

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

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Received : 12 DECEMBER 2024; Accepted: 05 FEBRUARY 2025

Abstract

How to cite this article:

Nair MKC, Gautam A, Arunima, Remadevi S, Swapna S, Sajitha J. Criterion Validation of ‘Speech Related Items’ in INCLN NDST-Research Form Against Receptive Expressive Emergent Language Scale-4 Among Children with Complaints of Speech Problems. Indian J Dev Behav Pediatr. 2025;3(1): 19-23. DOI: 10.5281/zenodo.15125261

Keywords:

- NDST
- Psychometric properties
- Speech delay
- Criterion validation

Introduction: 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.

Aims and Objectives: The primary objective of the study was criterion validation of ‘speech related items’ in INCLN 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.

Materials & Methods: 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.

Results: 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 INCLN 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.

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 (age 0-7 years) 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 against REELS-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.

Materials & Methods:

The present study was a hospital based criterion validation study which was carried out from January to August 2022 over a period of 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/2022/01/03, dated 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-4 was 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.

Conclusion:

Speech related items' in INCLIN 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.

Financial Support and sponsorship:

Nil

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