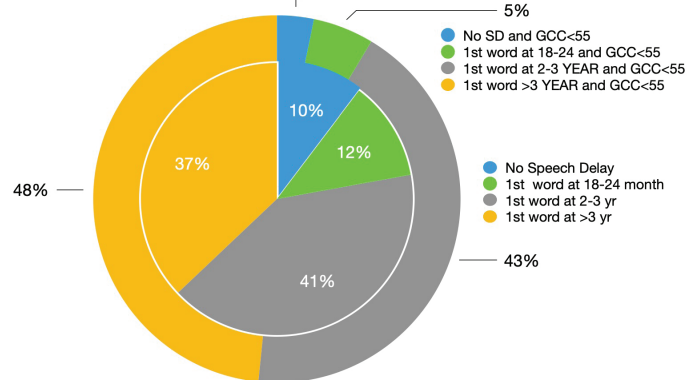


Chart -3 Comparison of language outcome in ASD vs Non ASD NDDs

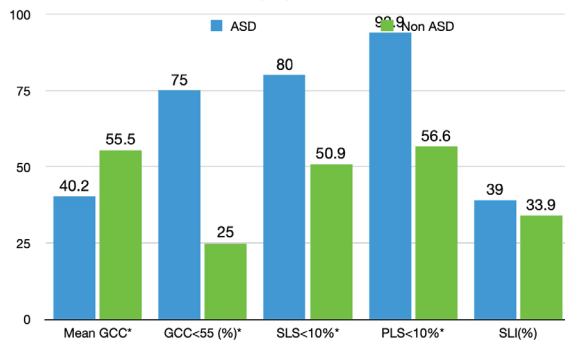
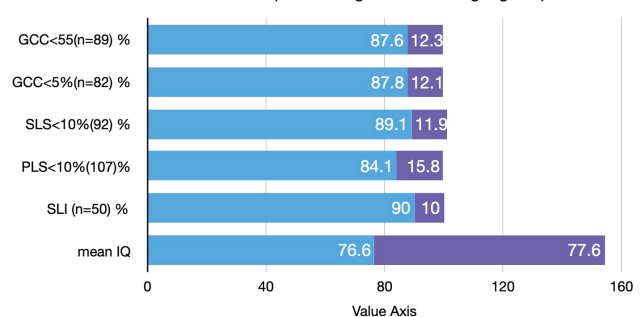


Chart - 4 Comparison of gender with language impairment



Discussion:

Over four months, we enrolled 135 children (males 112, females 23) with NDDs using consecutive sampling. Most participants were male (83%; 112), and 17% (23) were female. The mean age of diagnosis was 7.27 in males and 7.9 in females. Most participants (80.7%; 109) were term, and only 19.3% (23) were preterm. 45.9 % (62) of participants were 6-8 years of age, and the remaining 54% were nearly equally divided into the 9-11(25.9%) and 12-16 age groups (28.2%). We excluded children with structural causes of developmental disorders such as epilepsy and cerebral palsy. We included only children who could speak, so we did not include

most cases of more severe intellectual disability and neurodevelopmental disorders.

Language Impairment and Language Outcome-

In our study of language impairment in children evaluated for neurodevelopmental disorders at a specialist child development clinic at a tertiary care teaching hospital, we observed that most children exhibited language impairment, with general communication skills falling below the CCC-2 cut-off (GCC < 55), as 65.7% of children (n=89) in the present study population scored lower GCC scores, and 60% of children scored GCC <5%, showing a significant language impairment. In the study population, pragmatic LI(79%) was more common

than structural LI (68.8%). Structural language deficits were strongly associated with pragmatic language components. Our observations are comparable to similar studies assessing children's language with NDD.^[10,11]

Structural and Pragmatic Language impairments among ASD and other neurodevelopmental disorders-

Regarding the NDD diagnosis, the majority (60.7% of the study participants) had an ASD diagnosis, followed by 28% having ADHD, and the remaining NDD constituted approximately 10% of participants. Most participants had ASD with ADHD (53.2% of ASD participants), and 19.2% had coexisting ID with ASD and ADHD (31.7% of ASD participants), similar to the observations made in other studies.^[10,11]

ADHD and comorbidities - 18.5% of the study participants had LD with ADHD (65% of ADHD participants). 15.7 % of ADHD children also had coexisting SCD, and 10.7 of participants with ADHD had coexisting ID.

Language Impairments in ASD vs Other NDDs:

The distribution of language impairments differed significantly among study subjects, as measured by GCC <55, GCC <5%, SLS <10%, and PLS <10%, and by mean GCS, SLS, and GPS scores. Participants with ID and coexisting ID with other NDDs had the lowest GCC, SLS and PLS scores. Participants with ADHD with ASD had significantly lower mean GCC scores, SLS and PLS scores as compared to participants with ASD alone. ($p < 0.001$)

The observed extent of language impairment in the present study is comparable to previous findings among children with ASD, ADHD and all across children with NDDs^[11,15,18]

Structural and Pragmatic Language impairments among ASD and other neurodevelopmental disorders-

Coming to the NDD diagnosis, the majority, 60.7% of the study participants had an ASD diagnosis, followed by 28% having ADHD, and the remaining NDD constituted approximately 10% of participants. More than 50% of ASD cases also co-occur with

ADHD. Children with multiple NDDs score lower on GCC and have more pragmatic and structural language impairments. Participants with coexisting ASD, ADHD, and ID had the lowest score compared to other NDDs. Participants with SCD and LD only had the highest GCC score and performed better on pragmatic language and cognitive scores.

Although structural and pragmatic language skills were widely distributed across both groups, pragmatic language was most affected. This is in line with previous results among school-aged children with ASD. Pragmatic skills involve initiating and maintaining conversations, adapting language to the social context, and communicating non-verbally. Our findings align with previous CCC-2 studies showing more profound pragmatic impairments in children with ASD compared to typically developing children^[15,26] but also compared to children with other NDDs, such as specific language impairment^[11,26,28] and ADHD^[11,15,27].

Summing together, the CCC-2 structural scales A to D ("speech," "syntax," "semantics," "coherence") assess structural language functions separately from pragmatic components (E to H), which are commonly affected in children with specific language impairments, including problems with vocabulary and articulation^[28]. Structural language includes the ability to produce and combine speech sounds and word combinations to form phrases and sentences, as well as the ability to understand and use the meaning of words and sentences and to use coherent language.

We found that structural language deficits are common in children evaluated for ASD, with the 'syntax' and 'coherence' subscales being the most affected within the structural component of language compared with other NDDs. All pragmatic subscales were significantly more affected in ASD as compared to non-ASD. Previous researchers also observed similar profiles^[15, 18, 27, 28]. ASD is often associated with other comorbidities, such as ADHD, as well as the more severe effect on child functioning and language, as documented in previous studies; similar observations were also made in the present study. Children having more comorbid conditions

with ASD or multiple comorbidities resulted in lower communication scores and intellectual functioning^[17,30].

In the present study, a small number of children with ASD (21.9%; 18) had no language impairments (GCC>55), and more than 50% of participants with other NDDs did not have language impairments, in line with other studies^[10,18,31].

Language impairment that co-occurs with ASD may affect the complexity of ASD symptoms and the functional impairment of the child. Therefore, we recommend including an assessment of language skills as part of the ASD diagnostic evaluation^[32]. Previous studies did not evaluate language profiles as thoroughly as the present study. We also detailed and evaluated the pragmatic and structural components of language, which prior studies had not assessed. This shows the importance of language assessment as an essential part of ASD assessments, especially in verbal children.

Early speech milestones and language outcomes and their effect on IQ

Language deficit may not be apparent or fully manifest until social demands exceed the limited capacity of a Child's communication level in verbal children with NDDs^[32,33]. Children with severe language and developmental disabilities are more likely to be referred as early as possible, but often, children with NDDs without language delay are missed^[17].

In the present study, all participants were verbal and able to speak in 3-word sentences at enrollment. 121 (89.6%) participants had a history of speech delay, while only 14 (10.3%) children had achieved meaningful full 1-word speech before 16 months.

Earlier ages of language milestones (1-word and 3-word sentences) were significantly associated with higher IQ and better communication skills, as assessed by mean GCC, SLS, and GPS scores. These differences were statistically significant. (Table 4) Mean GCC, SLS, and GPS scores also differed significantly, with each score increasing significantly as IQ increased. In the present study, most participants with ID (78%) had achieved a

one-word sentence milestone after three years of age and three-word sentences after five years of age (95%). Children speaking 3-word sentences after age 3 had a significantly lower mean IQ than those who acquired 3-word sentences earlier. Mean IQ decreased as the age of early speech milestones increased ($p^* < 0.0001$). Present and previous studies also confirm our findings^[34,35].

These and the present findings suggest that early language delays represent an important predictor of the child's later language ability and intellectual level, distinct from autism symptoms^[10,12,18,19].

Gender Differences in Language Profile and Clinical Presentation

Most participants (83%)were males, and 17% were females. The mean age of diagnosis was earlier in males than in females (7.27 vs 7.9), probably because females reach language milestones earlier, making behavioural symptoms of NDDs less observable and often leading to delayed identification.

Although there was no significant difference in the mean GCC score between males and females when assessing language impairment (GCC < 55), there was a significant difference between male and female participants (34% vs 12%).(Table2)

Our results suggest that assessing male and female language profiles separately may improve understanding of the clinical presentation of female ASD. Other researchers also observed that female children had better structural language profiles despite similar GCC scores and performed better on the syntax subscale of the CCC-2^[36].

A recent review indicates that females with ASD may demonstrate stronger linguistic abilities. This shows typical gender differences in NDDs' presentation, as they may present as typically developing children, making their clinical presentation different from males. However, these language differences may also mask pragmatic communication problems and sometimes make diagnosis difficult, leading to delays^[37,38]. The literature also reported that Early language delay is associated with earlier diagnosis; typical language milestones in NDDs lead to later diagnosis^[17,18].

Because the study included few female participants, it is not possible to conclude that gender differences play a significant role in NDD presentation in a larger population. Although many other researchers did not find significant differences in language and communication skills among ASD[36,39], a few also reported that Female children with ASD had more advanced language skills and were diagnosed later than non-verbal or minimally verbal children^[40,41,42].

Strengths and Limitations

Our study's strengths include using a detailed approach to study language skills in children assessed for ASD, with and without ASD diagnoses, multiple NDDs, and a comparatively large sample size compared to previous studies.

Additional data on age at diagnosis, early language milestone age, and intellectual abilities enabled a more detailed understanding of NDD clinical presentation. Limitations included several selection biases, such as recall and referral biases, due to the study's observational, descriptive design. The participants may not represent children with neurodevelopmental disorders in the general population at a tertiary care hospital. Most children were referred by primary care physicians, introducing significant selection bias, as many with minor delays or symptoms may not have been referred.

We used the CCC-2 scale for language assessment, which is only used for verbal children speaking in sentences. This led to the exclusion of many children with more severe forms of NDDs and severe intellectual disabilities. We also included only children older than 6 years to set an upper limit on language skill acquisition, so our results may not apply to children younger than 6 years. So our interpretation may not reflect the actual proportion of language impairment among all Children with NDDs.

Clinical Implications:

Language and communication skills are significantly associated with cognitive and social skills. They strongly predict future academic and employment

outcomes, making language assessment critical during initial assessment of children with NDDs for management and intervention planning^[12,13,42].

Children assessed for suspected ASD and other NDDs often have both structural and pragmatic language impairments, which are likely to persist and require ongoing support as they grow older. These impairments represent an important target of intervention. Earlier interventions are more likely to be effective than later interventions because of the critical period of neuroplasticity in language and intelligence before 6 years of age. Intervention should focus on improving structural language skills and social skills, while also improving comprehension, often involving a multidisciplinary approach to improve outcomes. Interventions should focus on the child's age and profile of strength and need rather than the diagnostic category alone^[12,13,19].

Conclusion

We observed significant structural and pragmatic language deficits in children evaluated for neurodevelopmental disorders. Children with ASD exhibited the most severe pragmatic and structural language impairments compared to those without ASD. Language impairment was more common among males, children with speech onset after 5 years of age, those with a history of speech regression, and those with severe and multiple neurodevelopmental disorders. A lower General Communication Composite (GCC) score was also significantly associated with lower IQ. Structural language impairments were associated with reduced pragmatic language skills in all participants and were more prevalent among children with early language delay. On the other hand, pragmatic language impairments were most pronounced in children diagnosed with ASD.

Our findings suggest that assessing language skills may help evaluate children with neurodevelopmental disorders and develop effective language intervention plans. These children may benefit from specific language interventions in addition to the management of the core ASD symptoms.

Conflict- No conflict of interest

from children aged 7 years and older.

Consent - Parents provided consent before enrolling children in the study; pictorial assent was obtained

Funding- No

References:

1. Thapar, A., Cooper, M., & Rutter, M. (2017). Neurodevelopmental disorders. *The Lancet. Psychiatry*, 4(4), 339–346. [https://doi.org/10.1016/S2215-0366\(16\)30376-5](https://doi.org/10.1016/S2215-0366(16)30376-5)
2. Gleason JB, Ratner NB. The development of language. Plural Publishing; 2022 Dec 20
3. Behrman RE, ed. *Nelson Textbook of Paediatrics / Richard E. Behrman [and Three Others] Editors. Twenty-first edition.* Elsevier; 2020. Chapters 48-56
4. Wellnitz, S. A. C., Kästel, I., Vllasaliu, L., Cholemkery, H., Freitag, C. M., & Bast, N. (2021). The Revised Children's Communication Checklist-2 (CCC-R): Factor Structure and Psychometric Evaluation. *Autism research: official journal of the International Society for Autism Research*, 14(4), 759–772. <https://doi.org/10.1002/aur.2467>
5. Malin, A.J.. (1971). Malin's intelligence scale for Indian children. *Indian J Mental Retard.* 4: 15- 25.
6. Krugman, Morris (1956). "Vineland Social Maturity Scale". *Journal of Consulting Psychology.* 20 (5): 408–409. doi:10.1037/h0038827
7. Shah HR, Sagar JKV, Somaiya MP, Nagpal JK. Clinical Practice Guidelines on Assessment and Management of Specific Learning Disorders. *Indian J Psychiatry.* 2019;61(Suppl 2):211-225. doi:10.4103/psychiatry.IndianJPsychiatry_564_18
8. American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* (5th ed.). Washington DC: American Psychiatric Association.
9. National Trust Web-based Intervention Resource Centre. Indian Scale for Assessment of Autism. Available from: www.nationaltrust.co.in.
10. Reindal, L., Nærland, T., Weidle, B. et al. Structural and Pragmatic Language Impairments in Children Evaluated for Autism Spectrum Disorder (ASD). *J Autism Dev Disord* 53, 701–719 (2023). <https://doi.org/10.1007/s10803-020-04853-1>
11. Geurts, H. M., & Embrechts, M. (2008). Language profiles in ASD, SLI, and ADHD. *Journal of Autism and Developmental Disorders*, 38(10), 1931–1943. <https://doi.org/10.1007/s10803-008-0587-1>.
12. Norbury, C. F., & Paul, R. (2018). Disorders of speech, language, and communication. In A. Thapar, D. S. Pine, S. Scott, M. J. Snowling, & E. A. Taylor (Eds.), *Rutter's child and adolescent psychiatry* (6th ed., pp. 683–701). New York: Wiley.
13. Paul R, Norbury C. *Language disorders from infancy through adolescence: listening, speaking, reading, writing, and communicating.* Elsevier: St Louis; 2012.
14. Hyter, Y. D. (2007). Pragmatic language assessment: A pragmatics-as-social practice Model. *Topics in Language Disorders*, 27(2), 128–145.
15. Helland, W. A., Biringier, E., Helland, T., & Heimann, M. (2012). Exploring language profiles for children with ADHD and children with Asperger syndrome. *J Atten Disord*, 16(1), 34–43. <https://doi.org/10.1177/1087054710378233>.
16. Stoeckel RE, Colligan RC, Barbaresi WJ, et al. Early speech-language impairment and risk for written language disorder: a population-based study. *J Dev Behav Pediatr.* 2013;34(1):38–44.
17. Lord, C., Elsabbagh, M., Baird, G., & Veenstra-Vanderweele, J. (2018). Autism spectrum disorder. *Lancet*, 392(10146), 508–520. [https://doi.org/10.1016/s0140-6736\(18\)31129-2](https://doi.org/10.1016/s0140-6736(18)31129-2).
18. Boucher, J. (2012). Research review: Structural language in autistic spectrum disorder-characteristics and causes. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 53(3), 219– 233. <https://doi.org/10.1111/j.1469-7610.2011.02508.x>.
19. Norbury, C. F. (2014). Practitioner review: Social (pragmatic) communication disorder conceptualisation, evidence and clinical implications. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 55(3), 204–216. <https://doi.org/10.1111/jcpp.12154>.
20. Juneja, M., Gupta, A., et al., (2022). Diagnosis and Management of Global Development Delay: Consensus Guidelines of Growth, Development and Behavioral Pediatrics Chapter, Neurology Chapter and Neurodevelopment Pediatrics Chapter of the Indian Academy of Pediatrics. *Indian pediatrics*, 59(5), 401–415.
21. Chaudhari, S., & Kadam, S. (2012). Ages and Stages Questionnaire--a developmental screening test. *Indian pediatrics*, 49(6), 440–441.

22. Fenson, L., Marchman, V. A., Thal, D. J., Dale, P. S., Reznick, J. S., & Bates, E. (2006). MacArthur-Bates Communicative Development Inventories, Second Edition (CDIs). <https://doi.org/10.1037/t11538-000>
23. Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2002). Preschool Language Scale, Fourth Edition (PLS-4) <https://doi.org/10.1037/t15140-000>
24. Brown, Virginia L., Bzoch, Kenneth R., League, Richard Receptive-Expressive Emergent Language Test (4th ed.)2020
25. Adams, C. (2021). Pragmatic Language Impairment. In: Volkmar, F.R. (eds) Encyclopedia of Autism Spectrum Disorders. Springer, Cham. https://doi.org/10.1007/978-3-319-91280-6_502
26. Oi, M., Fujino, H., Tsukidate, N., Kamio, Y., Yoshimura, Y., Kikuchi, M., et al. (2017). Quantitative aspects of communicative impairment ascertained in a large national survey of Japanese children. *Journal of Autism and Developmental Disorders*, 47(10), 3040–3048. <https://doi.org/10.1007/s10803-017-3226-x>.
27. Kuijper, S. J., Hartman, C. A., Bogaerds-Hazenbergh, S. T., & Hendriks, P. (2017). Narrative production in children with autism spectrum disorder (ASD) and children with attention-deficit/hyperactivity disorder (ADHD): Similarities and differences. *Journal of Abnormal Psychology*, 126(1), 63–75. <https://doi.org/10.1037/abn0000231>.
28. Norbury, C. F., Nash, M., Baird, G., & Bishop, D. (2004). Using a parental checklist to identify diagnostic groups in children with communication impairment: A validation of the Children's Communication Checklist-2. *International Journal of Language and Communication Disorders*, 39(3), 345–364. <https://doi.org/10.1080/13682820410001654883>.
29. Baixauli-Fortea, I., Miranda Casas, A., Berenguer-Forner, C., Colomer- Diago, C., & Rosello-Miranda, B. (2019). Pragmatic competence of children with autism spectrum disorder: Impact of theory of mind, verbal working memory, ADHD symptoms, and structural language. *Appl Neuropsychol Child*, 8(2), 101–112. <https://doi.org/10.1080/21622965.2017.1392861>.
30. Levinson, S., Eisenhower, A., Bush, H. H., Carter, A. S., & Blacher, J. (2020). Brief report: Predicting social skills from semantic, syntactic, and pragmatic language among young children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 50(11), 4165–4175. <https://doi.org/10.1007/s10803-020-04445-z>.
31. Kjelgaard, M. M., & Tager-Flusberg, H. (2001). An investigation of language impairment in autism: Implications for genetic sub-groups. *Language and Cognitive Processes*, 16(2–3), 287–308. <https://doi.org/10.1080/01690960042000058>.
32. Hyman, S. L., Levy, S. E., & Myers, S. M. (2020). Identification, evaluation, and management of children with an autism spectrum disorder. *Pediatrics*. <https://doi.org/10.1542/peds.2019-3447>.
33. Baird, G., & Norbury, C. F. (2016). Social (pragmatic) communication disorders and autism spectrum disorder. *Archives of Disease in Childhood*, 101(8), 745–751. <https://doi.org/10.1136/archdischi-2014-306944>.
34. Ozonoff, S., Li, D., Deprey, L., Hanzel, E. P., & Iosif, A. M. (2018). Reliability of parent recall of symptom onset and timing in autism spectrum disorder. *Autism*, 22(7), 891–896. <https://doi.org/10.1177/1362361317710798>.
35. Kenworthy, L., Wallace, G. L., Powell, K., Anselmo, C., Martin, A., & Black, D. O. (2012). Early language milestones predict later language, but not autism symptoms in higher functioning children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, 6(3), 1194–1202.
36. Solomon, M., Miller, M., Taylor, S. L., Hinshaw, S. P., & Carter, C. S. (2012). Autism symptoms and internalising psychopathology in girls and boys with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 42(1), 48–59. <https://doi.org/10.1007/s10803-011-1215-z>.
37. Lai, M. C., & Szatmari, P. (2020). Sex and gender impacts on the behavioural presentation and recognition of autism. *Current Psychiatry Reports*, 33(2), 117–123. <https://doi.org/10.1097/ycp.0000000000000575>.
38. Parish-Morris, J., Liberman, M. Y., Cieri, C., Herrington, J. D., Yerys, B. E., Bateman, L., et al. (2017). Linguistic camouflage in girls with autism spectrum disorder. *Molecular Autism*, 8, 48. <https://doi.org/10.1186/s13229-017-0164-6>.
39. Lawson, L. P., Joshi, R., Barbaro, J., & Dissanayake, C. (2018). Gender differences during toddlerhood in autism spectrum disorder: A prospective community-based longitudinal follow-up study. *Journal of Autism and Developmental Disorders*, 48(8), 2619–2628. <https://doi.org/10.1007/s10803-018-3516-y>.
40. Salomone, E., Charman, T., McConachie, H., & Warreyn, P. (2016). A child's verbal ability and gender are associated with age at diagnosis in a sample of young children with ASD in Europe. *Child*, 42(1), 141–145. <https://doi.org/10.1111/cch.12261>.
41. McCormick, C. E. B., Kavanaugh, B. C., Sipsock, D., Righi, G., Oberman, L. M., Moreno De Luca, D., et al. (2020). Autism heterogeneity in a densely sampled U.S. population: Results from the first 1000 participants in the RI-CART study. *Autism Research*, 13(3), 474–488. <https://doi.org/10.1002/aur.2261>.
42. Conti-Ramsden, G., & Durkin, K. (2015). What factors influence language impairment considers resilience as well as risk. *Folia Phoniatrica et Logopaedica*, 67(6), 293–299.