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ORIGINAL ARTICLE

Development of A Test for Articulation and Phonological Disorders in Urdu Speaking Children

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Keywords

Test for Articulation and Phonology in Urdu (TAAPU), Articulation and Phonological Disorder (APD).

Author`s Contribution

[1] Discussion Interpretation and Manuscript writing
[2]Synthesis, Data Analysis, Conception
[3]Planning of research and manuscript writing

Article Info.

Received: Jan 1, 2017
Revised: Jan 26, 2018
Accepted: Mar 27, 2018

Conflict of Interest: Nil
Funding Sources: Nil

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***Cite this article as**: Noveen S, Butt AK, Alam MB. Development of a test for articulation and phonological disorders in Urdu speaking children. JRCRS. 2017; 5(2):89-93.*

A B S T R A C T

Background: The non-availability of language appropriate and culture-based tests for assessing speech sound disorders in Urdu has always posed a challenge in clinical, educational and research areas. The aim of the current research was to develop such a test for assessment of Articulation and Phonology in Urdu (TAAPU).

Objectives: The objective of the test was to develop a valid and reliable tool for assessment of Urdu Articulation and Phonological Disorders in children between 4-8 years of age.

Methodology: The study employed a cross sectional study design. Validity and reliability assessments were conducted for the development of the test. TAAPU was piloted and developed in Islamabad and Rawalpindi using purposive sampling technique for primary data collection; a sample of 50 children without APD and sample of 50 children with suspected speech sound disorder were included. Statistical Package for Social Sciences (SPSS- Version 21.0) was used in the study.

Results: The Test- retest reliability in pilot study of TAAPU with N=15 showed almost same mean and standard error of the mean confirming that TAAPU performed on same population with two weeks' interval gave almost same results. Correlation between test and retest is 0.991 and Chronbach's Alpha value is 0.70 ascertains its reliability. Factor analysis revealed 21 factors received frequent errors have Eigenvalues greater than 1. Chronbach's value of main study with N=100, 50 with APD and 50 without APD, is 0.74 and has α greater than 0.5 confirms the interdependance of items in the test. Substitution was the most frequent error type and the mean administartion time of TAAPU by children with APD is 26.48 minutes.

Conclusion: The study concludes that TAAPU is a valid and reliable tool for assessment of APD for Urdu speaking children.

Introduction

Urdu is not only spoken in Pakistan but also in India with some variation. There must be sixty million people in South Asia who regard Urdu as their mother tongue.[1] Urdu language differs in a number of consonants and sounds as well as in the arrangement of sounds in the words.[2] Shapiro suggested that Urdu has a core set of 28 consonants inherited from earlier Indo-Aryan.[3] Urdu is spoken in a different manner than English or other languages. Every language has a different phonology due to mother tongue rules for production and use of sounds; correct sound production is a key to the clarity of spoken language.[4] Speech Sound Disorders (SSD) cause imprecise utterance of words. There are multiple tests that have been developed in English and other languages to test APD, like Goldman Fristo Test of Articulation (GFTA)[5] and a companion test phonological disorders Khan-Lewis Phonological Analysis (KLPA)[6], Bilingual Assessment of Articulation and Phonology (BAPA) to assess phonological disorders of Spanish-English speaking children[7] and many other. Research on TAAPU was conducted with an aim to develop a norm-referenced test for SLPs/SLTs to assess Articulation and Phonological

Disorders (APD) in Urdu speaking children between 4-8 years of age. The test is developed to evaluate articulation abilities of school-age children and to assess the occurrence of common phonological disorders among children. Articulation disorder is the "characteristic assembly of speech sounds categorized by the substitutions, omissions, additions, or distortions that may inhibit with fluency".[8] These errors in sound production are motor-based.[9] Phonological Disorders Phonological disorders involve error patterns in the application of phonological rules for speech. The rules for the system for language comprise of the set of phonemes with the permissible patterns and combinations modifications.[10] The errors produced in sound are mostly cognitive or language based.[4]

The non-availability of speech and language tests in Urdu pose a great hindrance in establishing a robust diagnosis and subsequent management. TAAPU allows for a quality assessment that clinicians can employ with ease to assist in the decision making process. It consists of an oral motor examination form to examine oral motor structure and function as one of the causal factors of articulation deficits. It further provides a list of words that matches Urdu vocabulary and phonology. The study may be significant in providing items that can be used for further test development in the field of Speech and Language Pathology in the Urdu language. The data in the study may also be instrumental in providing a protocol for the assessment of articulation and phonological disorders to be used by the speech pathologists in Pakistan. This study will further pave way for evidence-based practice in the field. It will assist with development of norms required for the assessment of articulation and phonological disorders.

Methodology

A descriptive cross-sectional study was conducted to develop TAAPU for assessment of APD. TAAPU was prepared, piloted and developed in twin cities, Islamabad and Rawalpindi from public mainstream and from speech therapy clinics during January2012-March 2012. The population of interest was Urdu speaking 4-8 years old children with and without APD but without any disability. Data was collected using background information form that provided complete birth and developmental history of the child, an oral motor screening form to present information about the structure and functions of articulators for the production of speech sounds. TAAPU contained 60 colorful pictures as assessment tool along with word list of names of those pictures in Urdu. There is response sheet to note down articulation disorders of substitution, omission, and addition at the initial middle and final position of words and phonological analysis sheet to determine the phonological process disorder.

Purposive sampling was applied. A sample of 100 (50 children with APD and 50 children without APD) was taken from Islamabad and Rawalpindi, and the sample size was determined by the following formula:

$$n = \left[\frac{z_{\alpha/2}\sigma}{E}\right]^2$$

The data was analysed by Statistical Software for Social Sciences (SPSS- V 21.0). Multiple measures of central tendency (mean and median) and ameasure of dispersion standard deviation were used to analyze the data statistically. The t-test was applied to check the mean time taken to conduct TAAPU on two groups namely children with APD and without APD. In a frequency distribution, the frequency or occurrence of all outcome was tabulated. The frequency of error type was determined.

In order to develop tool for assessment of APD Urdu text books of grade 1 and 2 of Feroz Sons, National Book Foundation and Punjab Text Book Board were used. The said books were thoroughly reviewed for identification of vocabulary of nouns for children of 4-8 years of age.

Collectively there are 63 phonemes in Urdu phonology, as consonant contribute more in the overall intelligibility of speech the study focused on consonantal assessment. The 34 major consonantal sounds were selected for the development of word list for TAAPU; these sounds were found in the core vocabulary used in the books with legible noun pictures. The rest of the consonants are used in only word formation at advance levels and are used in literature. The 17 vowels sounds were not included in the test due to least contribution of vowels in intelligibility of speech. Initially a list of 63 words

with 108 pictures was developed. While pilot study the responses of the children to pictures were noted and a list of 60 pictures and words was developed.

The following five out of six aspects of Construct Validity as mentioned by Messick's Unified Theory of Construct Validity[14] are justified by TAAPU:

Content- All test items appear to measure the sound.

Substantive- Although no test in Urdu for assessment exists, yet for the development of TAAPU theoretical foundations of other tests for assessments was taken into account.

Structural- The interrelationships of the dimensions which were measured by the TAAPU correlate with the construct of interests.

External- TAAPU has predictive quality as it can predict intelligibility and presence or absence of phonological disorders.

Generalizability- The test was administered in twin cities and need to be generalized in other areas of Pakistan (Islamabad and Rawalpindi)

Consequential – The test results are not worthwhile if TAAPU is not administered by Speech Therapist.

Statistically TAAPU was found out to be reliable and valid test as appropriate sampling procedure namely purposive sampling was used and appropriate Statistical tests (Chi-square test, T-test, Test-retest reliability, Frequency of error occurrence and type and Factor analysis for validity) were used to analyze the data.

Results

The items of TAAPU were validated through pilot testing on 15 children without APD but not from the same sample.

Table I: Test Re-Test Reliability of TAAPU in pilot testing (N=15)

APD	Mean	N	St. Error of Mean	t-Value	p-value
First Time	77.31	15	0.647	1.65	0.000
Second Time	77.16	15	0.642		

TAAPU was piloted on 15 children. The Test-retest reliability showed almost same mean and standard error of the mean confirming that TAAPU performed on same population with two weeks' interval gave almost same results.

Table II: Test Re-Test Reliability Correlation (N=15)

Paired Samples Correlations			
Test and Retest	N	Correlation	Sig.
	15	0.991	0.000

Correlation between test and retest is 0.991 which depicted TAAPU a reliable tool.

Table-3 Cronbach's Alpha (N=15)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.789	0.78	68

The Cronbach's Alpha value, determined is 0.70 that shows the high reliability of the tool.

Table IV: Comparison of Errors between Children with APD and Without APD

	Phonemes presented	No phoneme error	Substitution	Omission	Addition	Total
Children (Without APD)	5100	5070	30	6	0	36
Children (With APD)	5100	4653	381	69	0	450
Total	10200		411	75	0	486

As per table IV children with APD committed more errors as compared to the children without APD.

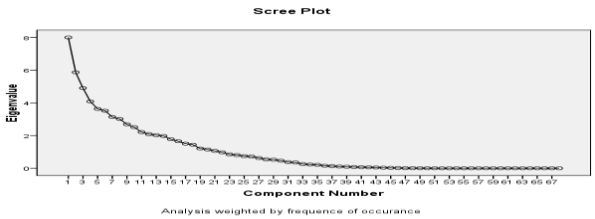

Figure 1- Scree Plot

Scree plot shows the component matrix which indicates the contribution of each sound in each element. It shows only those factors which met our criterion. In this study, 21

factors had Eigenvalues greater than 1, so these are items for which frequent error was received.

Table V: Cronbach's Alpha		
Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.75	0.74	60

As α is greater than 0.5, it depicts that sample items are inter-dependent on one another. As per figure-2 children with APD committed more errors as compared to the children without APD and substitution errors were found to be more prevalent. No addition error was detected.

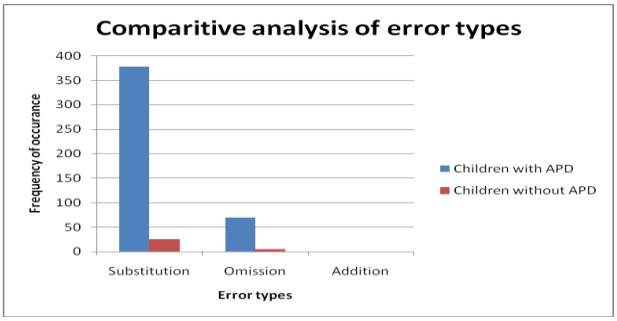

Figure 2. Bar Chart of Frequency of Error Types

Table VI: Cross-tabulation of Time and Age					
Time (in minutes)	Age (in years)				
	3.5-4.5	4.5-5.5	5.5-6.5	6.5-7.5	7.5-8.5
15	0	0	6	3	2
20	0	2	0	3	5
25	0	1	2	2	1
29	0	1	0	0	0
30	1	3	1	1	1
35	5	0	0	0	1
40	4	3	1	1	0

Table VI shows the time of test administration on children without APD of age ranging from 3.5 to 8.5 years and the time. There is a variation in time taken by children to take the test e.g. that most of the children had taken 15 minutes. Moreover, 5 children took 40 minutes for test administration.

Table VII: Measures of Central Tendency and Dispersion					
Variable	Category of Student	N	Mean	Std. Deviation	Std. Error Mean
Time (Minutes)	Children (Without APD)	50	19.96	4.99	0.706
	Children (WithAPD)	50	26.48	9.099	1.287

Table VII depicts that mean time taken by the children, without APD is 19.96 minutes and with APD is 26.48minutes. T-test reveals Significance value has been determined through application of t-test statistic and p-value, i.e., probability values for the t-test is found to be 0.000 that is highly significant at 5% level of significance.

Table VIII: Chi-square Test			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-square	2.825	2	0.244
Likelihood Ratio	4.511	2	0.105
Linear by Linear Association	1.021	1	0.312
N of Valid Cases	50		

Table VIII shows that the chi-square test is significant at 5% level of significance.

Discussion

The study aimed to develop and apply a valid and reliable test for assessment of APD in Urdu speaking children and to determine time taken for test administaration. During the developmental phase the results of pilot studies were determined. Statistically TAAPU was found out to be reliable and valid test as appropriate sampling procedure namely purposive sampling was used and appropriate Statistical tests, Cronbach's alpha reliability is, Test-retest reliability were used to analyse the data like GFTA-2. The GFTA-2 addresses two main concepts of validity, they are: content validity and construct validity similarly TAAPU used T-test for comparison of mean between children with APD and without APD and Factor analysis for content validity.[5]

Table I describes Test-retest reliability that was achieved by administering the same test or tool twice over a period of time on same sample or individuals [11]. The score of both Tests i.e. Test1 and Test2 were then correlated, the greater the value of correlation the higher the stability of tool or test over time. TAAPU was piloted on 15 children. The Test- retest reliability showed almost same mean and standard error of the mean.

Moreover, to inculcate quantification element to the test- retest reliability, correlation

between test and retest was performed; the value of correlation was 0.991 which depicted TAAPU a reliable tool shown in Table II.

In classical test theory of Statistics, Cronbach's alpha is the insignificant name used for equivalent reliability as a lower limit of the reliability of a psychometric test .[2,13] Table-3 shows the result of pilot testing, 15 children were selected from the population of the study but not from the same sample. The reliability of the test tool was determined by Cronbach's Alpha. The Cronbach's Alpha value is from 0 to 1. If the value is greater than 0.70, it shows the high reliability of the tool.

TAAPU successfully detected the errors committed by children with APD and further it was found that children with APD committed more errors as compared to the children without APD as shown in table IV. Similarly, from Table 6 it can be concluded that there exists a remarkable difference between the average time taken for the administration of the test to the children with and without APD, moreover table 7 shows average time taken by children with APD is almost 30 minutes, GFTA-2 and KLPA take 15 minutes.[5,6] Table VIII shows that the chi-square test (at 5% level of significance) results depict that there is a significant difference in error production of children with APD and without APD detected by application of TAAPU. Item analysis in Scree plot (Figure 1) it is observed that /s/ omission /z/ omission /ch/ omission /dh/ omission /t/ omission /ro/ substitution and /k/ substitution, /g/ substitution contribute most than other sounds in APD. It is also observed that /r/ is substituted with /l/ sound in the Urdu language.

Table V shows that the variables comprise of total 17 demographic variables. Whereas 13th and 18th variable were dependent variables and remaining 103 independent variables were of sound and disorders of which 35 were extracted giving the remaining of 60 variables. 0.750 Cronbach's alpha for 60 variables showed a high level of internal consistency or reliability for this sample.

Error types of APD in both groups were successfully detected, and substitution error was found to be a most prevalent phonological disorder shown in Fig ure 2. It is an appropriate tool for detailed assessment of articulation and phonological process disorders in Urdu. The test inventory containing 60 easily recognizable colorful pictures meets the evaluation criteria for Urdu phonology. Although TAAPU is reliable and valid to detect APD in children of 4 to 8 years who speak the Urdu language, yet the examiner should be familiar with the dialectal characteristics of other languages.

Conclusion

The study concludes that TAAPU is a reliable and valid tool for assessment of consonantal sounds and detection of Articulation and Phonological Disorders in Urdu language. The most frequent articulation disorder evident in Urdu substitutions.

Limitations of The Study: The test only addresses consonants and not vowels. Data was collected only from Rawalpindi and Islamabad. The test is not generalized on bilingual children due to limited time and resources all over the Pakistan.

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