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EDITORIAL ADDRESS

Dr. Zafar Mahmood Meenai
Director, Ummeid Child Developement Centre,
Z-30, Meena Tower, Polytechnic Main Road, Civil Lines, Bhopal-462002
Mobile : +91-8989039786 **Email :** editor.ijdbp@gmail.com
Journal Website : https://ijdbp.in **Chapter Website** : https://iapndp.org

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Aims and Scope of Indian Journal of Developmental and Behavioural Pediatrics (IJDBP)

IJDBP is a specialty journal in Developmental and Behavioural pediatrics published by Indian Academy of Pediatrics Chapter of Neurodevelopmental Paediatrics

The Journal welcomes Original papers, Review articles, Case reports and other articles relevant to child development & Behaviour including :

- Neuro developmental disorders,
- Developmental delays,
- Behavioural issues,
- Autism,
- Attention deficit hyperactivity disorder,
- Learning difficulties,
- Intellectual disabilities,
- Evidence based role of early intervention,
- Family centred multidisciplinary intervention,
- Neurogenetic disorders affecting child development,
- Neuroimaging & Neurological issues affecting child development,
- Corrective and assistive surgeries
- Home environmental and environmental issues affecting child development,
- Medical conditions
- Low birth weight and High-risk neonate requiring neonatal intensive care & its outcome,
- Preventive aspects in adolescents and pregnancy.
- Management of conditions covered in Rights of Persons with Disability Act,2016 of GOI.

It aim to promote advances in research in the field of child development and Behavioural issues so that latest evidenced based information is shared to enhance the quality of care and improve lives of children with special needs and their families.

The journal will be National Double Blind Peer review Open access journal published Quarterly. We will accept for publication manuscripts that were not published earlier in any form. The journal is devoted to publishing quality papers based on original innovative and most advance research in the field of developmental behavioural pediatrics.

The Journal aims to have the highest possible ethical and publication standards by scrutinizing the papers, through peer review assisted by eminent experts from prestigious teaching institutes from the country. For all Manuscripts submitted the journal will employ a plagiarism detection system for detecting plagiarism against previously published work.

INVITED GUEST EDITOR

HEARING LOSS IN NEWBORNS – NEED FOR EARLY DETECTION & INTERVENTION

Hearing impairment is one of the sensory impairments with prominent social, educational and psychological implications. The affected children are at high risk for deficits in language acquisition social skills. Hearing impairment can be congenital or acquired and can occur at any age from an array of causes. Identifying the cause is essential for effective management, better prognosis and genetic counseling in indicated cases.

The incidence of profound congenital hearing loss (PCHL) is 1 to 2 per 1000 in well baby population and 2 to 4 per 100 in neonatal intensive care unit population. Most children with congenital hearing impairment at birth can be identified by newborn hearing screening. However, certain cases of genetic / hereditary hearing loss may not manifest until later in life. Infectious diseases, especially meningitis, otitis media traumatic brain injury, damaging noise levels and ototoxic drugs can place a child at risk of developing Acquired hearing loss can occur secondary to genetic causes, infections, traumatic brain injury or ototoxic medications.

Failure detect children with congenital or acquired hearing loss may result in lifelong deficits in speech and language acquisition, poor academic performance, personal-social maladjustments and emotional difficulties. Early identification of hearing loss and appropriate intervention within the first 6 months of life has been demonstrated to prevent many of these adverse consequences and facilitate optimal language acquisition.

The Joint Committee of Infant Hearing (JCIH) position statement provides guidelines that include Universal Newborn Hearing Screening (UNHS) soon after birth before discharge from hospital or before 1 month of age, diagnosis of hearing loss through audiologic and medical evaluation before 3 months and intervention through an interdisciplinary program for infants with confirmed hearing loss before 6 months of age.

The Oto-acoustic emissions (OAEs), the Auditory Brainstem Response (ABR) and Automated Auditory Brainstem Response (AABR) tests have all been used in newborn hearing screening programs. ABR assesses the function of the auditory pathway starting from the eighth nerve through the auditory brainstem and OAE tests the integrity of cochlea.

The ABR and OAE are tests of structural integrity of the auditory pathway and are not tests of hearing. Even if ABR and OAE test results are normal, hearing cannot be definitely considered normal until a child is mature enough for a reliable behavioral audiogram. All infants, regardless of Newborn hearing screening outcome, should receive ongoing monitoring for development of age-appropriate communication skills.

With Regards & Best Wishes,

Dr. Abraham .K. Paul
Advisor IJDBP
Senior Consultant Pediatrician
Indira Gandhi Co-operative Hospital, Kochi – 682020

EDITORIAL

As we celebrated World DOWN Syndrome day on 21st March for inclusion I was reminded of sports, which provide a holistic fulfilling opportunity for inclusion and accomplishment. The 2024 Paris Paralympics featured 22 exciting sports. Here are the games that were included:

- Para Archery: With up to 140 athletes competing at the Invalides [1].
- Para Athletics: As the largest sport in the Paralympics, with up to 1,069 athletes competing across 164 medal events.
- Para Badminton: A fast-paced racquet sport,
- Blind Football: A thrilling team sport that requires skill and strategy.
- Boccia: A precision ball sport that demands focus and control.
- Para Canoe: A thrilling water sport that requires endurance and agility.
- Para Cycling: With events on the road and track, this sport demands speed and skill.
- Para Equestrian: A beautiful sport that showcases the harmony between riders and horses.
- Goalball: A fast-paced team sport that requires quick reflexes and strategy.
- Para Judo: A martial art that demands strength, agility, and technique.
- Para Powerlifting: A strength-based sport that requires power and endurance.
- Para Rowing: With up to 104 athletes competing in five medal events.
- Shooting Para Sport: A precision sport that demands focus and control.
- Sitting Volleyball: A thrilling team sport that requires skill and strategy.
- Para Swimming: With over 600 athletes competing across 141 medal events.
- Para Table Tennis: A fast-paced racquet sport that demands speed and agility.
- Para Taekwondo: A martial art that requires strength, agility, and technique.
- Para Triathlon: A demanding endurance sport that requires skill and strategy.
- Wheelchair Basketball: A thrilling team sport that requires speed, agility, and strategy.
- Wheelchair Fencing: A precision sport that demands focus, control, and technique.
- Wheelchair Rugby: A physically demanding team sport that requires strength, endurance, and strategy.
- Wheelchair Tennis: A fast-paced racquet sport that demands speed, agility, and technique.

This list can be a source for vocational planning for children with special needs

Best Regards

Dr. Zafar Mahmood Meenai
FRCPCH(UK), MSc paediatric Neurodisability (UK)
Editor-in-Chief, IJDBP

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Indian Journal of Developmental & Behavioral Pediatrics
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RESEARCH ARTICLE

Neurodevelopmental outcome of new-borns with neonatal seizures at 6 and 12 months of age – a prospective cohort study at Children Hospital Bemina, GMC Srinagar, Jammu and Kashmir, India.

Authors:
Dr. Ishfaq Ahmad Reshi, Prof. Sheikh Mushtaq, Dr. Mubashir Hassan Shah
Corresponding Address:
Prof. Dr. Sheikh Mushtaq Ahmad, Professor Department of Pediatrics,
500 Bedded Children Hospital Bemina Bypass Road 190018
waleekamil@gmail.com

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Abstract:

Introduction: Neonatal seizures represent the most prevalent neurological disorder in newborns and are critical for neurodevelopmental outcomes [1]. These seizures frequently occur during the neonatal period, with an incidence ranging from 1.5 to 5.5 per 1000 live births, and are more prevalent in preterm infants due to brain immaturity and increased risk of injury [2,3]. They signify neurological dysfunction, which may be reversible or persistent depending on the underlying cause. Prompt diagnosis and intervention are imperative to reduce mortality and mitigate long-term neurological consequences.

Methods: This prospective cohort study was conducted on neonates admitted with seizures between January 2022 and March 2023 in the Neonatology Division, Department of Pediatrics, GMC Srinagar. Following history taking, physical examination, and etiological screening, data were systematically recorded. Neonates were monitored in a high-risk neonatal outpatient department, conducted biweekly. The Amiel Tison neurological examination was performed at discharge and during follow-up. Neurodevelopmental assessment was conducted at 6 and 12 months using the Denver Developmental Screening Test II (DDST – II) in collaboration with a clinical psychologist. Univariate analysis was employed to examine the relationship between risk factors and neurodevelopmental outcomes. Categorical data were compared using the Chi-square or Fisher's exact test, with statistical significance set at $p \leq 0.05$. Relative Risk (RR) with a 95% confidence interval (CI) was calculated.

Results: During the study period, 367 neonates were admitted to the NICU with seizures. After applying the selection criteria, 120 neonates were included in the study. It was observed that 61.66% (n=74) exhibited normal development,

11.66% (n=14) experienced developmental delay in two domains with scores below 70%, 8.33% (n=10) had Global Developmental Delay, 5% (n=6) were diagnosed with cerebral palsy, 1.66% (n=2) developed postnatal epilepsy, 6.66% (n=8) succumbed to complications, and 5% (n=6) were lost to follow-up.

Conclusion: Hypoxic-ischemic encephalopathy was significantly associated with developmental delay in 33% of patients, with a relative risk (RR) of 2.26. Developmental delay was also observed in cases of meningitis and intraventricular hemorrhage; conversely, metabolic causes such as hypoglycemia and hypocalcemia demonstrated favorable outcomes when treated promptly. Prolonged and recurrent hypoglycemia was linked to impaired neurodevelopmental outcomes. Adverse prognostic factors included gestational age at birth, APGAR Score at 5 minutes, the necessity for resuscitation beyond 5 minutes, neonatal status epilepticus, onset of seizures within 24 hours, abnormal neurological examination at discharge, and abnormal EEG or neuroimaging findings.

Introduction

Neonatal seizures significantly impact neurodevelopmental outcomes [1]. They are common in neonates, with an incidence of 1.5 to 5.5 per 1000 live births, higher in preterm infants due to brain immaturity and injury risks. Outcomes depend on etiology, gestational age, EEG activity, and antiepileptic response [2]. Prompt diagnosis and treatment are crucial to reduce mortality and long-term neurological issues. Most seizures are acute, symptomatic, and caused by severe brain insults like HIE or ICHs, but some involve neonatal-onset epilepsy linked to structural, metabolic, or genetic disorders [3,4,5]. Few studies focus on neurodevelopmental outcomes, especially in developing countries. This study assessed outcomes of neonates with seizures, emphasizing etiology-based outcomes over a year.

Material and Methods

After INSTITUTIONAL ETHICAL COMMITTEE clearance (Notification No: F(BOPGS-Medicine) Acad/KU/23 Dated-31-08-2023), the study was conducted on neonates admitted with seizures in the Division of Neonatology, Department of Paediatrics at Govt.Children HOSPITAL, a 500 Bedded Tertiary Care Hospital of Govt. Medical College, Srinagar. Neonates admitted from January 2022 to March 2023 were included. Neonates aged 34-41 weeks and weighing 2-4 KG were included. Exclusions were congenital anomalies, inborn errors of metabolism, and syndromic features.

History, examination, and etiologic screening with investigations were done. Neurological Assessment used the Amiel Tison method, a clinical tool to evaluate newborns' neurological status, focusing on muscle tone, reflexes, posture, and head control.

Developmental Assessment

Developmental assessment was supervised by a clinical psychologist using the Denver Developmental Screening Test II (DDST – II), assessing child development in:

- Gross motor.
- Fine motor-adaptive.
- Language.
- Personal social.

It includes 125 items divided into categories, arranged chronologically by age. The test took 10 – 20 minutes.

Interpretation of DDST-II:

- Normal – if a child passes, fails, or refuses an item where the age line falls between the 25th and 75th percentiles.

- Delayed – When a child fails or refuses a task within the age line cut through >75th percentile.

Statistical analysis:

Baseline data was recorded in a case record form, and a master sheet was prepared in an MS Excel worksheet. This was analyzed using SPSS Version 22. Standard statistical methods were used, with continuous variables shown as Mean (± Standard Deviation) or Median (IQR) based on data distribution. A descriptive analysis of the study population was done. A univariate analysis studied the relationship of risk factors with neurodevelopmental outcomes. Chi-square or Fischer's exact test compared categorical data. A P-Value ≤ 0.05 was considered statistically significant. Relative Risk (RR) with a 95% confidence interval (C.I) was calculated.

Results:

A total of 7234 out born neonates were admitted during the study period, of which 367 (5.07%) had neonatal seizures. After applying inclusion and exclusion criteria, 120 neonates were enrolled for study outcomes. Of these, 8 (6.6%) died due to complications, 6 (5%) were lost to follow up. Finally, 106 (88.3%) neonates were followed up and neurodevelopmental assessment was done at 6 and 12 months of age. Of 120 neonates, 56.6%[n=68] were males and 43.3%[n=52] females, 17.5% (n=21) were low birth weight (LBW) and 82.5% [n=99] had normal birth weight, 30% (n=36) were moderate to late preterm and 70%(n=84) were term babies (table 3). 36.6% (n=44) babies were delivered by normal vaginal delivery (NVD) while 63.3% (n=76) by LSCS. 63.3%(n=76) had an APGAR Score at 5 minutes ≥7 (normal), 21.6%(n=26) had a score of 4 to 6 (moderately depressed) and 15% (n=18) were severely depressed with a score of 0 to 3.

Onset of seizures within 24 hours was seen in 45% (n=54) neonates, 30% (n=36) presented between 24 to 72 hours of life while 25% (n=30) had seizures after 72 hours. Most common type of seizures were subtle seizures seen in 50% (n=60), followed by clonic 26.6%(n=32), myoclonic 12.5%(n=15) and Tonic seizures in 10.8% (n=13). The most common cause of neonatal seizures was Hypoxic Ischemic Encephalopathy (HIE) seen in 45.83% (n=55), followed by metabolic causes (33.3%) like hypoglycemia 13.33%(n=16), hypocalcemia 20% (n=24). Meningitis was seen in 11.6% (n=14), Post-natal epilepsy in 5% (n=6) cases, intraventricular haemorrhage (IVH) in 2.5%(n=3), bilirubin encephalopathy with seizures in 1.66% (n=2).

Ultrasonography cranium was normal in 71.6%(n=76) and abnormal findings like dilated ventricles, raised periventricular echogenicity, IVH were seen in 28.3% (n=30) cases. MRI Brain was done in 90 cases, abnormal in 33.9% (n=36). Electroencephalography (EEG) was done in 85 cases, normal in 51.8%(n=55) and abnormal in 28.3% (n=30) cases. Abnormal EEG findings included focal or multifocal discharges, abnormal background EEG, burst suppression pattern. BERA was done in 19 out total 22 cases of meningitis and bilirubin encephalopathy with seizures and it was abnormal in 13.6% of cases. Abnormal BERA was reported as increased threshold or latency seen in I, III, or V waves.

At the time of discharge from hospital, neurological assessment revealed 83% (n=88) to be mentally alert, 17% (n=18) were neurologically depressed, 69.8%(n=74) had normal tone, 27.3%(n=29) had hypertonia with exaggerated reflexes, 2.8%(n=3) had hypotonia. Head circumference for age was normal in 92.4% (n=98), microcephaly was seen 1.8%(n=2) , macrocephaly was seen in

5.6% (n=6) cases as per Fenton growth charts. Incomplete Moros reflex was seen 9.4%(n=10) cases while it was completely absent in 7.5%

(n=8) cases. Suckling reflex was Sustained in 84.9% (n=90), Unsustained in 9.4% (n=10%) and absent in 5.6% (n=6).

Poor prognostic factors associated with impaired neurodevelopmental outcome included Gestational age, APGAR Score at 5 minutes, need for resuscitation after 5 min., neonatal status epilepticus, onset of seizures less than 24 hours, abnormal neurological exam. at discharge, abnormal EEG or Neuroimaging. Unfavourable outcome (developmental delay, cerebral palsy) was seen in 17.9% (n=17) patients born as preterm compared to 14% (n= 15) term babies. This was found to be statistically significant with a p value < 0.05 and confidence interval 1.8-5.2. APGAR score less than seven after five minutes of birth was associated with unfavourable outcome in 18.8%(n=20) patients. This was statistically significant with p value 0.002 and C. I = [1.3-3.9]. Patients who needed extra resuscitation after 5 minutes of birth like intubation, chest compressions were associated with unfavourable outcome in 19.8%(n=21) and this was statistically significant with p value 0.0002 and C.I [1.5-3.9].

Similarly, onset of seizures less than 24 hours was associated with unfavourable outcome in 23.5% (n=25) with a statistically significant p value 0.0015 and C. I [1.34-4]. Neonatal status epilepticus was associated with unfavourable outcome in 17.9%(n=19) which is statistically significant with p value 0.00007 and C. I [1.7-5]. Abnormal neurological exam. at discharge was associated with unfavourable outcome in 16.9%(n=18) with a statistically significant p value 0.0004and C.I [1.5-4.4].Abnormal EEG was associated with unfavourable outcome in 16%(n =17) which was statistically significant with a p value 0.001 and C.I [1.44.6].Abnormal cranial ultrasonography or MRI Brain was associated with unfavourable outcome in 16%(n=17) which was statistically significant with p value 0.012 and C. I [1.153.8].

As far as aetiology based outcome is concerned, Hypoxic Ischemic encephalopathy was found to be strongly associated with developmental delay in 33%(n=35) with a relative risk (R.R) of 2.26, C.I [1.48-3.44] and p value 0.000044. Metabolic causes like hypoglycemia and hypocalcaemia have favourable outcome with developmental delay seen in only 6%(n=7) and R. R 0.36 and significant p value 0.00028. This is because most of the metabolic causes being reversible and early diagnosis and treatment prevent long Neurological sequeale. Meningitis was associated with developmental delay in 5.6%(n=6) with statistically significant p value 0.047, relative risk of 0.54 and C.I [0.271.10]. Intraventricular haemorrhage(IVH) was associated with developmental delay in 1.8%(n=2) with a R.R of 1.34 and C.I [0.59- 3.06]. This was statistically insignificant with p value 0.55, possibly due to small sample size of preterm babies. Postnatal epilepsy was associated with developmental delay in 2.8%(n=3) with R. R 2.06, Confidence interval (C.I) [1.68-2.5] and p value 0.07. We found 61.66% (n=74) babies with neonatal seizures had normal development, 11.66% (n=14) had developmental delay in or two domains less than 70%, 8.33%(n=10) had Global Developmental Delay, 5%(n=6) developed cerebral palsy, 1.66%(n=2) had postnatal epilepsy, 6.66%(n=8) died due to complications and 5% (n=6) were lost to follow up. (table 1).

Table 1. Neurodevelopmental outcome of neonatal seizures at 6 and 12 months

Outcome	At 6 months		At 12 months	
	Number	Percentage	Number	Percentage
Normal	68	56.6%	74	61.66%
Developmental delay in one or two domains < 70%	24	20%	14	11.66%
Global developmental delay	6	5%	10	8.33%
Cerebral palsy	6	5%	6	5%
Postnatal epilepsy	2	1.6%	2	1.6%
Death	8	6.6%	8	6.66%
Loss to follow up	6	5%	6	5%

Table 2. Association of Etiology of Neonatal seizures with Developmental delay at 1 year of age.

Outcome ► / Etiology ▼	Developmental Delay			Total	Relative Risk (R.R)	Confidence internal (C.I)	Chisquare	P-Value
Hypoxic Ischemic Encephalopathy		Yes	No		2.26	1.48-3.44	16.7	0.000044
	Yes	35	14	49				
	No	18	39	57				
Metabolic causes	Yes	7	24	31	0.36	0.18-0.72	13.17	0.00028
	No	46	29	75				
Meningitis	Yes	6	14	20	0.54	0.27-1.10	3.9	0.047
	No	47	39	86				
Intraventricular Hemorrhage (IVH)	Yes	2	1	3	1.346	0.59-3.06	0.34	0.55
	NO	51	52	103				
Postnatal Epilepsy	YES	3	0	3	2.06	1.68-2.5	3.08	0.07
	No	**50**	**53**	**103**				

Table 3: Association of different prognostic variables of neonatal seizures with neurodevelopmental outcome.

Variables		Unfavourable outcomes (n%)	Favourable outcomes (n%)	Total	Confidence interval	P-value
Mode of delivery	NVD	10 (9.4%)	29 (27.3%)	39	0.5-2.2	>0.05
	LSCS	15 (14.1%)	52 (49%)	67		
Gestational age	Preterm	19 (17.9%)	12 (11.3%)	31	1.8-5.2	<0.05
	Term	15 (14%)	60 (56.6%)	75		
APGAR at 5 min	< 7	20 (18.8%)	19 (17.9%)	39	1.3-3.9	0.002
	≥ 7	15 (14%)	52 (49%)	67		
Need for resuscitation after 5 min of birth	Extra	21 (19.8%)	13 (12%)	34	1.5-3.9	0.0002
	Routine	18 (16.9%)	54 (50.9%)	72		
Onset of seizures	<24 hours	25 (23.5%)	23 (21.6%)	48	1.34-4.0	0.0015
	>24 hours	13 (12.2%)	45(42.4%)	58		
Neonatal Status epilepticus	Present	19 (17.9%)	13 (12.2%)	32	1.7-5.0	0.00007
	Absent	15 (14%)	59 (55.6%)	74		
Neurological examination	Abnormal	18 (16.9%)	14 (13.2%)	32	1.5-4.4	0.0004
	Normal	16 (15%)	58 (54.7%)	74		
EEG	Abnormal	17 (16%)	13 (12.2%)	30	1.4-4.6	0.001
	Normal	12 (11.3%)	43 (40.5%)	55		
USG cranium /MRI brain	Abnormal	17 (16%)	19 (17.9%)	36	1.15-3.8	0.012
	Normal	12 (11.3%)	42 (39.6%)	54		

Discussion:

In our study, 7234 outborn neonates were admitted in Neonatology Division of which 367 had neonatal seizures, showing an incidence of 5.07%, similar to other studies like Perrine Plouin et al. (2013) [35] who reported an estimated incidence between 1.5 to 5.5 per thousand live births. After applying inclusion and exclusion criteria, 120 neonates were selected for the study. Baseline clinical data was obtained with proper history and exam. and appropriate lab. investigations were done for etiologic screening. Data was entered in case record form. All enrolled cases were investigated and managed as per standard hospital protocol. Before discharge, neurological assessment using Amiel tison method was done in every baby and recorded. These were kept on regular follow up in high risk neonatal OPD conducted twice a week and again followed up at 6 and 12 months to access their neurodevelopmental outcome. DDST-II scale was used for neurodevelopmental assessment. After assessing neurodevelopmental outcome of neonatal seizures at 6 and 12 months, we found that at 6 months: 56.6% of infants demonstrated normal development. At 12 months, this increased to 61.6%. This finding aligns with Glass et al. (2009) [37] who reported that approximately 50-60% of infants with neonatal seizures exhibited normal neurodevelopmental outcomes by 12 months[7]. However, variations in the definition of "normal development", underlying causes, population studied or interventions used and assessment tools can affect these percentages.

At 6 months, 20% of infants had developmental delays in one or two domains with individual DQ less than 70%, but at 12 months this proportion decreased to 11%. This could be explained by continuous CNS maturation and early stimulation/ intervention leading to improved developmental outcome at 12 months. This necessitates early prognostication and intervention. In our study, Global Developmental Delay (GDD) was found in 5% of infants at 6 months, increasing to 8.3% at 12 months. Overall developmental delay was seen in 26.65% cases. These results align with previous studies like Pellegrin S et al (2019) [11] and Spagnoli C et al (2024) [12] which reported overall developmental delay of 30-40% including GDD. The proportion of cerebral palsy cases at 6 and 12 months was 5%, comparable to previous studies. Glass et al. (2009) observed a cerebral palsy rate of approximately 6-8% in their cohort by 12 months [37]. This minor variation may be due to differences in underlying causes of seizures or population studied. Tekgul et al. (2006) reported cerebral palsy in 5-10% of infants who experienced neonatal seizures, particularly in those with severe hypoxic-ischemic encephalopathy (HIE) [13]. Our findings fall within this range. Postnatal Epilepsy was seen in 1.6% of infants at 6 and 12 months. Pisani F et al. (2012) reported during their seven-year follow-up that approximately 17.6% of infants with neonatal seizures developed postnatal epilepsy [14]. This higher rate could be due to differences in population studied, longer follow-up, genetic predispositions, limited genetic studies in our setup, or severity of initial brain injury. Among enrolled neonates, mortality was 6.6% after one-year follow-up. Similar results were obtained in other studies like Tekgul et al. (2006), who reported a 7% mortality rate in infants with neonatal seizures, particularly those associated with severe HIE [13]. The mortality rate has significantly decreased with time, possibly due to improved antenatal, intranatal and postnatal care. However, mortality after neonatal seizures ranges from 7-30% as per literature review.

Heljic S et al (2016) reported 23% mortality after one year [15]. The difference in mortality rates across studies could be due to different sample sizes or population characteristics. Overall, comparison of our study's findings with other research indicates both consistency and variation in neurodevelopmental outcomes following neonatal seizures. Our study shows similar trends in prevalence of normal development, developmental delays, cerebral palsy, and mortality. However, there are differences in rates of postnatal epilepsy and developmental delays in specific domains, which could be attributed to differences in study populations, interventions, and follow-up protocols.

Our study showed that neonates with severe HIE had a significantly higher risk of developmental delay (R.R = 2.26, C.I. 1.48-3.44, p = 0.000044), consistent with Glass et al. (2017) [9] and Sanjeev Sudia et al. [6] who reported poor outcomes with HIE-III. Neonatal seizures from metabolic causes had a favorable outcome, with a lower risk of developmental delay (R.R = 0.36, C.I. = 0.18-0.72, p = 0.00028). Treated hypocalcemia seizures were not linked to developmental delay, aligning with Yi-Chieh Huang et al [17]. Hypoglycemic seizures showed varied outcomes, with R Shah et al [20] noting no universal safe blood glucose threshold. We aggressively treated hypoglycemia in high-risk neonates, finding 2 of 16 hypoglycemic seizure cases with developmental delay, one developing West Syndrome and another with visual defects and occipital lobe atrophic changes, both with severe hypoglycemia. Early identification of metabolic causes can prevent seizures and improve long-term outcomes. Christopher J D McKinlay et al. found that maintaining blood glucose at least 47 mg/dL did not increase neurosensory impairment risk [19], supported by Ramesh Bhat Y. et al. [16] and Rasmussen et al [18].

To conclude, Mild and transient hypoglycemia when treated early has less chances of neurodevelopmental impairment as brain utilizes ketones, amino acids till hypoglycemia gets corrected. However, severe and recurrent hypoglycemia is definitely associated with neurodegenerative changes in brain. It may lead to developmental delay, cerebral palsy or even death, Emily W.Y. Tam et al [21].

In our study, neonatal meningitis was associated with developmental delay with a statistically significant association (R.R=0.54, C. I 0.27-1.10, p =0.047). This is similar to the study by Darrah N Haffner et al. [22] where 30% survivors had development delay. Another study by G Klinger et al.2000 [23] showed 16.8%(17) infants having moderate to severe disability at one year. Infants with IVH showed a relative risk of 1.34 for developmental delay with C. I. 0.59-3.06 and p value=0.55. The statistically insignificant p value could be due to small sample size of extreme and very low preterm babies excluded from our study. Literature suggests grade III-IV IVH is associated with poor neurodevelopmental outcome. Srinivas Bolisetty et al. [24] found infants with grade III-IV intraventricular haemorrhage (IVH; n = 93) had higher rates of developmental delay (17.5%), cerebral palsy (30%), deafness (8.6%), and blindness (2.2%). Infants who developed postnatal epilepsy had the highest relative risk of developmental delay (R.R = 2.06, C.I 1.68-2.5, p = 0.07). A study by Pisani F et al (2007) [25] shows post neonatal epilepsy presents with distinct EEG patterns and seizure types, is highly refractory, and carries an adverse prognosis. Battaglia D et al. [26] concluded that Developmental and Epileptic Encephalopathies are usually genetic and carry poor neurodevelopmental outcome. In conclusion, HIE III, post-natal epilepsy and meningitis are associated with the highest risk of developmental delay, while metabolic causes seem to carry a favourable prognosis.

Association between perinatal and neonatal

factors affecting neurodevelopmental outcome of neonatal seizures:

1. Mode of Delivery (NVD vs. LSCS) Our study shows no statistically significant association between mode of delivery (Normal Vaginal Delivery [NVD] vs. Lower Segment Caesarean Section [LSCS]) and neurodevelopmental outcomes ($p > 0.05$). Both groups had comparable incidence of unfavourable outcomes. Previous studies show conflicting results. Some report elective caesarean sections may reduce HIE risk, a major cause of neonatal seizures. However, a cohort study by Zhu JJ et al. (2014) [27] suggested no significant difference in long-term outcomes.
2. Gestational Age (Preterm vs. Term) A significant association was found between gestational age and neurodevelopmental outcomes ($p < 0.05$). Preterm infants showed higher rate of unfavourable outcomes (17.9%) compared to term infants. This could be attributed to high risk injury to immature brain of preterm neonates. Preterm birth is a well-established risk factor for adverse neurodevelopmental outcomes in neonates with seizures. Studies by Song IG et al. (2023) [28]and Pisani et al. (2016) [29] have consistently shown that preterm infants have poorer outcomes compared to term infants due to increased vulnerability of the immature brain to injury.
3. APGAR Score at 5 Minutes Infants with an APGAR score < 7 at 5 minutes had more unfavourable outcomes (18.8%) than those with a score >= 7 (14%), with a p-value of 0.002. Low scores are linked to higher risks of neonatal encephalopathy and poor outcomes. Studies by Razaz N et al. (2019) [30] highlight risks of seizures and developmental delays.
4. Need for Resuscitation After 5 Minutes Neonates needing resuscitation beyond 5 minutes had worse outcomes (19.8% unfavourable) compared to those needing routine care (16.9% unfavourable), with a p-value of 0.0002. Prolonged resuscitation indicates underlying asphyxia or perinatal complications leading to hypoxic-ischemic injury, as shown by Perlman et al. (2016).[31]
5. Onset of Seizures (< 24 hours vs. > 24 hours) Early-onset seizures had a higher rate of unfavourable outcomes (23.5%) than late-onset seizures (12.2%), with a p-value of 0.0015. Early-onset seizures relate to acute brain injuries like HIE, posing a higher risk for long-term impairment. Studies by Anand V et al. (2014) [32] found early-onset seizures strongly predict poor outcomes.
6. Neonatal Status Epilepticus Neonates with status epilepticus had more unfavourable outcomes (17.9%) than those without (14%), with a p-value of 0.00007. Status epilepticus is linked to high mortality and morbidity. Studies by Shellhaas et al. (2018) [33] associate it with extensive brain injury and poor outcomes.
7. Neurological Examination (Abnormal vs. Normal) An abnormal neurological examination at discharge was linked to worse outcomes (16.9% unfavorable), with a p-value of 0.0004. Neurological abnormalities strongly predict adverse outcomes in neonates with seizures, as shown by K.Famra et al.[8].
8. EEG Findings Abnormal EEG findings were linked to unfavourable outcomes (16%), with a p-value of 0.001. Abnormal EEG patterns like burst suppression and ictal spread to the contralateral hemisphere predict poor outcomes[10]. Wusthoff et al. (2019) [34] reported similar findings.
9. Imaging Findings (USG Cranium/MRI Brain) Neonates with abnormal cranial ultrasound or MRI findings had worse outcomes (16%

unfavourable), with a p-value of 0.012. Abnormal neuroimaging findings are linked to adverse outcomes. Studies by Yvonne W Wu et al. (2023) [36] emphasized MRI's role in predicting outcomes in neonates with seizures.

To conclude, these factors impact the neurodevelopmental outcome of neonatal seizures. These findings align with existing literature, emphasizing the importance of early identification and intervention.

Conclusion:

Hypoxic-ischemic encephalopathy (HIE) has been identified as being strongly associated with developmental delay, accounting for the highest number of cases. Developmental delay was also observed in instances of meningitis, intraventricular haemorrhage, and postnatal epilepsy. In contrast, metabolic causes such as hypoglycemia and hypocalcaemia tend to have favourable outcomes when treated promptly. However, prolonged and recurrent hypoglycemia is linked to impaired neurodevelopmental outcomes. Poor prognostic factors associated with impaired neurodevelopmental outcomes include gestational age at birth, APGAR score at 5 minutes, the necessity for resuscitation after 5 minutes, neonatal status epilepticus, seizure onset within 24 hours, abnormal neurological examination at discharge, and abnormal EEG or neuroimaging findings. The most common cause of neonatal seizures was found to be HIE, followed by metabolic causes such as hypoglycemia, hypocalcaemia, and infections like meningitis. This underscores the need for improvements in antenatal, perinatal, and postnatal care of neonates. Additionally, comprehensive follow-up and individualized care plans are essential for enhancing long-term outcomes.

Limitations:

Due to non-availability of aEEG/cEEG in our setting, some neonates with only electrographic seizures could have been missed leading to decrease in sample size. This emphasizes the need of aEEG/cEEG to monitor subtle seizures so that these patients can be kept on follow up to assess their neurodevelopmental outcome.

Research Implications:

- Neurodevelopmental outcome of neonatal seizures based on Continuous EEG monitoring needs to be studied in detail to predict outcome of even subtle seizures.
- Long-term and multicenter studies are required in order to to develop accurate risk models of poor neurodevelopmental outcome.

Conflict of interest:

None

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RESEARCH ARTICLE

A Case Control Study on Impact of Screen Time on Language Development in Children Between 2–5 Years of Age

Authors :
Dr. Shikhar Gupta MBBS, Faculty of Medical Sciences, King George's Medical University, Lucknow, Uttar Pradesh, India
Dr. Shally Awasthi MD, Professor, Department of Pediatrics, King George's Medical University, Lucknow, Uttar Pradesh, India
Dr. Chandrakanta MD, Department of Pediatrics, King George's Medical University, Lucknow, Uttar Pradesh, India
Dr. Gunjan Parasher MBBS, Faculty of Medical Sciences, King George's Medical University, Lucknow, Uttar Pradesh, India

Running title: Screen time and language delay in young children

Corresponding author
Dr. Gunjan Parasher:
King George Medical University, Lucknow, Uttar Pradesh, Pin Code: 226003
Phone: +91-8171968211 / +91-8853268150
Email: parashergunjan1@gmail.com

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Abstract:

Objective: This study attempts to find a correlation between parental reported language delay in children and their screen media usage habits. Various other factors like the effect of the type of content viewed and behavior changes have been studied.

Methods: A case-control study was conducted in outpatients' setting of a tertiary care center. Controls were selected based on normal developmental milestones, after excluding any chronic illnesses. Cases exhibited language delay according to the LEST (Language Evaluation Scale Trivandrum scale) excluding any functional, structural, and syndromic conditions. The DSEQ (Development and Evaluation of the Digital Screen Exposure Questionnaire) was used to assess media usage habits of both cases and controls. Screen time data was collected and analyzed separately for television and handheld electronic devices.

Results: A total of 54 cases and 54 controls were recruited from November 2022 to October 2023. On univariate analysis, total screen time exceeding two hours increased the odds (OR=4.48 95% CI 1.98-10.17) (p-value<0.05) of language delay while watching poems, rhymes and other educational videos as primary content - reduced the odds of developing language delay (OR= 0.34 95% CI 0.13 to 0.89) (p-value=0.02). On conditional

logistic regression, an excess screen exposure increased the risk (OR = 1.68 95%CI 1.01-2.80) while watching educational content had a protective effect (OR=0.21 95% CI 0.06-0.68) from language delay, controlling for age and gender.

Conclusion: Children developing language delay had significantly higher exposure of screen time as compared to normally developing children. Language developmental delay might be associated with the type of content watched by the children. Hence awareness about effects of screen time on language development has to be informed to the parents and society.

Keywords: Screen Time, Language Delay, Electronic Devices, children, India[3]

Introduction:

In India, accessibility to technology has boomed over the past decade, outpacing the understanding of its moderation by the consumers. These changes particularly affect growing children who are eager to divulge. Consequently, parents bear the responsibility of regulation of media and fostering social interactions. Various studies highlight a surge in screen time among preschoolers, surpassing recommended limits set by the Indian Academy of Pediatrics (IAP). One of its studies published in 2019 shows around 50-80% of children were exposed to screen for a duration that was much above the daily limit (1). In view of the escalating prevalence of screen usage, the IAP recommends no screen time for children under 2 years and no more than 1 hour for those of age 2-5 years. A cross-sectional study conducted in 2019 in western India reported only 17.2% of participants met these recommendations (2).

Handheld devices, now more prevalent than television, serve as common babysitters and recent literature suggests it can be more harmful than beneficial for our children. The IAP states that introducing digital screens and audio at an early stage can impede the development of social skills in toddlers and preschoolers. Karani et al did a systematic review to describe the multifactorial effect of screen time on language development of a child (3). Not just the language, but the quality of programs along with increasing screen time has also been linked to a child's language development as well as their sleep patterns (4,5).

Language delay can manifest as primary (with no underlying disorder) or secondary, stemming from underlying conditions such as autism spectrum disorder, hearing loss and selective mutism among others (7). Our study encompassed the 4 post-covid pandemic view on screen habits of children with primary language delay, comparing it with normally developing children. We wished to investigate a correlation between development of language delay in a child with duration of exposure to screen. Apart from duration of screen exposure, we also enquired about the content quality and behavioral changes in the two groups. Increased screen time and language development delay lacks independent studies in the Indian subcontinent and the scarcity of data on primary language delay exacerbates the challenge of late diagnosis and treatment. This is worrisome since persistent delays burden children with attention and social difficulties later in life (6). Few pre-pandemic studies from different parts of the world show a positive correlation between language delay

and screen time and identified a high screen time as an important risk factor for developing language delay (3,10,11). Our case-control study delves into the screen habits of children with language delays, comparing various parameters to typically developing children. 5

Materials & Methods:

Study Design and Sample Population This study employed a case-control design, spanning data collection from November 2022 to October 2023, at the Pediatric Outpatient Department of a tertiary medical center located in North India. The presence of language delay was determined by Language Evaluation Scale Trivandrum (LEST) available for age ranges of 0-3 years and 3-6 years (12,13) followed by evaluating for secondary causes of language delay in parent reported cases of language delay as our study focuses only on primary language delay. To gauge screen time habits, the Development and Evaluation of Digital Screen Exposure Questionnaire (DSEQ) was utilized (14) in all participants of the study.

A case was a child presenting with parent reported language delay to our OPD and who screen positive with our language assessment tool (i.e. LEST). Children were included only after evaluating for all of the following- concurrent global developmental delay, autism spectrum disorder, attention deficit hyperactivity disorder, birth asphyxia, or those with previously diagnosed neurological conditions. Such children were excluded from the study. Additionally, all cases had to exhibit normal audiometry. Followed by relevant history, examination and investigations necessary to rule out secondary causes, parents were asked for their consent to participate in the study.

DSEQ (our tool to assess screen habits) was filled by the parents (if literate) or by our co-authors on their behalf (if parents could not read and/or write). Similarly, controls were included in the study. Controls were also children attending our OPD but with acute illnesses that apparently did not influence overall [6] growth or any particular domain of development. The selection of controls was based on exact one-to-one matching, based on age and gender, and a set-criteria, which included - normal development in all domains and the absence of any history of chronic medical illness (ear problems, severe infectious diseases, surgical procedures, cleft palate, low birth weight, premature birth, any previously documented disorders like Down syndrome, epilepsy or birth asphyxia). A child who could be matched for any one of the cases (based on age and gender) and satisfying rest of the inclusion criteria was included in the study following informed consent. The DSEQ questionnaire was applied to controls alike to assess their screen habits. Finally, 54 cases and 54 controls were included in the study.

Measurement :

The Language Evaluation Scale Trivandrum (LEST) was employed to assess language delay in children within the age brackets of 0-3 years and 3-6 years. This tool, specifically developed in India, was chosen for its alignment with our socio-demographic context, ease of availability and applicability. It primarily focuses on expressive speech delay and categorizes children as either having or not having language delay.

The data collection instrument, the Development and Evaluation of the Digital Screen Exposure Questionnaire (DSEQ), is

a self-reporting questionnaire. The initial section of this questionnaire contains essential information such as the child's age, gender, place of residence, and details about the occupation and income of each family member. These details were amalgamated to gauge the socioeconomic status. 7 To reduce potential confounding variables, age and gender were matched, allowing for a permissible variance of +/- 2 months in age matching.

Subsequently, screen time was calculated as an average of daily usage during weekdays and weekends, with separate considerations for mobile and television screen habits. The questionnaire inquired about the type of content viewed, the duration of each program, the frequency of media device usage throughout the day, and supervision (e.g., whether the child uses a mobile on weekdays, for how long does he normally sit in front of mobile/ television, the frequency of usage in a day, and involvement in video games, is there always a guardian to monitor the screen habits of the child?). The third section of the questionnaire focused on behavioral changes, such as imitation of characters on screen, discussions about characters, mood alterations (e.g., whether the child becomes aggressive or did not eat when denied access to a mobile or television or the reverse- if the child stopped crying or completed the food only and only if given some screen exposure or if choices of food were affected by programs watched?) and sleep alterations. Here, sleep alterations were judged by parent's experience if the child slept on most nights only after seeing some mobile or television screen or if it has increased the sleep latency, affecting the sleep timings of the child as compared to before. Questions like 'Do you feel mobile or television screen has become a necessity for your child, before going to sleep?' were put up in case of ambiguity. Categorical variables required a "yes" or "no" response format.

Statistical Analysis:

The analysis involved coding variables from the questionnaire, including gender (male or female), age (in years), locality (urban or village or urbanized village), and8 socioeconomic status (upper or middle or lower). Furthermore, it included the duration of mobile, television, and overall screen time (in hours). Responses gathered in a "yes" or "no" format were- video games as the primary share of screen time, poems and rhymes as the primary share of screen time, imitating the content viewed, experiencing aggression when denied access to mobile devices, and compromising on food or sleep (as explained above). Co-viewing was not incorporated into the final analysis due to incomplete data.

For continuous data, descriptive statistics were presented as both mean and standard deviation, while categorical data were conveyed as median values, percentages, and counts. Univariate analysis was conducted to compare cases and controls, utilizing two-tailed t-tests for continuous data and chi-square tests for discrete values. We performed multivariate conditional logistic regressions using forward selection method. All the variables with association between the case and control groups at $p<0.1$ from univariate analysis were incorporated in the conditional logistic regression analyses .Other variables were included one by one to obtain model with highest sensitivity. Analysis was done using SPSS version 29 (Chicago II, USA).9

Results:

Table 1 furnishes the foundational characteristics of our dataset. A total of 108 matching cases and controls were analyzed. The average age was 3.35 and 3.40 years for cases and controls respectively(p=0.82). In each group, the total number of male participants was higher, comprising 74% of the sample (n=40). The median screen time usage among cases amounted to 3 hours (interquartile range [IQR]=1.5-5 hours), approximately threefold the duration reported in the control group, which was 1.05 hours (IQR=0.5-2.63).

The daily total screen time usage was higher in cases (mean=3.48, standard deviation [SD]=2.5, 95% confidence interval [CI] 2.78-4.15) compared to controls (mean=1.90, 95% CI 1.37 to 2.43) (p=0.0005, alpha level 0.5) (see Figure 1). This observation underscores a robust correlation between excessive screen time and the presence of language delay. The elevated daily average of screen time was primarily attributed to an increased mobile screen time among cases (mean=2.38, SD=2.15, 95% CI 1.79-2.97) in comparison to controls (mean=1.08, SD=1.08, 95% CI 0.79-138) (p<0.05, alpha level 0.05) (see Figure 1). The duration of television viewing did not yield statistically significant results.

On univariate analysis, it was determined that an overall screen time exceeding 2 hours (OR=4.48 95% CI 1.98-10.17) (p-value<0.005) was a significant risk factor (see Table 2). Children who watched poems, rhymes or some form of educational content as major share of screen time had around 70% lesser odds of developing language delay than those who didn't (other content included games, YouTube shorts and adult10 content) (OR= 0.34 95%CI 0.13 to 0.89) (p-value=0.02). No other factors, such as type of locality, behavioral aspects, or manifestations of aggression, exhibited a significant association (see Table 3).

Multivariate regression was performed to identify the risk factors of language delay in children with and without the disease. The dependent variable for logistic regression was the presence or absence of language delay i.e. 1 for cases and 0 for controls. Since age and gender were used as matching variables, they were included in the regression model. Total screen time (sum of both mobile and television screen time) and individual screen time from mobile or television were not included together in one model because of risk of multicollinearity. In the final model, we included 5 parameters- age, gender, total screen time, watching poem as predominant content and imitation of characters on screen - for our regression model as they yielded the highest sensitivity.

Total screen time exceeding 2 hours (OR = 1.68 95% CI 1.01-2.80) was associated with increased odds while watching poems, rhymes or educational content (OR=0.21 95% CI 0.06-0.68) was associated with a reduced odds ratio (p<0.05) (see Table 4). Changes in behavior such as imitation of characters did not yield significant results (p value=0.12). Excess screen exposure and type of content viewed were the two most consistent factors for influencing development of language delay in our analysis.11

DISCUSSION:

By analyzing the Digital Screen Exposure Questionnaire (DSEQ) completed by parents, we observed that 40 cases (74%) and 21

controls (38.8%) reported screen time usage exceeding 2 hours. The average media consumption was much higher in cases (3.48 hours) as compared to controls (1.9 hours). Upon analysis, it was evident that surpassing a total screen time of 2 hours has an increased risk of language delay concurring with many studies from different parts of the world that have shown increased risk of developing language delay with more screen usage (3,9-11,15,19,20). Since the COVID-19 pandemic, education and recreation have undergone a significant change. Accessing knowledge has become easier with smartphones and the internet. Parents now also use these devices for their children's leisure activities. Schools conduct classes online and students submit homework via platforms like What Sapp. In such a scenario, we expect to see increased screen time in the general population as well. In our sample, children's preferred content consisted of cartoons in their mother tongue, poems, video games, and, during unsupervised sessions, a diverse range of YouTube shorts spanning non-child-friendly categories. These patterns align with the observations made in the study by Hudon et al (4), which ascribed poor quality viewing and solitary viewing as a potential risk factor. Hudon et al mention that quantity and quality are two completely different factors influencing language development and should not be correlated. Two other studies (3,17) reiterate that the quality of shows watched affected the outcome of language skills in children. Our study and previous literature clearly demonstrated viewing informative content like poems, stories or rhymes had some positive effect on child's language12 acquiring skills and reduced the odds of developing language delays significantly .One possible explanation could be that they help in improving a child's vocabulary by giving similar information provided in schools but in a colorful and interactive way. Many organizations recommend children's complete abstinence of screen time. We believe a more pragmatic approach involves actively engaging in the education of children, regarding responsible smartphone usage. Parents must be educated on 'what should be' and 'what should not be' seen by their children on smartphones and television.

Garrison et al (5) in their study concluded that increase in night time usage of media devices as well as violent content, increased sleep problems in children(between 3-5 years of age). Instances of imitation and aggression when denied access to screen, and compromises on sleep (like throwing tantrums or increased sleep latency) were reported consistently by both cases and controls (i.e. normally developing children) in our study too. However, it was not related to language delay. A study by Perdana et al (11) did not find any factor other than increased screen time in development of language delay. While a few other study (8,18) showed that language delay is attributed to multiple socioeconomic factors (like mother education and home environment) and family history. In our study, no correlation was found between socioeconomic factors and its influence on the language development of children. Moyle et al (9) did an extensive review of the genetic and environmental factors that predicate the learning process. They explain how multiple complex neurobiological interactions play a role in development of speech. From the earlier literature that explained the complex

mechanism of language development in a child during growing years (9), we certainly know that a single factor (like an increased13 screen time) cannot be attributed in development of the entire disease process. However, with the latest evidence, including our study, early exposure to screen time does seem to influence, in some way, the development of language in a child, especially when unregulated.

Despite various studies (aforementioned) and fair acceptance of the linkage, we have been unable to develop a diagnostic protocol and competitive therapy for children suspected of developing language delay due to media divulgence. Prevention has been outlined in various studies as the key. From our experience of meeting with guardians of children with language delay, we believe studies should take into account variables like parental education and work hours to formulate dynamic guidelines. It is also important to address parental attitudes regarding introduction and use of technology to children. Additionally, pediatricians as well as psychiatrists should be trained for diagnosis and behavioral therapy specific to this circumstance. The study's brief duration and constrained sample size hinders broad generalizations of the findings. The tools used to assess language delay were chosen because of regional factors and may be improved in subsequent studies. Being a single center study, we could not ascertain the prevalence of language delay. The cases were not followed up, to see future implications of the disease. Nonetheless, the study's results are unanimous with preceding studies and requires steady action to safeguard the holistic development of the children.1415

Conclusion:

In our study, we found that an overall increase in screen time predisposed a child to the risk of language delay. Excess mobile and television usage posed a risk factor for language delay, while watching educational content reduced the risk. Our study highlights one of the reiterated facts in recent times – increasing screen time among children and its harmful effect on their development. We should focus on the 'quantity' as well as the 'quality' of social media content consumed by children.16

Conflicts of Interest and Source of Funding:

None

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Ethics Approval:

Institutional Ethics Committee gave approval for the study (ECR/262/Inst/UP/2013/RR-19)

WHAT THIS STUDY ADDS ?

Our study is one of the very few studies done to compare screen viewing habits of normal children with those having language delay.

It points towards a direct correlation between duration of screen time and language delay in children. Quality and Quantity of screen time have shown to produce different effects on language development in children

Table 1: Sociodemographic characteristics of Cases and Controls

	Cases	**Controls**	**P value**
Total	54	54	-
Gender*: Male	40(74%)	40(74%)	
: Female	14 (26%)	14(26%)	
Average age* (in Years)	**3.35**	**3.40**	**0.82**
Socio-economic Status			
Upper (includes upper	7 (13.4%)	9(16.6%)	0.5
and upper middle)			
Middle (includes middle and lower middle)	33(61%)	30(55.5%)	Ref
Lower (includes upper	14 (25.6%)	15(24%)	0.7
lower and lower)			
Average Screen Time (in Hours)	**3.48**	**1.90**	**<0.01**

Table 2 : Univariate analysis between Screen Time and Language Delay.

Variable		Cases(n=54)	Control(n=54)	p value
Age (in years)	2-3	30	30	
	3-4	12	12	
	4-5	12	12	
Gender	Male	40	40	
	Female	14	14	
Locality	Urban	29	27	0.7
	Non-urban	25	27	
Total Screen time	<1 hour	7	17	ref
	1-2 hour	7	16	0.9
	>= 2 hours	40	21	<0.05 (OR=4.48 ;95%; CI 1.98-10.17)
TV usage in hours	<1 hour	34	36	ref
	1-2 hour	4	10	0.17
	>= 2 hours	16	8	0.12
Mobile usage in hours	<1 hour	25	29	ref
	1-2 hours	10	9	0.6
	>= 2 hours	19	16	0.07
Content	Poems/rhymes	8	18	0.02
	Non informative content / videos and games	46	36	OR= 0.34 95%CI 0.13 to 0.89
Imitate/Talk to character on screen	YES	23	29	0.24
	NO	31	25	
Aggression	Yes	18	16	0.67
	No	36	38	
Compromise on food/ sleep	Yes	10	10	1
	No	44	44	

Content	Poems/rhymes	8	18	0.02
	Non informative content/ videos and games	46	36	OR= 0.34 95%CI 0.13 to 0.89
Imitate/Talk to character on screen	YES	23	29	0.24
	NO	31	25	
Aggression	Yes	18	16	0.67
	No	36	38	
Compromise on food/ sleep	Yes	10	10	1
	No	44	44	

Table 3: Univariate analysis of Screen Related Habits with Language Delay.

	Odds Ratio[exp(b)]	**95%CI**	**p-value**
Gender	1.0		
Age	1.0		
Overall screen time exceeding 2 hours	1.68	1.01-2.80	0.04
Imitate characters	0.46	0.17-1.23	0.12
Poems/rhymes as prime share of screen time	0.21	0.06-0.6	<0.01

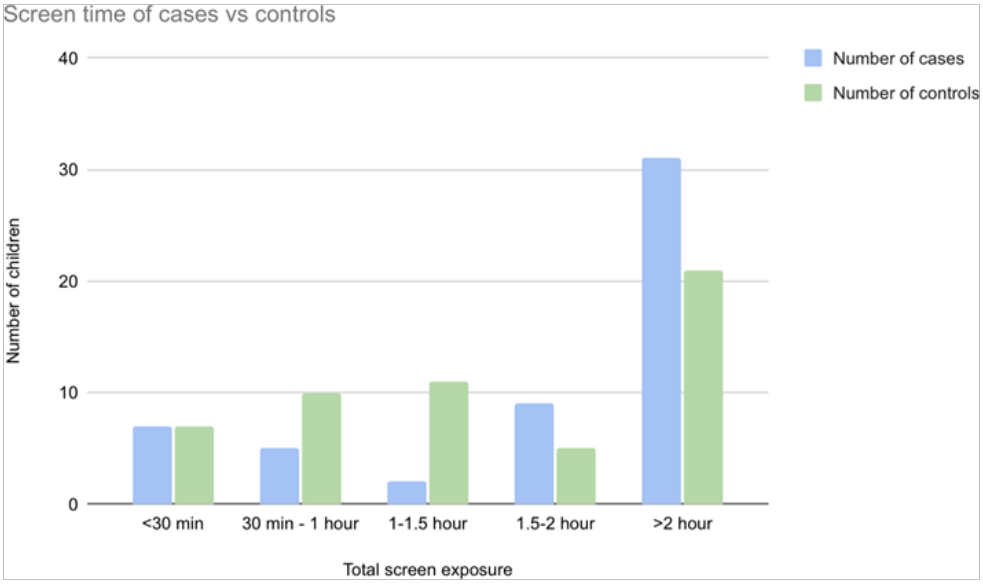

Fig 1 – Distribution of screen exposure among cases and controls.

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RESEARCH ARTICLE

Criterion Validation of 'Speech Related Items' in INCLEN NDST-Research Form Against Receptive Expressive Emergent Language Scale-4 Among Children with Complaints of Speech Problems

Authors
Dr. MKC Nair DSc, Director, NIMS-SPECTRUM-CDRC, Emeritus Professor, NICHE University, Kanyakumari, Kerala
Dr. Amrita Gautam, IAP Fellowship Trainee, NIMS-SPECTRUM-CDRC
Dr. Arunima MS, Developmental Nurse Counsellor Trainee, NIMS-SPECTRUM-CDRC
Dr. Remadevi S, Former Associate Professor, Department of Community Medicine, GMC, Thiruvananthapuram
Dr. Swapna S, Senior Developmental Therapist, NIMS-SPECTRUM-CDRC
Dr. Sajitha J, Developmental Therapist, NIMS-SPECTRUM-CDRC
Running title: Validation of NDST speech items against REELS-4
Corresponding author
Dr. MKC Nair:
NIMS-SPECTRUM-CDRC, NIMS Medicity, Neyyatinkara, Thiruvananthapuram, Kerala
Email: cdcmkc@gmail.com

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Abstract

Delay in speech and language is one of the most common neurodevelopmental disorders in early childhood with a prevalence rate of around 6% in children

Objectives:

The primary objective of the study was criterion validation of 'speech related items' in INCLEN NDST-research form against receptive expressive emergent language scale-4 among children with complaints of speech problems as gold standard and to calculate sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Methodology

This descriptive study - diagnostic test evaluation, was carried out from January to August 2022 over a period of 8 months, at NIMS Spectrum-CDRC, Thiruvananthapuram, and a tertiary care centre for children with neurodevelopmental problems. Seventy-five children with complaints of speech problems, coming to NIMS-Spectrum-CDRC, were screened with NDST-research against REELS by an experienced developmental therapist and evaluated with REELS-4 by Developmental nurse counsellor, blind to the results of screening

Result

On doing criterion validation of Speech related items in NDST-research, the psychometric properties were as follows; sensitivity of 97.96%, specificity of 42.31%, positive predictive value

of 76.19 %, negative predictive value of 91.67%, positive likelihood ratio 1.70 and negative likelihood ratio 0.05. Diagnostic accuracy of the test was found to be 78.67%.

Conclusion

Speech related items' in INCLEN NDST-research form against Receptive Expressive Emergent Language Scale-4 (REELS-4) among children is a simple screening test, with good psychometric properties, to screen among children suspected with developmental problems.

Keywords

NDST, Psychometric properties. Speech delay, criterion validation

Introduction

Development of speech helps children not only to get attention from others, to satisfy their needs, to influence the behaviour of others, and to develop social relations, but it also plays an important role in their academic achievements as they grow[1].Language delay or abnormalities in speech and language should be detected during the early stages of life itself, so that early intervention could be instituted. Several tools are available for the purpose of assessing speech and language delay for example; Early Language Milestone Scale (ELM Scale), The Receptive Expressive Emergent Language Scale (REEL), 3-Dimensional language Assessment Tool (3-DLAT), Language Evaluation Scale Trivandrum etc.[2,3]. Speech delay is defined as "when the child's conversational speech is either more delayed than would be expected for age or marked by speech sound error patterns not appropriate for age"[4,5].Delay in speech and language is one of the most common neurodevelopmental disorders in early childhood with a prevalence rate of around 6% in children [6]. Up to 60% of language delays at the age of 2 to 3 year probably resolve spontaneously [7]. However, if serious language delays persist and remain untreated, they can have detrimental effects at older age. Language disorders are strongly related to psychiatric/ behavioural problems [8] and learning problems later at school [9]. These results indicate the need for intensive, early intervention for language impaired youngsters [10].

REELS-4 tool was designed to help identify children (age0-7years) who have language impairments or who have other disabilities that affect language development. The validated tool REELS-4 is too expensive and time consuming for routine clinical use. Hence it was essential to have a screening tool developed and validated locally. In the present study, a feasible approach was to use 'speech related items' in NDST-Research form developed by INCLEN-NDD study team led by Dr N.K Arora, to screen for speech and language problems. After validation againstREELS-4, 'speech related items' in NDST-Research form can also be used to identify a child with speech and language delay early.

Objectives

1. To administer Neurodevelopmental screening tool Research form(NDST-R/F), on consecutive children of 2-7 years with complaints of speech problems, attending NIMS-spectrum CDRC.
2. To administer Receptive Expressive Emergent Language Scale (REEL-4) diagnostic tool on the same children.
3. Criterion validation of 'speech related items' in NDST-R/F as a screening tool against REEL-4 as gold standard using sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Methodology

The present study was a hospital based criterion validation study which was carried out from January to August 2022 over a period of 8months, at Thiruvananthapuram NIMS-Spectrum-Child Development Research Centre (CDRC), Noorul Islam Centre for Higher Education (NICHE), Deemed-to-be University. Institutional Ethical Committee clearance was obtained (Regn. No. ECR/218/Inst/Ker/2013/RR-16 and Approval No. NIMS/IEC/2022/01/03, dtd. 10/01/2022). Seventy five consecutive children of consenting parents, aged 2-7 years with complaints of speech problems, coming to NIMS-Spectrum-CDRC, were included.

Data was collected by interview method. Screening by 'speech related items' in NDST-R/F was done by an experienced Developmental Therapist and then REEL-4was administered by a Developmental Nurse Counsellor, blind to the screening results. The analysis was performed using Statistical package for social science (SPSS version 20).

Results

Out of the study population of 75 children,

- Age: 24-35 months – 26; 36-47 months – 22; 48-59 months - 11; 60-71 months – 12; 72-84 months- 4
- Gender: Male 63 (84%); Female 12 (16%).
- Using NDST-R/F 63 (84%) children had at least one question positive suggestive of Speech related problems.((Table 1)

Table 1: 'Speech related items' in NDST-Research form (n=75)

NDST-Research form Item	**No**	**Sounds only**	**Recognisable words**
Can your child speak?	3	14	58
NDST-Research form Item	**No**	**Somewhat Reduced**	**Yes/lost speech/ Stopped speaking**
After attaining initial speech has your child now stopped speaking or has, he/she stopped learning new words and sentences?	52	15	8
NDST-Research form Items	**No**	**Some-times**	**Most of the time**
Is your child's speech in any way different from other children of his/ her age?	39	10	26
Can your child speak words or sentences which can also be understood by non-family members?	43	24	8
Does your child often repeat the same word or phrase over and over again in the same manner?	59	5	11
Can your child name familiar objects (less than 3years old) or is able to describe an object/ event or an action (if more than 3years old)?	25	16	34
Does your child seem to have difficulty in comprehending what you are saying?	45	21	9
NDST-Research form Impression = No Speech related problems: 12(16%); Speech related problems: 63(84%)			

- Using REEL-4, 49 children (65.3%) had Speech problems. (Table 2)

Table2: Prevalence of Speech problems as per REELS

Interpretation	Number
Normal	26 (34.7%)
Delay	49 (65.3%)
Total	75

Table 3: 'Speech Related items' in NDST-Research form Vs REELS

'Speech related items in NDST-Research form' Impression	REELS Impression		Total
	Delay	Normal	
Delay	**48 (TP)**	15 (FP)	63
Normal	1 (FN)	**11(TN)**	12
Total	49	26	75

On doing criterion validation of Speech related items in Neurodevelopmental screening tool (NDST-Research form) against REELS, the psychometric properties were as follows; sensitivity of 97.96%, specificity of 42.31%, positive predictive value of 76.19 %, negative predictive value of 91.67%, positive likelihood ratio 1.70 and negative likelihood ratio 0.05. Diagnostic accuracy of the test was found to be 78.67%.

Discussion

The COVID-19 pandemic has had long lasting effects on the communication skills of the children especially those who were in their pre-linguistic phase when the pandemic started. Masks are known to degrade the speech signal, serving as a low-pass filter by attenuating high frequencies spoken by the wearer; the decibel level of attenuation ranges from 3 to 4 dB for simple medical masks and close to 12 dB for N95 masks [13]. In children with hearing loss, this seemingly small change may significantly affect speech understanding as compared with their normal-hearing peers. Speech screening tools like Language Evaluation Scale Trivandrum (LEST) have been validated against REELS to be used in the community [sensitivity and specificity of LEST(0-3), was found to be 95.85% and 77.5%, respectively with a negative predictive value of 99.8% and LR (negative) of 0.05] [3]. Another test version tool Screening Test of Early Language Development-Test version (STELD-T) was validated by expert through expert opinion and tested against REELS [14]. However, the NDST being a comprehensive tool evaluating plenty of spheres of development including diseases like epilepsy as well, makes it more community friendly and time saving.

The present study showed that Speech related items in NDST-R/F have good psychometric properties when validated against REELS-4 taken as gold standard. Due to ease of administration and low cost, NDST-R/F is an ideal tool for quick screening of speech problems in the community as well as outpatient setting.

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Conflicts of interest:
There are no conflicts of interest

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RESEARCH ARTICLE

Children with Auitsm Spectrum Disorder and patterns of participation in daily Physical and Play activity

Authors
Dr. Pallavi Sanga MBBS, Department of Pediatrics, Saveetha Medical College, Chennai, Tamil Nadu, India
Dr. Lal D.V. Nair MBBS, Department of Pediatrics, Saveetha Medical College, Chennai, Tamil Nadu, India
Dr. Mohit Dey MBBS, Department of Pediatrics, St. John's Medical College Hospital, Bengaluru, Karnataka, India
Running title: Physical activity and play patterns in ASD children
Dr. P. Sanga: Concept, design, data collection
Saveetha Medical College, Chennai
Corresponding author
Dr. Pallavi Bhasha Sanga
Fellowship Registration No.112394001
Saveetha Medical College
Central IAP Membership Number: S/2015/S-702
A-12,Pasumai Rbi Officers Quarters, 15Th Main Road, Anna Nagar -West, Chennai, Tamilnadu-600040
Mobile no. : 9836475778/ 8777616770, Email address : pallavi.b.sanga@gmail.com

Abstract:

Children with Autism Spectrum Disorder (ASD) often face challenges in motor development and physical activity, leading to reduced participation in organized activities and an increased risk of comorbid conditions such as obesity. This study aims to explore the diversity and significance of play in children with ASD. The objective was to understand the diversity of autistic play and its significance, in assessing play levels in children with autism, evaluate diversity in daily activity participation and Correlate autism severity with play participation.

The study utilizes the WESTBY scale, Pre-linguistic Scale 5, Vineland Social Maturity Scale (VSMS), and Social Responsivenes Scale-2 (SRS-2) to assess play levels, language, and social maturity in children with ASD, respectively. It was observed that most children were at Stage 1 (74%) or Stage 2 (26%) on the WESTBY Play Scale. Significant differences in physical activity participation were noted, with jumping and running being more popular. Correlations were found between play participation and autism severity, social communication, and social maturity.

The findings suggest that tailored interventions to enhance physical activity and social skills in children with ASD are crucial for improving their quality of life and addressing comorbid conditions.

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Background:

Children with ASD are less likely to participate in organized activities like sports [1]. This is attributed to their deficits in motor development and physical activity (PA) behaviour. Social and behavioural impairments in ASD limit

children's opportunity to participate in PA and recreations that eventually end to their inactivity predisposing children with ASD to comorbid conditions such as overweight and obesity[1].

ASD is clinically defined by impairments in social, communication and reciprocal interaction, with repetitive, restricted, and stereotypical behavioral patterns and is now thought to affect up to 2.5% of children [1]. Social impairment and restricted interests combined with high rates of motor problems. PA helps socialization, increase motor skills, and have positive impacts on a range of outcomes [2].

Disturbing statistics suggest that children with autism are 40% more likely to be overweight and obese compared to their typically developed peers. Increasing PA is a primary health objective. Thusalthough motor skill difficulties have started to receive more attention in autism literature, PA patterns have received less [3]. Comorbid conditions can significantly impact children with Autism Spectrum Disorder (ASD). Quite often, the comorbidities are related to the key manifestations of ASD itself, like-

1. **Physical Health:** Conditions like overweight and obesity are common due to reduced physical activity. This can lead to further health issues such as diabetes, cardiovascular problems, and joint pain.
2. **Mental Health:** Children with ASD are also at a higher risk for mental health conditions like anxiety, depression, and ADHD. These can exacerbate social and behavioral challenges, making it even harder for them to engage in daily activities.
3. **Social Interaction:** Comorbid conditions can further limit social interactions. For example, obesity might lead to bullying or social isolation, which can worsen the child's social skills and self-esteem.
4. **Quality of Life:** Overall, these comorbid conditions can reduce the quality of life for children with ASD, making it crucial to address both the core symptoms of ASD and any additional health issues.

AIM-The study aims at understanding the diversity of autistic play and its level of significance.

OBJECTIVE

1) To assess, the level of play in children with autism.
2) To assess, the diversity in participation of daily activities.
3) To understand correlation between severity of autism and level of participation in play.

Methodology:

Study design: The children whose parents gave consent were enrolled in the study. It was a cross sectional study meant to analyze the association of the levels of play and the severity of ASD symptoms.

Recruitment & Sampling method: the study involved only children with autism. Hence those parents who were willing to participate only were included; hence convenience sampling method was selected.

Sample size: Using Open Epi software the sample size of the study population was found to be 41 with an expected incidence of the population as 2.5% and an alpha of 0.05 at 80% power and design effect size of 2.5 for surveys. Using the formula N=(Za)

65 patients were initially recruited of which 10 dropped out at different levels.

Methods:

Assessments:

a) The level of play for each child was assessed with WESBY's Play Scale (WPS). The Westby Play Scale is designed to be sensitive to various stages of symbolic play, which are closely linked to cognitive and language development. However, specific sensitivity and specificity values for the Westby Play Scale are not commonly reported in the literature. This scale is more qualitative, focusing on the developmental milestones and the types of play behaviours that should be observed at different ages.

b) The appropriate language level of each child was assessed using the PLS-5.The Preschool Language Scale, Fifth Edition (PLS-5) has a sensitivity of 0.83 and a specificity of 0.8012. These values indicate that the PLS-5 is quite effective in correctly identifying children with language delays (sensitivity) and in correctly identifying children without language delays.

c) The social responsiveness levels of the child was determined with SRS-2.

d) And the behavioural abnormality and social quotient was assessed using VSMS. Interview of each parent was done and questionnaires were filled up along with observations by the DBP. Any deficiencies were subjected to reconfirmation with the parents. The results were tabulated and analyzed using appropriate statistical methods

Statistical analysis:

SPSS-23 version was used for statistical analysis. Frequency distributions with mean +/- SD were calculated for parametric data and median with IQR for the nonparametric distributions. Shapiro-Wilk testing was done to ensure parametric quality of data. No normalization of data was done. Chi-square was done for comparing the observed play with the expected. Pearson's correlation was done to analyze the comparability of levels of play with the severity levels of ASD.

Results:

Table 1: Assessment of play using Wes by Play Scale (WPS)

WPS Stages	N	%
Stage 1	37	74
Stage 2	13	26

If the same assessment is applied to a larger group, we can predict similar distributions. For example, if 100 children are assessed, we might expect:

- Stage 1: (74%) of 100 = 74 children
- Stage 2: (26%) of 100 = 26 children

If interventions or educational programs are introduced, tracking the movement of children from Stage 1 to Stage 2 over time can help measure the effectiveness of these programs. Most children are found to be in the Stage 1 (74%), as assessed by the WPS (Table 1).

Table 2: Assessing the diversity of participation in physical activities

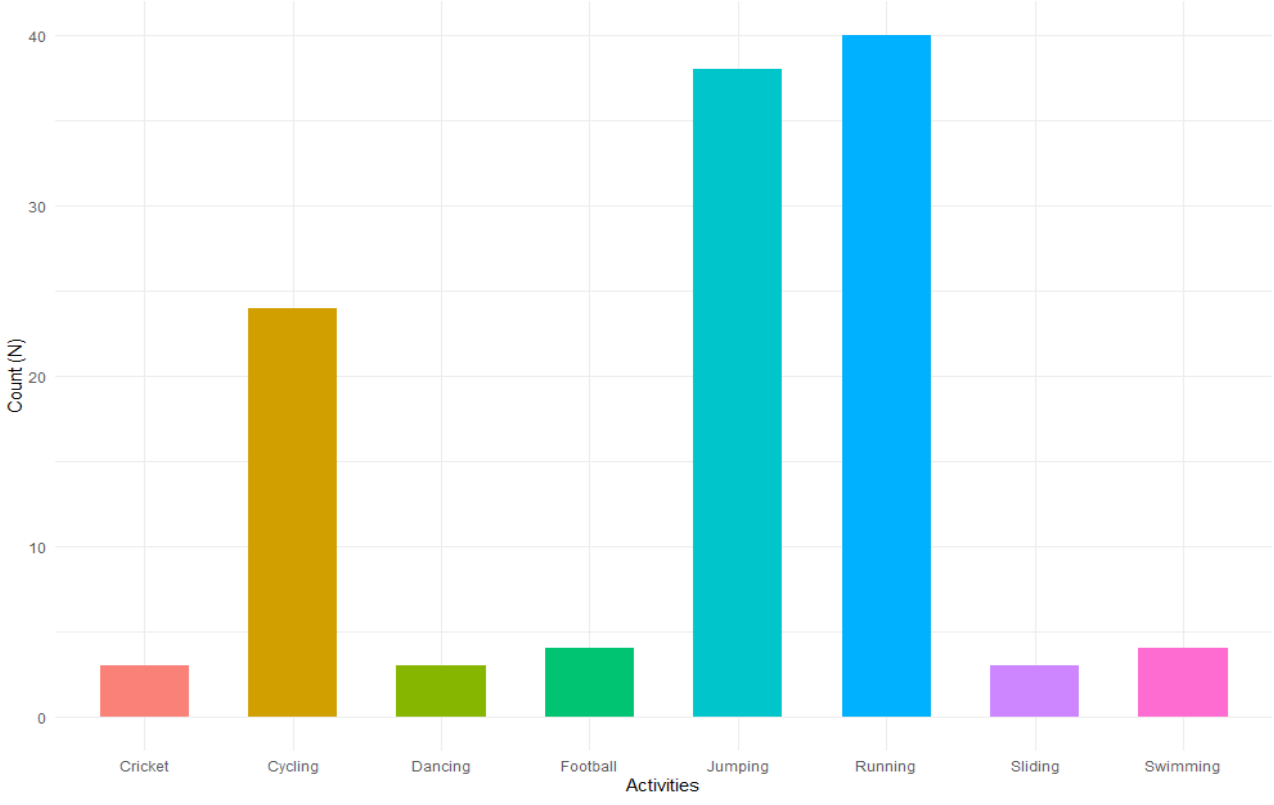
Activities	Observed N	Expected N	x^2
Cricket	3	14.9	128.328**
Cycling	24	14.9	
Dancing	3	14.9	
Football	4	14.9	
Jumping	38	14.9	
Running	40	14.9	
Sliding	3	14.9	
Swimming	4	14.9	

***** p < 0.001***

Jumping and Running have much higher observed frequencies compared to the expected frequencies, indicating these activities are significantly more popular than expected (Table 2).

Dancing, Football, Sliding, and Swimming have much lower observed frequencies compared to the expected frequencies, indicating these activities are significantly less popular than expected (Figure 1).

Fig 1: Bar plot showing the frequencies of the activities



A significant χ2 (goodness of fit test) among the activities implies there is significant difference (diversity) among the physical activities involved in, by the children. The observed and expected frequencies have been given in the (Table 2).

Table 3: t-test for BMI across the age and gender groups

Variables	Age	N	M	SD	T	Df	M_D	SE_D	p
Age	Below 5yrs	21	16.511	1.653	0.582	48	0.29	0.498	0.563
	Above 5yrs	29	15.221	1.793					
Gender	Male	33	16.097	1.95	-1.691	47.752	-0.722	0.427	0.097
	Female	17	16.819	1.067					

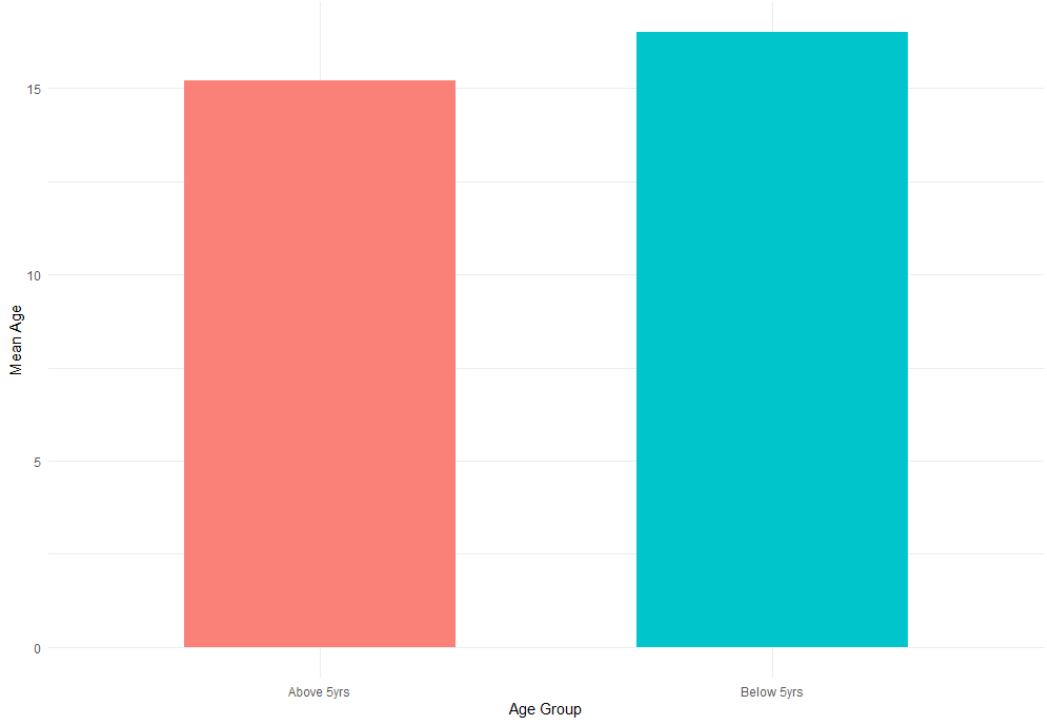
Variable: BMI

The above table reveals that there is no significant difference found among the age groups and the sexes in terms of the BMI of the autistic children (p = n.s.). However, children below 5 years were found to have a slightly higher mean BMI. Similarly, the females were found to possess slightly higher mean BMI than the males (Table 3).

a) Age Group Comparison:

- The mean score for children below 5 years is slightly higher than for those above 5 years.
- The p-value (0.563) indicates that the difference is not statistically significant, meaning there is no strong evidence to suggest a difference in means between the two age groups (Figure 2).

Fig 2: Bar plot showing the mean of the age groups



b) Gender Comparison:

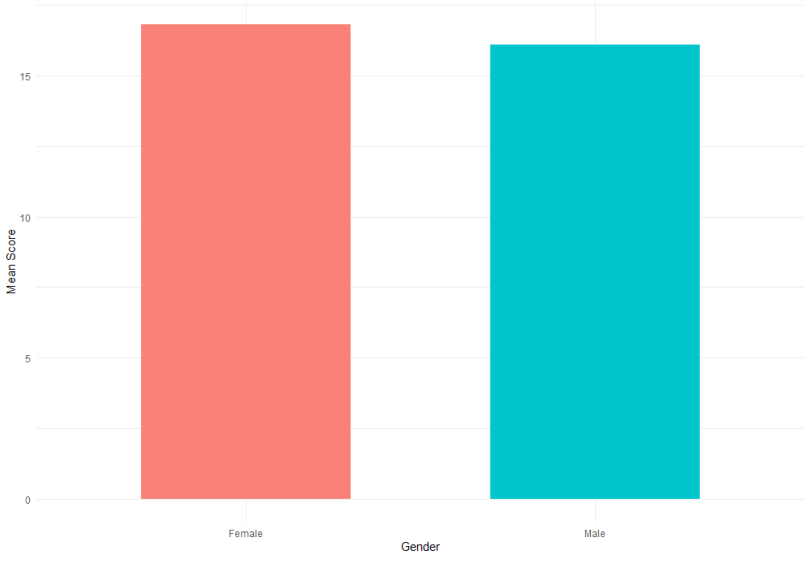
- The mean score for females is slightly higher than for males.
- The p-value (0.097) is close to the conventional threshold for significance (0.05), suggesting a potential difference, but it is not statistically significant at the 0.05 level (Figure 3).

Fig 3: Bar plot showing the mean of the gender group

Variable	Statistics	SCI	RRB	VSMS	PLS-5 Auditory	PLS-5 Expressive	SRS-2
WPS Stages	R	-.645**	-.077	.658**	571*	0.426**	-.580*
	P	0.000	0.594	0.000	0.000	0.002	0.000

** $p < 0.01$ * $p < 0$

Table 4: Correlation between level of participation in play and variables related to the severity of autism



Variables and Correlations:

a) **SCI (Social Communication and Interaction):**

- **Correlation ®:** -0.645**
- **p-value:** 0.000
- **Inference:** There is a strong negative correlation between level of participation in play and social communication and interaction.Highersocial communication and interaction is associated with lower level of participation in play (Table 4).

b) **RRB (Restricted and Repetitive Behaviors):**
- **Correlation ®:** 0.077
- **p-value:** 0.594
- **Inference:** There is no significant correlation between participation in play and restricted and repetitive behaviors.

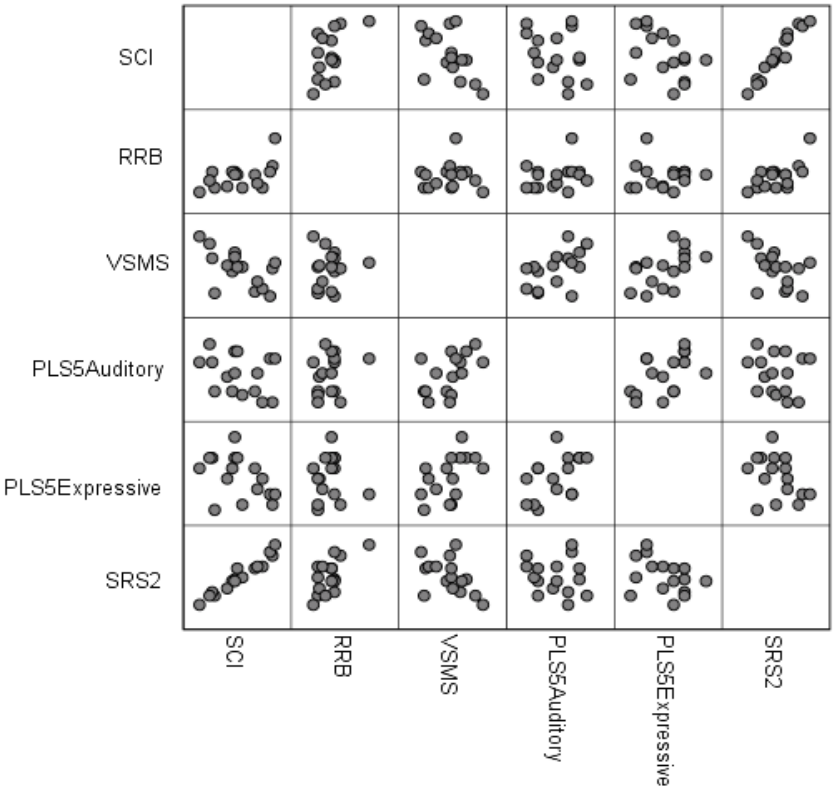
c) **VSMS (Vineland Social maturity Scale):**
- **Correlation ®:** 0.658**
- **p-value:** 0.000
- **Inference:** There is a strong between level of participation in play and social maturity. Better social maturity is associated with higher participation in play.

d) **PLS-5 Auditory Comprehension:**
- **Correlation ®:** 0.658**
- **p-value:** 0.000
- **Inference:** There is a strong positive correlation between participation in play and auditory comprehension. Better auditory comprehension is associated with higher participation in play.

e) **PLS-5 Expressive:**
- **Correlation ®:** 0.571*
- **p-value:** 0.002
- **Inference:** There is no significant correlation between level of participation in play and expressive language skills.

f) **SRS-2 (Social Responsiveness Scale):**
- **Correlation ®:** -0.580**
- **p-value:** 0.000
- **Inference:** There is a moderate negative correlation between participation in play and social responsiveness. The severity in social responsiveness issues is associated with lower participation in play.

Fig 4: Correlogram for the variables



It is observedthat there is a strong negative correlation between WPS Stages and SCI (r= −.645, p=.000), indicating that as WPS Stages increase, SCI decreases significantly. There exists a strong positive correlation between WPS Stages and VSMS, (r= .658, p=.000), and a moderate positive correlation with Auditory Comprehension (r= .571, p=.000), suggesting that higher WPS Stages are associated with higher scores in these areas. Also, a moderate negative correlation was observed between WPS Stages and SRS-2 (r= −.580, p=.000), indicating that higher WPS Stages are associated with lower SRS-2 scores. However, the correlations between WPS Stages and RRB (r=−.077, p=.594) and Expressive Comprehension (r= .426, p=.002) were not statistically significant implying that WPS Stages are significantly related to certain aspects of autism severity, particularly SCI, VSMS, and SRS2. It is not linked significantly with restricted interests and restricted behaviours and the expressive comprehension, as assessed by PLS-5 (Figure 4).

Discussion:

ASD components: SCI is inversely correlating with the play stages, but RRB does not correlate with stages of play.Children with ASD often exhibit delays in spontaneous pretend play compared to typically developing peers. Pretend play involves symbolic thinking and creativity. However, the relationship between RRBs and play stages isn't straightforward. While RRBs may interfere with certain play behaviors (e.g., rigid adherence to routines), they don't always correlate directly with play development [4, 5]. So, even though RRBs are common in ASD, they don't necessarily predict play stage progression.

VSMS: There exists a strong positive correlation between WPS Stages and VSMS, (r= .658, p=.000). This shows that social quotient of VSMS can reliably be used not just in analyzing sociability, but in analyzing how to play with the child. While the exact correlation with the Vineland Social Maturity Scale (VSMS) isn't directly covered in thisreview"A Systematic Review of Play-Based Interventions Targeting the Social Communication Skills of Children with ASD", understanding the impact of play-based interventions on social communication remains crucial for children with ASD[6]. Play-based interventions, recognizing that play offers a unique context for social communication development, especially in educational environments.

PLS-5: There exists a moderate positive correlation with Auditory Comprehension (r= .571, p=.000), suggesting that higher WPS Stages are associated with higher scores in these areas. However, the expressive part of it though is returning a significant p-value cannot be considered as r valueis <0.5; hence expressive language is not significantly correlating with the stages of play.A recent study titled "Neurophysiological measures of auditory sensory processing are associated with adaptive behavior in children with Autism Spectrum Disorder" investigated the relationship between early auditory processing (measured through auditory event-related potentials) and everyday adaptive behavior in children with ASD[7]. Atypical auditory cortical processing (smaller and/or slightly delayed auditory evoked potentials) was consistently found in children with ASD. Lateralization of auditory event-related potentials (AEPs) was significantly associated with adaptive functioning in the socialization domain.Sensory processing differences may impact everyday adaptive behavior in autism [7].

SRS-2: A moderate negative correlation was observed between WPS Stages and SRS-2 (r=

−.580, p=.000), indicating that higher WPS Stages are associated with lower SRS-2 scores. Although not directly related to WPS Stages, this study'Performance of the SRS-2 for Assessment of Neurodevelopmental Conditions" explored correlations between SRS-2 scores and other cognitive measures.A small negative correlation was observed between SRS-2 total T-score and various cognitive subtests [8].

Conclusion:

Study gives information on the similarity in level of play and social responsiveness. Level of play and severity of Autism are not related with respect to RRB, but is strongly related to SCI of SRS-2. Better social maturity and improved auditory comprehension are linked to higher levels of play participation in children with Autism Spectrum Disorder (ASD). On the other hand, greater severity in social responsiveness issues tends to be associated with lower engagement in play activities.

Stages of play closely correlate with social quotient. Children with ASD prefer solitary play to other type of play like parallel & Co-operating play; by age 4 years they the directly go to constrictive play. These children have a mild degree of autism severity with training developed pretend play and proceeded to different type of play. This differences in social responsiveness and play have to be considered while interacting with the child during activities.

These findings suggest that improving social communication and responsiveness, as well as auditory comprehension and expressive language skills, could enhance participation in play for children with autism. Programs focusing on enhancing social communication and language skills might be particularly effective in increasing play participation. Regular assessment of these variables can help tailor interventions to individual needs, potentially leading to better outcomes in play participation.

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Conflicts of interest:

There are no conflicts of interest

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RESEARCH ARTICLE

Effect of Clinic-Based Parental Guidance with ADHD Management on Parental Attitude and Behaviour in ADHD Children – A Practice-Based 5-Year Follow-Up

Authors
Dr. Lata Bhat MD, Director, Palak Child Development Centre, Delhi
Ms. Areeba Ahmed, Palak Child Development Centre, Delhi
Ms. Insha Mohammad, Palak Child Development Centre, Delhi
Ms. Akshita Bhat, Palak Child Development Centre, Delhi
Running title: Long-term impact of clinic-based parental guidance in ADHD
Dr. Lata Bhat: Concept, design, corresponding author
Palak Child Development Centre, 226 A, Pocket B, Mayur Vihar Phase 2, Delhi - 110091
Email: lata2207@gmail.com
Source(s) of support – Nil
Dr. Lata Bhat, Ms. Areeba Ahmed, Ms. Insha Mohammad, Ms. Akshita Bhat
Department & amp; Institution: Palak Child Development Centre, Delhi
Correspondence Author:
Dr. Lata Bhat,
Director Palak Child Development Centre,
226 A,Pocket B, Mayur Vihar, Phase 2, Delhi -110091;
E mail: lata2207@gmail.com

Abstract

Introduction: The prevalence of ADHD in India is 8 to 10 % of school-going children. Yet most parents do not seek the advice of a Developmental Paediatrician /mental health professional due to stigmas present in society and lack of awareness. In many cases, it's difficult for the parents to exactly understand the progress.

Aims and Objectives

To track the progress of ADHD children and see if there is a difference in the parental outlook.

Materials & Methods

A Quantitative Study on ADHD patients by using a self-administered survey questionnaire.

Results

A total of 50 parents of ADHD children were asked to answer the survey questionnaire, out of which 35 were answered. The survey comprised of77.8% males and 22.2% females; 48.1 % of children were 16 to 20 years old, 29.6% were 7 to 10 and 14.8 % were 11 to 15 years of age. 40.7% visited the clinic at the age of 11 to 15 and 25.9% at the age of 7 to 10. The common reasons for consultation were low concentration (88.9%), inattention (77.8%), hyperactivity (74.1%), difficulty in handling daily activities at school (70.4%), difficulty in handling daily activities at home (44.6%), behavioural issues (55.6%) and aggressive behaviour (44.4%). 48.1% of

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children showed improvement with behaviour modification alone and an equal percentage responded to both (behaviour modification and medications).< 5% responded to medication alone 77.8% are still following treatment after coming to the clinic> 5 years.7.4%followedfor 12 months or more whereas the least time frame for following recommendations was < 2 months, and only 7.4% followed treatment for less than 2 months. At least, 44.4 % of parents were>50% satisfied with medication, whereas about 30% were>80% satisfied with medication. About 70% of patients were > 50% satisfied with behaviour modification.

The effectiveness of behaviour modification was the highest in positive reinforcement (92.6%), followed by short targets for studies (77.8%),1:1 attention 74.1 %, repeat instructions, following timetable, and stopped criticizing with equal percentage (70.4%), physical activity 63% and stopped scolding (67%).91.2 % gave a score of > 50% satisfaction with the overall treatment.

Conclusion

Even though parents face problems with their kids from an early age, they seek guidance after 11 years of age, thus showing parental resistance to accepting a problem. However, the fact that currently, nearly 50% of children are in the 16 to 20 age group means that once they seek guidance and see results, they stick to the advice. However, there is a lot of resistance to medication, although they follow behavioural modification.

Keywords

Attention Deficit Hyperactive Disorder (ADHD), Developmental Paediatrician /mental health, parental

Introduction

Attention Deficit Hyperactive Disorder (ADHD) has a prevalence ranging from 2.5-10% in various parts of India, which is similar to the prevalence arrived at by many studies done internationally [1,2,3,4]. Lack of awareness and social stigma associated with it prevents most parents from seeking help at appropriate times. ADHD is a neurodevelopmental disorder defined by impairing levels of inattention, disorganization, and hyperactivity-impulsivity.

Behaviour management interventions are widely utilized as non-pharmacological strategies for addressing ADHD and its associated challenges. Among school-aged children with ADHD, symptoms of inattention, hyperactivity, and impulsivity often result in significant academic and social difficulties at home, school, and in various settings. Rather than directly addressing ADHD symptoms, behaviour management interventions primarily focus on addressing functional impairments [5]. In a home setting, behaviour management treatment commonly targets issues such as noncompliance with daily tasks, homework difficulties, and conflicts with family members. Behavioural parent training aims to improve parenting practices, enhance child behaviours, strengthen family relationships, and reduce overall family conflict.

Similarly, in school environments, students with ADHD frequently struggle with inattention, disorganization, and disruptive behaviours, leading to incomplete work and peer-related difficulties. Behaviour management interventions in schools aim to address these behaviours comprehensively [6]. The importance of treating ADHD during the school-age years cannot be overstated. Short-term consequences of untreated ADHD symptoms include

academic underachievement and strained social relationships, including conflicts within families and challenges in forming friendships. The aim of treating ADHD is to better the core symptoms and mitigate behavioural issues, typically through drug therapy and non-drug interventions. Evidence-backed treatments involve stimulant medication and behavioural approaches, either independently or in combination, although professional consensus on their relative efficacy and timing of initiation varies. Concerns over stimulant side effects, such as impacts on growth, heightwith dosage and duration of use counteract its optimal use. Consequently, behavioural interventions, which may improve outcomes, reduce costs, and minimize side effects, are often the initial choice, especially for preschoolers, as recommended by the American Academy of Paediatrics, Indian Academy of pediatrics (IAP) , and National institute of Health and care excellence (NICE) guidelines (UK).

Biofeedback, a therapeutic method targeting brain function to address neurological or psychological symptoms, represents a well-established treatment for ADHD, boasting remission rates of 32-47% with sustained effects observed after 6-12 months. [7] Research into behavioural interventions for ADHD underscores the effectiveness of parental management training in reducing symptoms. Cognitive-behavioural therapy interventions have shown promise in ameliorating ADHD symptoms and associated anxiety [8]. Studies also highlight the efficacy of telephone-assisted self-help interventions for parents of children with ADHD, indicating improvements in child behaviour and parenting practices [9] Moreover, observational data suggests that behaviour therapy can lead to long-term improvements in ADHD symptoms, suggesting promising prognoses for affected children [10]. However, its impact on core ADHD symptoms varies and is relatively modest when only blinded assessments are considered. Recent research suggests that combining medication with Cognitive Behaviour Therapy [CBT] is more effective than using stimulant medication alone [11].

For children under the age of 6 diagnosed with ADHD, the most recommended evidence based initial intervention is parent behaviour training. The effectiveness of psychostimulants in this age group is not well supported, and their use is not approved by any international guidelines, including the IAP guidelines on ADHD [12,13, 14]. However, for children aged 6 and above, medication, primarily targeting core ADHD symptoms, should be considered. Nonetheless, since over half of children with ADHD have other psychiatric and developmental conditions, a comprehensive approach that includes non-pharmacological interventions,including psycho educating the parents and families, should be adopted to improve compliance, academic performance, and overall quality of life.[9]Parents' preferences for either medication or behavioral interventions for younger children are influenced by their beliefs, accessibility of interventions, and concerns regarding adverse effects and stigma. Those focusing on improving academic skills tend to lean toward medication, while those concerned about behaviour are more inclined toward behavioural therapy. Further, there's a growing concern about the overprescription of stimulants for non-ADHD-related disorders and the use of multiple medications for ADHD treatment [10].Consequently, the prescription rates for ADHD have risen substantially in

various countries. Regarding the effects of stimulant medication, while short-term trials have shown improvements in various domains such as decision-making and academic productivity, the long-term impact on core ADHD symptoms is uncertain. However, stimulants seem to enhance quality of life, and academic achievement, and reduce rates of comorbid anxiety and depression in young adulthood. Longitudinal studies suggest that persistent ADHD symptoms into adulthood may warrant continued stimulant treatment, as it is associated with better employment outcomes and reduced risks related to motor vehicle injuries. [11]

Considering the uniqueness of Indian scenario where the parents often take self-decisions, do irrational interventions and are often mislead to alternative interventions with dubious benefits, it becomes imperative to understand the role of psychoeducation of the parents of children with ADHD and understanding the dynamics behind informed decision making. Hence a study was proposed to compare the effectiveness of the stimulant medications with or without parental education for parents of children with ADHD.

Objectives

The primary objectives of the study were to understand the progress of the ADHD children undergoing ADHD interventions by behaviour modification and / or medication and to assess the effectiveness of parental training followed up by interval guidance in sustaining the interventions at clinic level.

The secondary objective was to study the parental outlook towards clinic based parental guidance in maintaining sustained interventions in children with ADHD.

Methods

Parents of children in the school going age group 6 years to 18 years, who gave written informed consent to participate in the study and undergo interventions as explained in the study brochure were enrolled into the study by consecutive sampling method. A validated self-administered questionnaire on ADHD was given to the parents to fill up their response. This quantitative study analysed the effect of the clinic based parental guidance on changing unhealthy attitudes of parents and its consequences on the behaviour of children. Questionnaire is given as Appendix: 1. Following recruitment, depending on their age, they were either offered medication with behaviour modification (CBT) or parental training on behaviour management alone. Counselling was done by Clinical psychologist, and medical interventions and needed assessments were done by Developmental paediatrician. Survey method was used for data collection to understand the attitude and changes there-in.

Statistical analysis

Descriptive analysis was done for the demographic characteristics. Mean with SD was calculated where ever parametric data was available and median with interquartile were calculated for nonparametric data.

Results

Out of 50 parents who enrolled in the study, only 35 parents of ADHD children completed the 5-year follow-up study and answered the survey questionnaire. Sex distribution was skewed towards males with 77.8% males and 22.2% females. At the time of analysis, 48.1 % of children were 16 to 20 years of age, 29.6% were 7 to 10 years, and 14.8 % were 11 to 15 years of age. (Figure:1)

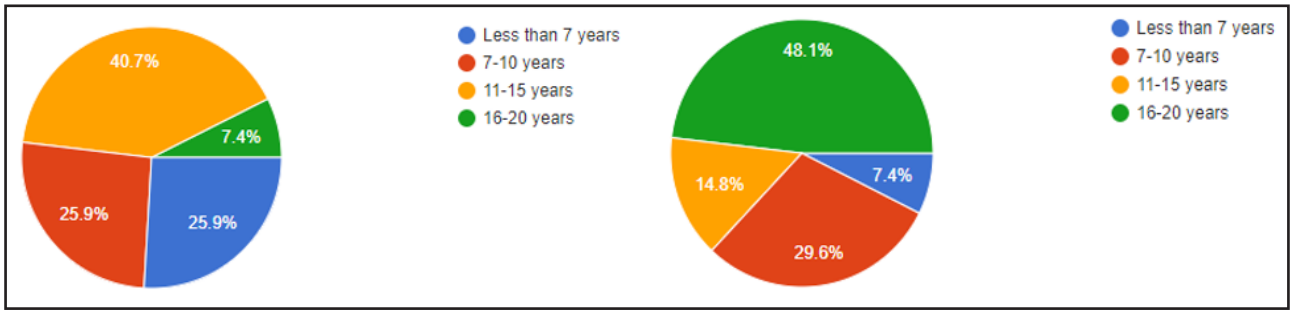


Figure 1: Distribution of age at enrolment and at follow-up.

Out of the study population, 40.7% came to the health care facility at 11 to 15 years, and 25.9 % came at 7 to 10 years. The common reasons for consultation were low concentration (88.9%), inattention (77.8%), and hyperactivity (74.1%), difficulty in handling daily activities at school (70.4%). Difficulty in handling daily activities at home (44.6%) behavioral issues (55.6%), aggressive behavior (44.4%).

Effect of Interventions:

48.1% of children showed improvement with behavior modification alone and an equal percentage responded to both (behavior modification and medications); < 5% responded to medication alone (Figure2).

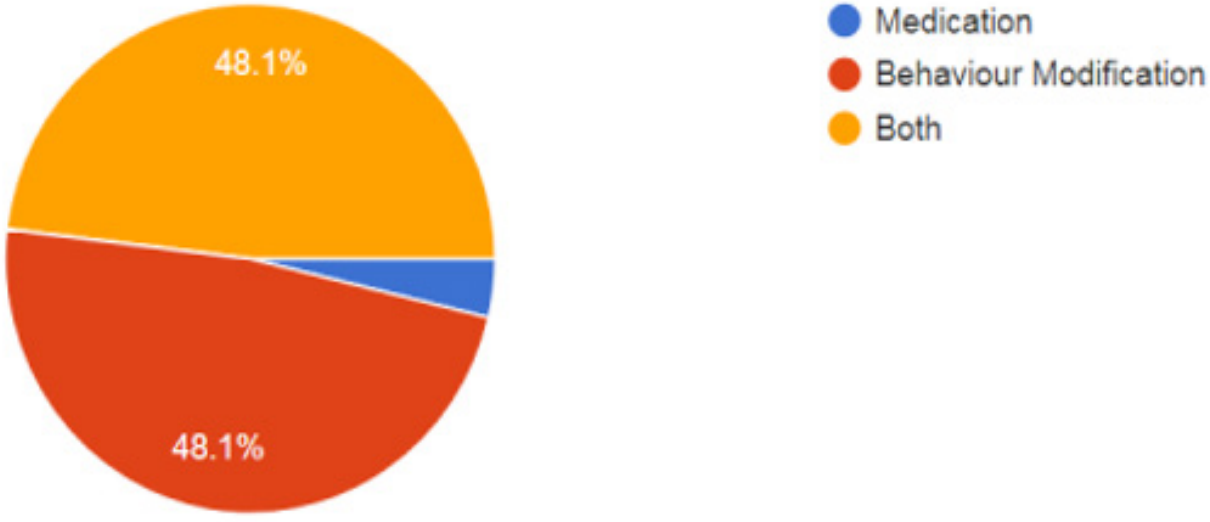
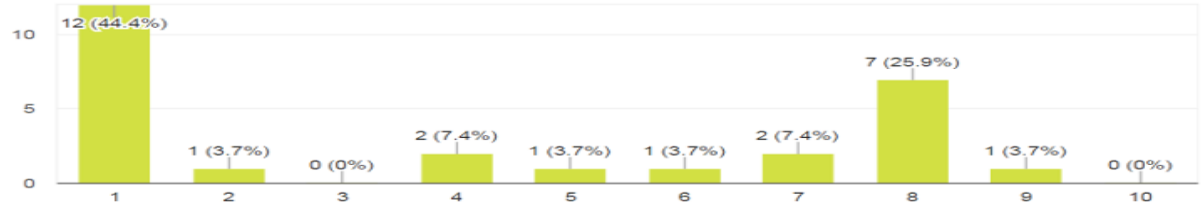


Figure 2: Distribution of effect of interventions

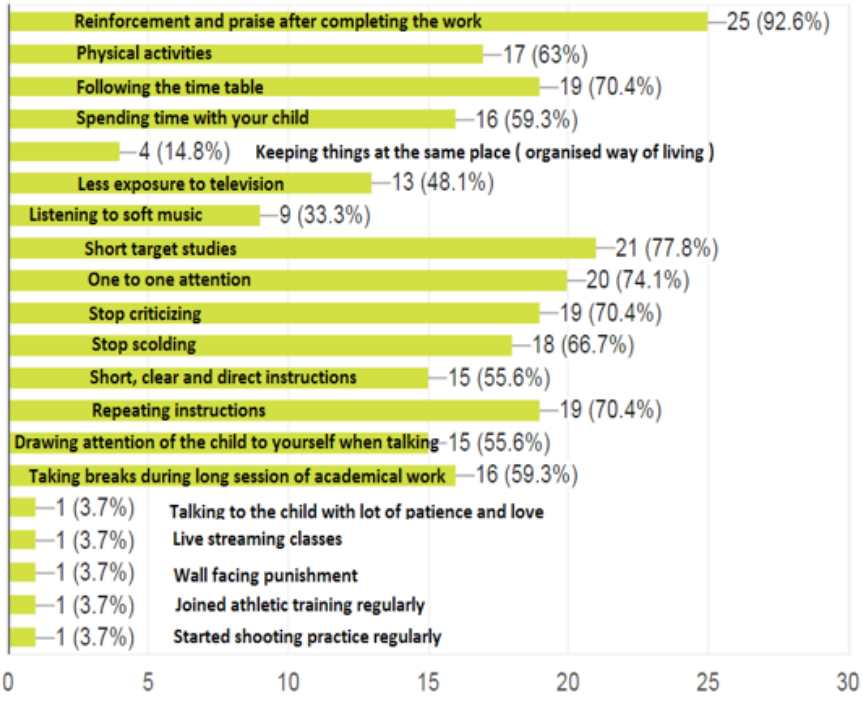
44.4 % were more than 50% satisfied with medication, whereas about 30% were more than80% satisfied with medication. About 70% of patients were more than 50% satisfied with behavior modification.44.4 % were more than 50% satisfied with medication, whereas about 30% were more than80% satisfied with medication. About 70% of patients were more than 50% satisfied with behavior modification. (Figure 3).



44.4% parents preferred not to give medication, which shows parental resistance to start medicine. Out of those ADHD kids who received medicine , about 70 % found it to be effective .

Figure 3: Figure 3: Effect of medications:

The most effective behavioural intervention was reinforcement and praising the child. In behavior modification positive reinforcement (92.6%), short targets for studies (77.8%),1:1 attention 74.1 %, following time table (70%), repeat instructions, and stopped criticizing (70 %,) physical activity 63%, Stopped Scolding (67 %).91.2 % gave a score of > 50% satisfaction in overall treatment. (Figure 4)



The most effective BM was found to be the 'positive reinforcement' given to the children followed by 'short target studies' and 'one to one attention'. The equal percent of effectiveness could be seen in 'not criticizing the child', 'repeating instructions' and 'following the time table.'

Figure 4: Effectiveness of interventions

77.8% were still following treatment after coming to clinic;14.8%followed for 12 months or more whereas only 7.4% followed treatment for less than 2 months. The fact that about 50% of children are 16 to 20 years old and still seeking guidance, means good compliance once they come to the centre. (Figure 5)

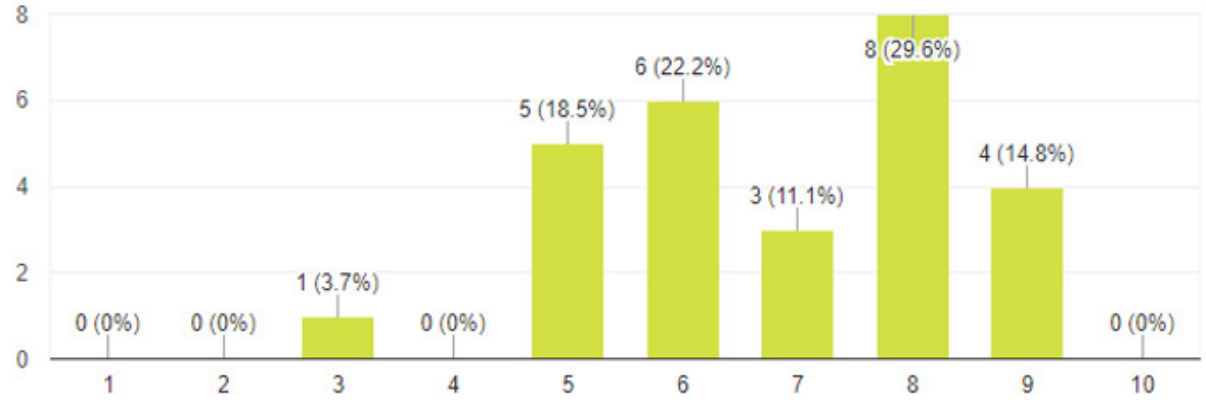


Figure 5: Better Overall satisfaction ensuring follow-up compliance

Most parents seek guidance after 11 years of age, although they face problems from an early age, thus showing parental resistance to accepting that there is a problem. However, the fact that currently, nearly 50% of children are in the 16 to 20 years age group, means once they seek guidance and see results, then they stick to the advice. However, there is still a lot of resistance to medication, although they follow behavioural modification.

Discussion

Despite its limitations, the current research has yielded insights into potential themes associated with ADHD behaviors in India [15,16]. Behavioral disorders in India are often viewed as specific to school environments and are not typically taken seriously until they impact academic performance as seen in the present study. This is inline with other studies also where the inattention and its effects are neglected till it affects the scholastic performance [17, 18].

In the present study, too most of the parents (74%) sought guidance after they got complaints from the school, that's why they approached our centre mostly when the child started showing poor scholastic performance. Parents of children diagnosed with ADHD often have doubts about behaviour interventions and medication. The acceptability of treatment depends on various factors such as positive outcomes, time, effort, and effectiveness. Parents who perceive their child's behaviours as severe, such as oppositional, disruptive, or aggressive, are more inclined to seek counselling rather than medication as a treatment option.

In Indian culture, child-rearing is primarily the responsibility of mothers, who are expected to prioritize homemaking and child-rearing over professional careers [19,20]. These expectations are deeply ingrained and reinforced by family and societal norms. Fathers typically become involved only when their child's behaviours become significantly problematic in a school setting [15; 16]

The present study found that ADHD children were perceived as difficult to handle at school and disruptive as is the case with Children with ADHD in many parts of India wherein they are often perceived as disruptive and hyperactive, leading to potential stigma for their mothers [21; 22; 23]. In the present study **the common reasons for consultation were low concentration in 45 children (88.9%), inattention in 39children (77.8%), hyperactivity in 37 children (74.1%),**

difficulty in handling daily activities at school in 35 children (70.4%). Difficulty in handling daily activities at home in 22 children (44.6%) behavioral issues in 28 children (55.6%), aggressive behavior in 22 children (44.4%).

The child's behaviors are commonly seen as a reflection of the mother's parenting style, regardless of whether the child is diagnosed with a mental illness [21]. Additionally, mothers may fear stigma themselves if they seek psychological services. Efforts to destigmatize mental illness are underway through initiatives like the National Mental Health Program in India.

The primary treatment for ADHD involves pharmacotherapy and behavioral management. Accurate diagnosis is crucial before initiating treatment, and parents should be counselled that while treatment may improve their child's behaviour, it might not eliminate core symptoms. Stimulant medications are typically the first line of treatment, with non-stimulant alternatives considered if there's no improvement after 6 to 8 weeks. Behavioral interventions from trained professionals are also beneficial in managing difficult behaviors.

In the present study too parents accepted behaviour modification very well and were satisfied with the results of behaviour modification by a trained psychologist. CBT was given to kids who were more than 10 years old in the present study. About 70%parents were more than 50% satisfied with behaviour modification whereas only 44.4% parents were more than 50% satisfied with medication in the present study.

Psychoeducation for parents and extended family members is essential for symptom improvement, along with involvement from schools to ensure appropriate behavioral management.

It showed beneficial results in the present study too.

Medication for ADHD should only be prescribed by healthcare professionals with expertise in ADHD diagnosis and management. Parent training programs are recommended as the initial treatment for children under 5 years old with ADHD. Medication for this age group should only be considered after consultation with a specialist. For children over 5 years old, education about ADHD causes and impacts, parenting advice, and collaboration with educational institutions are advised. Medication should only be considered for children and young people over 5 years old if symptoms persistently impair daily functioning after environmental modifications have been attempted and evaluated. These guidelines were followed in the present study.

Conclusion

The problems faced by the kids from an early age are often neglected and guidance is usually sought latesince behavioural problems in India are often viewed as typical to the school environment and not typically taken seriously until it affects scholastic performance. Further inattention and its ill effects are often neglected till it affects academic performance.

Kids with ADHD responded better to combined treatment with behaviour modification and medication than medication alone.However, there is a lot of resistance to medication, although they follow behavioural modification.The counselling of parents and behaviour modification sessions of the child in the clinic contribute significantly to improving the outcome. Medication has a very important role to play in a kid with ADHD, since it improves concentration, improves behaviour and makes the child less oppositional. Thus the

child is more available for learning. Behavioural interventions, improve outcomes, reduce costs, and minimize side effects of medication due to reduction in the dose requirement. Thus the parents should be counselled that behaviour modification in association with medication reduces the dose of medication required to improve the symptoms and thus their concerns about side effects and cost will be reduced.

Further, once they seek guidance and see results, they stick to the advice.

What this study Adds :

1. Most parents seek guidance for ADHD after 11 years of age, although they face problems from an early age, thus showing parental resistance to accepting that there is a problem.
2. Parents of children with ADHD have lots of resistance to medication, although they follow behavioral modification. But once they see results especially in a very difficult behaviour of the child or very poor academic achievement, they follow the advise.

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Conflicts of interest:

There are no conflicts of interest

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Appendix 1

Self-administered Survey Questionnaire:

ADHD Treatment Survey (Palak Child Development Centre - Dr. Lata Bhat)

"Your responses will contribute to our analysis and will give us a chance to improve things and reach to you and other ADHD parents and children in a better way. Through this survey, we will be able to authenticate our treatment with the evidence-based practices used worldwide to treat ADHD. Please fill the questionnaire as per your experience. We thank you for giving us your precious time and we ensure that the information provided by you will be kept confidential.

* Indicates required question

1. Name of the child*

2. Gender of the child*
   Male Female

3. Age of the child*
   Less than 7 years 7-10 years
   11-15 years 16-20 years

4. Approximate age of the child when first consulted to the Centre*
   Less than 7 years 7-10 years
   11-15 years 16-20 years

5. What was the issue/reason of consultation. You can mark more than one response.*
   Inattention Hyperactivity
   Low Concentration Low Confidence
   Low Motivation Behavioural Issues
   Aggression Difficult peer relations
   Difficulty in handling daily activities at home
   Difficulty in handling daily activities at school
   Other:

6. In your opinion, which of the following was more effective in the treatment of your child?*
   Medication Behaviour Modification
   Both

7. For how long did you follow the treatment/recommendations given?*
   Less than 2 months 6 months
   12 months 12 months or more
   Still following

8. On a scale of 1-10; how much effective was the Medication? (10 being the most effective)*
   1 2 3 4 5 6 7 8 9 10

9. On a scale of 1-10; how much effective was the Behaviour Modification? (10 being the most effective)*
   1 2 3 4 5 6 7 8 9 10

10. Which of the following recommendations of Behaviour Modification was more effective? You can mark more than one response.*
    Reinforcement and praise after completing the work
    Physical activities
    Following the time table
    Spending time with your child
    Keeping things at the same place
    (organised way of living)
    Less exposure to television
    Listening to soft music
    Short target studies
    One to one attention
    Stop criticizing
    Stop scolding
    Short, clear and direct instructions
    Repeating instructions
    Drawing attention of the child to yourself when talking
    Taking breaks during long session of academical work
    Other:

11. On a scale of 1-10; how much were you satisfied with the overall treatment? (10 being highly satisfied)*

GUIDE LINES FOR AUTHORS AND MANUSCRIPT PREPARATION:

THE MANUSCRIPTS:

The manuscript should be an original research paper which sufficiently contributes novelty to Development and Behavioral Pediatrics. Authors are requested to submit their papers electronically by using IJDBP online submission procedure. The corresponding author should also provide a statement that the manuscript is not concurrently being under consideration for publication elsewhere. The Editors will ignore submissions that do not follow these procedures.

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2. Abstract should not be more than 300 words & should be on a separate sheet. It should present the most important results stating the background, methods, results & conclusion.
3. Key words (5 to 7).
4. Word count-
   a. For Research Articles 2000 to 2500 words.
   b. For Review Article 2500 to 3000 words.
   c. For Consensus Guidelines 3000 to 3500 words.
   d. For updates 500 to 1000 words.
   e. For Case Reports 500 to 1500 words.
   f. Commentary 1000 to 1500 words
   g. Letter to editor 500 words
5. Introduction – should state purpose of study & give brief review of pertinent literature. Cite only those references that are essential to justify the purpose of study.
6. Material & Methods should follow the introduction & should provide enough information to permit repetition of experimental work/ project, giving how the study was designed, carried out and data was analyzed. State whether study was approved by ethics committee or not. Describe statistical analysis methods used with required details. Give actual p-values, t-values define statistical terms, symbols and abbreviations.
7. Results should describe the outcome of study giving relevant data. Avoid repeating in the text all the data depicted in tables or illustrations: Tables (numbered in roman numerals) & illustrations (Numbered in Arabic Numerals) should be prepared on separate sheet(s) with headings or legends. Minimum size of illustrations should be 8 x 10 cm. Top of figure should be marked by an arrow on its back as well as figure's number and author's name on left side of photograph. Cite the tables/ figures in the text at appropriate places.
8. Discussion ordinarily should not be more than 1/3 of total length of manuscript. New and possible important findings of the study should be emphasized, as well as any conclusions that can be drawn. The Discussion should compare the present data to existing literature. The implications of the findings and their limitations, including potential for future research should be discussed. New hypotheses and clinical recommendations that are appropriate should be clearly identified.
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B. When writing a reference in text, the surname of the author should be given; if there are two authors, the surnames of both the authors should be given & if there are more than two authors, then surname of first author followed by "et al" and name(s) should be followed by year in bracket.

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4. The title is written using capital letters only at first word or special name (example: location name), 17 font size, center position.
5. Sub titles are written using capital letters only at first word or special name, 12 font size, starting from the left margin.
6. Sub of a sub of sub titles, if any, are written using capital letters only at the beginning of each word except for connecting words, all in italics. They should be started from the left margin.
7. All references should be preferably of the last ten years publication.

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