Criterion Validation of 'ADHD Related Items' in INCLEN NDST Against AIIMS Modified INDT-ADHD Among Children with Developmental Problems

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Abstract

Introduction: Attention deficit hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders of childhood with a global prevalence of 3-5% in school-aged children.

Aims and Objectives: The primary objective of the study was to assess the criterion validity of ADHD-related items in the Neurodevelopmental screening tool (NDST) against AIIMS-modified INDT-ADHD as Gold standard using sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Materials and Methods: This was a descriptive study - diagnostic test evaluation carried out at NIMS Spectrum-CDRC, Thiruvananthapuram, a tertiary care center for children with neurodevelopmental problems. 50 consecutive children who came to CDRC for suspected developmental problems were screened initially with ADHD-related items in NDST by an experienced developmental therapist and evaluated with AIIMS modified INDT-ADHD by a developmental nurse counselor trainee, blind to the screening results.

Result: On doing criterion validation, the psychometric properties were as follows sensitivity of 90%, specificity of 80%, positive predictive value of 94.74%, negative predictive value of 66.67%, positive likelihood ratio of 4.50 and negative likelihood ratio of 0.13 with diagnostic accuracy of 88%. Prevalence of ADHD as per screening NDST items was 76% and with gold standard AIIMS modified INDT-ADHD was 80%.

Conclusion: ADHD-related items in NDST had acceptable psychometric properties, to screen for ADHD among children suspected with developmental problems.

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Keywords:

- Attention deficit hyperactivity disorder (ADHD)
- NDST
- INCLEN

Introduction:

Most children may have times when their behaviour becomes out of control like; crashing into everything around them, drifting as if in a daydream, failing to finish what they have started, failing to pay attention, making noise, refusing to wait their

turn, and speed about in constant motion and all these are normal at certain ages[1]. On the other hand, children with Attention-Deficit Hyperactivity Disorder (ADHD) have behavior problems that are so frequent and/orso severe that they interfere with their normal life routines. Their impulsive nature may put them in actual physical danger and those who have trouble paying attention usually have trouble learning. ADHD is typically observed by 4 years of age. However, younger presentations of symptoms are being increasingly reported. Symptoms typically increase over the next 3 to 4 years, peaking between 7 and 8 years of age. The percentage of children ever diagnosed with ADHD increases with age.If left undiagnosed and untreated, ADHD can lead to serious, lifelong problems such as; (i) poor grades in school, (ii) trouble with the law, (iii) failed relationships, (iv) substance abuse, and (v) inability to keep a job.

ADHD is one of the most common neurodevelopment disorders of childhood, with a global prevalence of 3 – 5% among school-aged children, as against 1.7% reported in India as per an INCLEN study[2,3]. Globally, the International Classification of Disease-10 (ICD-10) and the Diagnostic and Statistical Manual of Mental Health Disorders (DSM) criteria are used to diagnose ADHD[4,5]. DSM-5, the latest version consists of two symptom domains-hyperactivity/impulsivity(H/I) and inattention(I), associated with impaired social, academic, adaptive, and occupational functioning[6]. The Neurodevelopmental screening tool (NDST-Research form) a 39-item screening tool developed by INCLEN trust, screens for 10 neurodevelopment disorders with 3 specific questions related to ADHD. INDT-ADHD, the International Clinical Epidemiology Network (INCLEN) Diagnostic Tool for Attention Deficit Hyperactivity Disorder was developed and validated for the age group of 6–9 years based on the DSM-IV criteria as the gold standard [7].ADHD is associated with impaired academics, dysfunctional peer relationships, and school dropouts[8-11].In the present study, a feasible approach was taken using the Neuro-developmental Screening tool (NDST-Research form) developed by the INCLEN NDD study team and led by Arora NK to screen for 10 neurodevelopmental disorders, and specifically use those items relevant for ADHD as a screening tool and validate the same against AIIMS modified INDT-ADHD as gold standard. After validation, ADHD-related items in the NDST-Research form can be used by community doctors and health workers to identify a child with ADHD early.

Objectives:

Primary Objectives: -

1. To administer (NDST-Research form) Neuro-developmental Screening tool, on all consecutive children4-12 years with complaints of inattention and/or hyperactivity, attending NIMS -Spectrum CDRC.
2. To administer AIIMS-modified INDT-ADHD Diagnostic tool on the same children.
3. Criterion validation of ADHD-related items in NDST-Research form (NDST R/F) against AIIMS modified INDT-ADHD as the gold standard and to calculate sensitivity, specificity, predictive value, diagnostic accuracy, likelihood ratio positive and likelihood ratio negative.

Materials & Methods:

The present study is a hospital-based criterion validation study carried out from January 2022 to July 2022 over a period of 6 months, at Thiruvananthapuram NIMS-Spectrum-Child Development Research Centre (CDRC), Noorul Islam Centre for Higher Education (NICHE), Deemed-to-be University. Fifty consecutive children 4-12 years of age with complaints of inattention and /or hyperactivity, coming to NIMS-Spectrum-CDRC, a tertiary care centre for children with neurodevelopmental problems, were included. Institutional Ethical Committee clearance was obtained (Regn. No. ECR/218/Inst/Ker/2013/RR-16 and Approval No. NIMS/IEC/2022/01/06, dtd. 10/01/2022) and the study was initiated with due consent from each parent.

The diagnostic tool used was the All India Institute of Medical Sciences modified AIIMS-INDT-ADHD tool, validated against DSM-5, which is easy to administer and requires minimal training[11,12]. The AIIMS Modified-INDT-ADHD tool has 18 items, 9 items each in two domains inattention and hyperactivity-impulsivity. To be diagnosed as ADHD child must fulfil 6 out of 9 criteria in inattention (A1) and hyperactive/impulsive domain (A2) with symptom onset in less than 12 years of age, lasting for greater than 6 months duration and

in more than 2 settings. The tool also mentioned that Intellectual Disability Disorder (IDD) must be excluded.

Data was collected by interview method. The NDST-Research form was administered by an experienced Developmental Therapist and AIIMS Modified INDT-ADHD by a trained Developmental Nurse Counsellor, blind to the screening results. The analysis was performed using the Statistical Package for Social Science (SPSS version 20).

Results:

Out of the study population of 50 children, 37 were of 4-9 years and 13 were of 10-12 years; 42 were male and 8 were female.

Table 1: Prevalence of ADHD using 'ADHD related items' in NDST-Research form.

NDST No.	NDST-Research form Items	No	Sometimes	Most of the time
75a	Is your child excessively active and appears to be 'on the go'?	6 (12%)	6 (12%)	38 (76%)
76a	Does your child appear to act, speak, or behave without thinking?	15 (30%)	8 (16%)	27 (54%)
77a	Does your child have difficulty sustaining attention on activities at school, home, or play?	5 (10%)	13 (26%)	32 (64%)
	NDST-Research form Impression: N (%) = ADHD: 38 (76%); No ADHD:12 (24%)			

Using ADHD-related items in NDST-R/F; 38 children were excessively active and appeared to be on the go; 27 appeared to act, speak or behave without thinking; and 32 were having difficulty in sustaining attention on activities at school, home, or play. Altogether, 38 (76%) children were positive for ADHD using NDST-R/F.(Table 1)

Table 2: Prevalence of ADHD using AIIMS Modified INDT- ADHD.

Domains	<6	6 or more
INDT ADHD A1-Inattention	13	37
INDT ADHD A2 –Hyperactivity/Impulsivity	13	37
	NO	**YES**
INDT ADHD 3 – Symptoms start before 12 years	12	40
INDT ADHD 4 – Symptoms present for at least 6 months	12	40
INDT ADHD 5- Symptoms present in at least 2 settings	12	40
INDT ADHD 6- Frequent fights/no new friends/frequent injuries/ frequent scolding by parents/complaints from teachers/poor school performance	12	38
INDT ADHD 7 – Symptoms be explained by ID	--	50
INDT ADHD 9 – Whether child can be diagnosed as ADHD	10	40
INDT ADHD 10- child on any medical/ non-medical intervention	29	21
AIIMS Modified INDT-ADHD Impression: N (%) = ADHD: 40 (80%); No ADHD: 10 (20%)		

Using AIIMS Modified INDT-ADHD, 37 children had inattention, and 37 had hyperactivity/impulsivity. Altogether, 40 children were found to have ADHD using AIIMS Modified INDT-ADHD. (Table2)

Table 3: ADHD Related items in NDST-Research form Vs AIIMS Modified INDT-ADHD.

NDST-Research form Impression	AIIMS Modified INDT-ADHD Impression		Total
	ADHD	No ADHD	
ADHD	**36 (TP)**	2 (FP)	38
No ADHD	4 (FN)	**8 (TN)**	12
Total	40	10	50

On doing criterion validation (Table 3) of 'ADHD related items' in the Neurodevelopmental screening tool (NDST-Research form) against AIIMS modified INDT-ADHD, the psychometric properties were as follows; sensitivity of 90%, specificity of 80%, positive predictive value of 94.74 %, negative predictive value of 66.67%, positive likelihood ratio 4.50 and negative likelihood ratio 0.13. Diagnostic Accuracy of the test was found to be 88%.

Discussion:

According to this criterion validation study,38(76%) children had ADHD as per the screening tool NDST, and 40 (80%) children had ADHD as per the diagnostic tool AIIMS Modified INDT-ADHD. The psychometric properties of ADHD-related items in NDST-R/F against AIIMS-modified INDT-ADHD is more than satisfactory. The ability of the NDST tool to correctly identify children with ADHD is 90% and the ability to correctly identify children without ADHD is 80%which is acceptable for a screening test.

A study revealed that older boys with ADHD showed fewer peer problems than younger boys with ADHD, but older girls with ADHD had similar peer problems as younger girls with ADHD[13,14]. In the present study, of the total 40 children who tested positive for AIIMS Modified INDT-ADHD,34children(85.0%) in the age range 4-9 years had ADHD features, while 6 children(15.0%) in the age range of 10-12 years had ADHD.A meta-analysis by Gershon J et al., states that ADHD girls have lower ratings on hyperactivity, inattention, impulsivity, and externalizing problems in comparison to ADHD boys[15].

Conclusion:

The results of this study showed that criterion validation of ADHD-related items in the Neurodevelopmental screening tool (NDST-Research form) has good psychometric properties when validated against AIIMS Modified INDT-ADHD taken as the gold standard. This suggests that ADHD-related items in the NDST-Research form can be used to screen for ADHD among children suspected of developmental problems in a Child Development Centre setting.

What this study adds ?

- The study validates the effectiveness of ADHD-related items in NDST-R/F, showing good psychometric properties against the gold standard AIIMS-modified INDT-ADHD.
- It supports NDST as a feasible community-level screening tool for early ADHD identification.

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Conflicts of interest

There are no conflicts of interest

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