Date Received : 27 AUGUST 2024 | Accepted: 29 SEPTEMBER 2024
Indian Journal of Developmental & Behavioral Pediatrics
(Official Journal of IAP Chapter of Neurodevelopmental Pediatrics)
RESEARCH ARTICLE

CRITERION VALIDATION OF 'ASD RELATED ITEMS' IN INCLENNDST – RESEARCH FORM AGAINST AIIMS MODIFIED INDT-ASD AS GOLD STANDARD

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Access this article online :
Quick Response Code:
Website :
https://ijdbp.in
DOI :
https://doi.org/10.5281/zenodo.13885153

Abstract:

Autism Spectrum Disorder (ASD) is an important developmental disorder worldwide with a prevalence of 0.09% - 1.07%, in the Southeast Asia population including India.

***Objectives**:* The primary objective of the study was criterion validation of 'ASD-related items' in NDST as a screening tool for ASD against AIIMS-modified INDT-ASD as gold standard and to calculate sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

***Methodology**:* This is a descriptive study - diagnostic test evaluation, which was carried out from January- July 2022, at NIMS Spectrum - CDRC, Thiruvananthapuram, a tertiary care center for children with neurodevelopmental problems. Fifty children, who came to CDRC with suspected developmental problems were screened with ASD-related items in NDST by an experienced Developmental therapist and evaluated with AIMS Modified INDT-ASD by a Developmental Nurse Counsellor trainee, blind to the results of the screening.

Result: On doing criterion validation of ASD related items in NDST the psychometric properties were as follows: Sensitivity of 100%, Specificity of 80%, Positive Predictive Value of 95.24 %, Negative Predictive Value of 100%, Positive Likelihood Ratio 5; and Negative Likelihood Ratio 0.0. Diagnostic Accuracy of the

test was found to be 96%. The prevalence of ASD as per screening tool NDST items was 84% and as per the gold standard is 80.00%.

***Conclusion**:* ASD-related items in NDST is a simple screening test, with good psychometric properties, to screen for ASD among children suspected with developmental problems.

Keywords*:* ASD, NDST, INDT-ASD, Psychometric properties.

Introduction:

Autism Spectrum Disorder (ASD), refers to a range of impairments in areas of social interaction and communication skills along with the presence of repetitive and restricted behaviours as its important features. Centre for Disease Control and Prevention (CDC)'s latest data suggest that 1 in 36 children have been identified with autism [1]. In a study conducted in India and other Southeast Asia populations, the prevalence of Autism Spectrum Disorders ranged from 0.09% to 1.07% among children in the age group of 0–17 years [2]. As per the latest studies done by INCLEN Trust International, about one in a hundred children in India under the age of 10 have autism[3]. A study conducted in Kerala revealed that there is a 20 times greater chance for a child to become autistic if there are no children of the same age to play with [4].

The Neurodevelopmental screening tool-Research form (NDST-R/F), a 39-item screening tool developed by the INCLEN-NDD study team led by Arora NK, screens for 10 neurodevelopment disorders such as Neuromotor impairment, ASD, ADHD, Epilepsy, Speech and language disorder, Intellectual disability, Learning disability, Cerebral palsy, Vision impairment, and Hearing impairment. NDST-R/F has 13 specific questions related to ASD and credit for each question can be given by direct observation of the child or by the report from the mother or caregiver. If the child has failed any one item, it is considered that the child has failed the test.

AIIMS-modified INDT-ASD with modifications made from INCLEN-INDT-ASD [5] was validated against the Childhood Autism Rating Scale (CARS), which demonstrated a sensitivity of 98.4% and specificity of 91.7%with acceptable diagnostic accuracy to diagnose ASD [6].

Rationale: ASD is considered as a condition with increasing prevalence as the years go by and both genetic and environmental risk factors have been attributed to it. In the current COVID-19 pandemic, the chances for children to have peer interactions were very low, affecting their social and communication skills. If desirable criterion validity measures are obtained against AIIMS Modified INDT-ASD, NDST-R/F can also be used by peripheral health workers to identify a child with ASD. Thus, the current study is undertaken to validate 'ASD-related items' in the Neurodevelopmental Screening Tool-Research form (NDST-R/F)against AIIMS-modified INDT-ASD, a diagnostic test for autism spectrum disorder among consecutive children with suspected social and communication problems.

Objectives:

The primary objective of the study was criterion validation of 'ASD-related items' in NDST-R/F as a screening tool for ASD against AIIMS-modified INDT-ASD as the gold standard and to calculate sensitivity, specificity, predictive values, diagnostic accuracy, and likelihood ratios.

Primary Objectives: -

1. To administer NDST-R/F, on all consecutive children of 2-6 years with suspected social and communication problems, attending NIMS -Spectrum CDRC.

2. To administer AIIMS-modified INDT-ASD diagnostic tool on the same children.
3. Criterion validation of NDST- R/F screening tool against INDT-ASD as the gold standard and to calculate sensitivity, specificity, positive predictive value, negative predictive value diagnostic accuracy, likelihood ratio positive and likelihood ratio negative.

Materials & Methods:

The present study was a hospital-based criterion validation study carried out from January to August 2022 for 8 months, 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/2022/01/05, dtd. 10/01/2022). Fifty consecutive children 2-6 years of age with suspected social and communication problems,coming to NIMS-Spectrum-CDRC, a tertiary care center for children with neurodevelopmental problems, were included after getting parental consent.

Data was collected by interview method. Evaluation with NDST-R/F was carried out by a Developmental Therapist and then the AIIMS Modified INCLEN tool INDT-ASD was done 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 50 children,

- Age: 24-35 months – 13; 36-47 months – 16; 48-59 months - 11; 60-72months – 10.
- Gender: Male 42 (84%); Female 8 (16%).

Table 1: Distribution of 'ASD related items' in NDST-Research form (n= 50).

NDST No.	NDST Research form Items	No*	Some-times	Most times#
	Socialisation questions			
39a.	Does your child make common age appropriate gestures to greet familiar people?	**18**	3	29
40a	Did/does your child ever seek your attention by pointing?	**21**	6	23
41a	Does your child look at your face & maintain eye contact when you are talking to him/her?	**16**	17	17
42a	Does your child ever engage in role plays or games involving role play?	**30**	7	13
43a	Like other children of his/her age, is your child able to do his/her ADL by himself/herself?	**26**	12	12
66a	Does your child pay attention when you address him/her by name?	**16**	9	25
67a	Does your child give attention to common sounds?	**12**	5	33

	Communication related questions			
60a	Has your child now stopped speaking/learning new words/ sentences?	26	12	**12**
63a	Does your child often repeat the same word/phrase over and over in the same manner?	27	8	**15**
68a	Do you always need to speak loudly to get the attention of your child?	28	14	**8**
	Behaviour related questions			
70a	Does your child insist on sameness and actively resist any change in his/her routines?	44	3	**3**
71a	Does your child appears to be lost in his/her own world, no matter what he/she doing?	16	12	**22**
72a	Does your child do activities that are purposeless, repetitive and excessive?	21	9	**20**

Using NDST-research form, 42 (84%) children had at least one question positively suggestive of ASD.'No' is suggestive of ASD for the first 7 questions related to Socialization, 'Most times' is suggestive of ASD for 3 questions related to Communication, and 3 questions related to Behaviour. (Table 1)

Table 2: Evaluation by AIIMS Modified INDT-ASD.

Domains	**2 or less**	**3**
INDT ASD A1 – No of criteria fulfilled in A1 of the section A (Social interaction & communication)	7	43
Domain	**Nil or one**	**Two or more**
INDT ASD A2 – No of criteria fulfilled in A2 of the section A(restrictive and repetitive)	9	41
Domain	**NO**	**YES**
INDT ASD 3 – Is there onset at early development?	8	42
INDT ASD 4 – Is there an impaired functioning?	7	43
Domain	**4 or less**	**5 or more**
INDT ASD 6- Total number of criteria fulfilled in A1 and A2 together.	9	41
Domain	**No ASD**	**ASD**
INDT ASD 5 – Interpretation of questionnaire (1 to 4)	9	41
INDT ASD 7 – Summary assessment of ASD	10	40
Domain	**NO**	**YES**
INDT ASD 8 – Can these symptoms be solely explained by intellectual disability	49	1
AIIMS Modified INDT-ASD Impression= No ASD: 10 (20%); ASD=40(80%)		

The prevalence of ASD using AIIMS Modified INDT-ASD. (Table 2). As per the criteria for interpreting AIIMS Modified INDT-ASD. [6]

- Out of section A, subsection A1, 43 children met 3 criteria.
- In subsection A2, 41 children met 2 or more criteria.
- 42 children had onset at an early age of development.
- Among 50 children, impairment of functioning was seen among 43 children.
- Ruling out the one child whose symptoms were solely explained by Intellectual disability, by using AIIMS modified INDT-ASD, the number of children with ASD was found to be 40 (based on responses in question7),and 10 children were found to have no ASD.

TABLE 3: 'ASD Related items' in NDST-R/F vs AIIMS Modified INDT-ASD.

NDST-Research form Impression	**AIIMS modified INDT-ASD Impression**		Total
	ASD	No ASD	
ASD	**40 (TP)**	2 (FP)	42
No ASD	0 (FN)	**8 (TN)**	8
Total	40	10	50

On doing criterion validation of related items' in NDST-R/F against AIIMS modified INDT-ADHD (Table 3), the psychometric properties were as follows; sensitivity of 100%, specificity of 80%, positive predictive value (PPV) of 95.24 %, negative predictive value (NPV) of 100%, positive likelihood ratio 5.00 and negative likelihood ratio 0.00. Diagnostic Accuracy of the test was found to be 96%.

Discussion:

Though, ASD is probably the most common neurodevelopmental disability presenting to a child development center, providing specialized diagnostic and intervention services, the reported community prevalence is not that high. A meta-analysis evaluating the prevalence of ASD in the community setting of India showed a pooled percentage prevalence from rural settings of 0.11 (95% CI 0.01-0.20) and urban settings of 0.09 (95% CI 0.02-0.16)[7]. The increasing prevalence of autism may be due to the inclusive definition of autism spectrum disorder, the availability of better screening and diagnostic tools, or a change in the family structure with a minimum number of children to play with. The reported modifiable risk factors for ASD, apart from excessive use of mobiles include; (i) the child does not play with children of the same age (OR=19.6); (ii) no outings (OR=3.4); (iii) does not tell stories/ sing songs to the child (OR=3.2); and (iv) breastfeeding duration nil/ <6 months (OR=3.4[4]. Parental awareness of ASD has improved in recent times, especially after the worsening situation with COVID-19. They are also more aware and motivated about the benefits of early intervention and therapies. The presence of the District Early Intervention Center (DEIC) under RBSK has opened up assessment and therapy facilities for the same.

Hence, this criterion validation study of ASD-related items in NDST-R/F against AIIMS Modified INDT-ASD is timely, as it has shown a PPV of 95.24% and NPV of 100%. Thus, the ability of the NDST-Research form to correctly identify children with ASD is 100% and the ability to correctly identify children without ASD is 80% which is acceptable for a screening test. The probability that a person who receives

a positive test result has the disorder is 95.24% and the probability that subjects with a negative screening test truly do not have the disorder is 100%. The accuracy of ASD-related items in NDST to diagnose correctly or the proportion of subjects who give the correct result is 96%.

Conclusion:

The results of this study showed that criterion validation of 'ASD-related items' in NDST R/F has good psychometric properties when validated against AIIMS Modified INDT-ASD taken as the gold standard, validating its use in a developmental clinic /child development center.

Financial Support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest

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