Original Article

Sociolinguistic Adaptation Process of the Bangla Western Aphasia Battery-Revised

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Abstract

Introduction: The purpose of this study was to complete a sociolinguistic adaptation and validation of the Western Aphasia Battery-Revised (WAB-R) (Kertesz and Raven, 2007), an English aphasia assessment into the Bangla language. Two hundred and fifty million people speak Bangla/Bengali in eastern parts of India and Bangladesh. **Methods:** This study had two steps: first, three professional translators performed the translation and back-translation processes on the WAB-R. Second, to validate the adaptation, 27 neurologically normal individuals and 36 patients with a history of cerebrovascular accident participated in this study. **Results:** Three types of adaptation processes, i.e., introduction of new words or phrases, direct translation, and direct translation replacing concepts were involved. As per different adaptation processes, Record form part 1 (derives aphasia quotient [AQ]) achieved 25% of sociocultural and linguistic changes whereas Record form part 2 (derives cortical quotient and language quotient) achieved 57% of sociocultural and linguistic changes. The items of Bedside record form (shorter version of the test) were taken from Record form part 1 and part 2. Normal controls completed the test with scores of 100% on most of the sub-tests while the patients' performance was significantly lower. Eighty percentage of the patients had aphasia, based on their test scores, and investigators could categorize the patients by aphasia type based on the AQ and bedside aphasia score. There is a high correlation between the subtest scores of Record form part 1 and Bedside record form. **Conclusion:** Some changes were needed to adapt the WAB-R for Bangla speakers. Preliminary validation study demonstrated that the Bangla WAB-R could differentiate the normal population from the patients with aphasia by their language performance. Investigators will attempt to standardize the test in the next phase of the study.

Keywords: Adaptation, Aphasia, back-translation, Bangla/Bengali, translation, Western Aphasia Battery

Introduction

Stroke or cerebrovascular accident (CVA) may result from different health disorders, such as high blood pressure, diabetes, and hypertension, and it causes disability. Aphasia, an acquired language disorder, occurs in 25%–40% of stroke survivors.[1] It also occurs due to focal brain lesions and can impair any or all language modalities – listening, speaking, reading, and writing. Aphasia is not defined as a disorder of cognition or motor functioning.[2]

India has the third highest stroke prevalence in Asia after China and Japan. After Mumbai, Kolkata has the second highest stroke incidence at 334/100,000 people in India.[3] Bangla/Bengali is the native language of Kolkata and Bangladesh. Worldwide, it is the 6th leading language, spoken by 250 million people.[4] Considering the incidence and prevalence of stroke and aphasia, it is clear that there may be a significant number of Bangla speakers with aphasia.

Aphasia can be treated to improve communicative effectiveness and thus quality of life. A speech and language assessment must be completed to identify the type and severity of aphasia which will lead to proper treatment. It is the speech language pathologists' (SLPs) job to select the most appropriate assessment tools. There are numerous aphasia assessments developed for English speakers and later translated into other languages. However, many countries still lack valid and reliable aphasia assessments.[5] There are two ways to create

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Access this article online

Quick Response Code:

Website: www.jisha.org

DOI: 10.4103/jisha.JISHA_35_17

How to cite this article: Mazumdar B, Donovan NJ, Narang V. Sociolinguistic adaptation process of the Bangla Western aphasia battery-revised. J Indian Speech Language Hearing Assoc 2018;32:23-33.

a test in a particular language – develop a new test or adapt an existing test in the target language. Sometimes, adapting an existing test is preferable because the adaptation process appears to be more efficient than developing a new test. In addition, in the test adaptation, task structure, scoring, and scaling models have been established, saving further time.

However, adaptation is not a simple translation of a test when the source language and target language are different and spoken in two diverse communities/cultures. If done well, adaptation provides a more culturally and linguistically equivalent version of a test.[6] For adaptation, clinician-offered changes have to be linguistically compatible with the existing test items. Otherwise, the results will produce a high rate of error. Spontaneous translation is not an optimal way to assess aphasia because it may differ with time and person which leads to invalid results. Due to the absence of standardized aphasia tests in Bangla, SLPs in West Bengal and Bangladesh have had to resort to the spontaneous translation of existing English aphasia assessments in Bangla in the past. Adapted aphasia tests have been completed for other Indian languages, such as Kannada,[7] Malayalam,[8] and Telugu,[9] but most of these tests remain unpublished or have limited circulation.[5,10] The published literature includes little to no discussion on the actual adaptation processes used for these tests.

There is a progress in aphasia test adaptation for Bangla speakers. Investigators recently reported on the validation of a Bangla version of the original Western Aphasia Battery (WAB).[11] However, they included only limited information on the adaptation process employed.[12] Recently, Kertesz and Raven introduced the WAB-Revised (WAB-R)[13] which included several important changes; the short version of the test (Bedside record form), a new task (Supplemental writing and reading), and new test items. In addition, the WAB-R underwent broader standardization, further improving the aphasia classification and severity metrics for people with aphasia. Thus, the WAB-R now offers a more valid aphasia test. Therefore, the new information renders the WAB obsolete. Considering this advancement, the current study was undertaken to adapt the WAB-R and validate the adaptation for Bangla speakers with aphasia.

Aims and objectives

This study aims to (a) complete a sociocultural and linguistic adaptation of the WAB-R into Bangla and (b) validate the newly adapted Bangla WAB-R using normal controls and patients with a history of CVA or brain injury.

Methods

This is a descriptive study reporting on the adaptation and preliminary validation of the WAB-R for Bangla speakers. The study was approved by the Institutional Ethical Review Board and all the participants received informed consent prior to study participation. This study was divided into two phases:

1. Sociolinguistic adaptation of the assessment in Bangla considering all the cultural and linguistic differences between the target language and the source language
2. Providing the adapted test to the normal controls and the patients with a history of CVA or brain injury to complete the validation process.

Sociolinguistic adaptation of Western Aphasia Battery-Revised in Bangla

There are many aphasia assessments in English available to SLPs. Commonly used assessments including the Boston Diagnostic Aphasia Examination,[14] WAB-R,[13] and Comprehensive Aphasia Test[15] differ greatly in their theoretical foundations, length, composition, and choice of tasks used to make a differential diagnosis. However, they all three allow clinicians to make valid and reliable diagnoses of the presence and severity of aphasia which should guide treatment decisions. Moreover, they may help demonstrate therapeutic outcomes by comparing changes in test scores from pre- to post-treatment. In this study, the authors had three key reasons for adapting the WAB-R in Bangla. First, the WAB/WAB-R was already the most adapted test in Indian languages.[7-9,12] Second, it takes only 45–60 min to administer, making it less burdensome for both the clinician and person with aphasia than other existing aphasia assessments. Third, the WAB-R defines the aphasia syndromes or types which may provide clinicians with treatment direction and provide researchers with metrics to study aphasia in Bangla speakers.

Investigators used the following steps to adapt the WAB-R into Bangla: first, the investigators used the translation and back-translation method introduced by Brislin.[16] Three professional translators translated the English test into Bangla. These translators were native Bangla speakers with advanced degrees in linguistics and English. Due to time and financial constraints, the same translators completed the back-translation process 3 weeks after the initial translation to minimize the learning effect of the translators. After the back-translation process was completed, the English-translated versions of WAB-R were compared with the actual WAB-R. This comparison was necessary to investigate the linguistic and sociocultural incongruities between English and Bangla that led to the identified differences between the original English WAB-R and back-translated English WAB-R. After identifying the differences, the back-translated English WAB-R was adapted in Bangla. Translators met and discussed differences in translations of items. After reconsidering the cultural and linguistic analysis of those particular test items, the translators arrived at a consensus and accepted the more suitable and conventional forms for the Bangla WAB-R. For example, the English word "doctor" has two synonymous variations in Bangla. Some people have borrowed the English word but pronounce it differently as (ɖaktaɾ), while others use the actual Bangla word (cɪkɪtʃɔk). Both of these words were found in the translated Bangla WAB. After discussion, the translators decided to keep the word (ɖaktaɾ) which is used more frequently by the majority of the population. A similar problem arose with the word "you" as this pronoun has

different Bangla synonyms. The speaker chooses the proper form to use based on his/her relationship with the listener. Therefore, the translators decided to use two of the three synonyms, one is used for a familiar person (ʈumɪ) and the other is the more formal version used for someone unknown, aged, or respectable (ɑpnɪ). They decided to exclude the informal version (ʈuɪ) from the test as the clinicians and the patients will share a formal relationship between them.

Translators adapted the entire WAB-R in Bangla including: (1) Record Form part 1, (2) Record Form part 2, and (3) Bedside record form, using the process described in the preceding paragraph. Three categories of change were identified.

1. Direct translation: English test items were translated into Bangla, retaining the semantic concepts and linguistic structure of the actual test
2. Direct translation replacing concepts: Semantic concepts were replaced while maintaining the linguistic structure of the actual test items
3. Introduction of new words or phrases: Both the semantic concepts and linguistic structures were replaced with new phrases and words.

Based on the three adaptation processes, the investigators then analyzed the WAB-R subsections to determine what types of adaptation processes were most utilized. There were seven subsections which required two different types (direct translation replacing concepts and introduction of new words or phrases) of adaptation. Appendices 1a and b provide detailed information about the types of adaptation for each subsection and the types of changes (cultural/linguistic).

Bangla Western Aphasia Battery-Revised validation

Neurologically normal control group

The Bangla WAB-R was first administered on 27 neurologically typical adult native Bangla speakers who could fluently read and write Bangla. Participants were recruited through a convenience sampling method or word-of-mouth communication. They were included in the study based on self-report of no known impairments in cognition, language, vision, and hearing. All the participants were right handed and lived in Kolkata and nearby. They ranged in age from 40 to 75 years, with at least 10 years of formal education in Bangla medium schools. They belonged to the middle socioeconomic class. The data were collected from the following sites: (a) the participant's home, or, (b) a quiet spot chosen by the participant. The test was administered individually by the primary investigator. Participants completed the test (Record Form part 1 and part 2) within 1 h and Bedside record form within 10 min.

Cerebrovascular accident group

After administering the newly adapted Bangla WAB-R to normal controls, the test was administered to 36 individuals with doctor-reported CVAs. Participants were recruited from three renowned hospitals in Kolkata. The age range of the participants was 25–83 years, with minimum 7 years of formal education. All the participants were right handed and native speakers of Bangla with the ability to fluently read and write Bangla. However, some of them lost their motoric writing ability due to right hemiparesis. CVA onset for all participants ranged from 7 days to 1 year. The primary investigator administered the complete test to twenty patients, mostly to the follow-up cases and two newly admitted cases with mild stroke who were medically stable, and the Bedside record form to 16 newly admitted stroke patients. Sixteen participants were unable to complete Record form part 2 and six participants were unable to complete the last three subtests of Bedside record form due to their deficits in reading, writing, and apraxia. Thus, investigators were unable to calculate the Cortical Quotient and Language Quotient and could not validate the Record form part 2 and the complete Bedside record form.

Results

Bangla Western Aphasia Battery-Revised sociolinguistic adaptation

After the adaptation process, the data were entered into Microsoft Office Excel 2013. The number of each type of adaptation for Record form part 1 and part 2 was plotted in two bar graphs.

The results illustrated in Figures 1 and 2 represent the amount of sociolinguistic change translators provided to make it more acceptable for Bangla. In Record form part 1, 75% was directly translated from English into Bangla and the other 25% was changed as per the sociolinguistic requirements. Within that 25%, 20% comprised introduction of new words or phrases and 5% required direct translation with replacing concepts. Thus, Record form part 1, which measures comprehension and verbal production of language (i.e., the aphasia quotient [AQ]), only required 25% of sociolinguistic changes. However, Record form part 2, which measures reading and writing modalities, required higher percentages of sociolinguistic

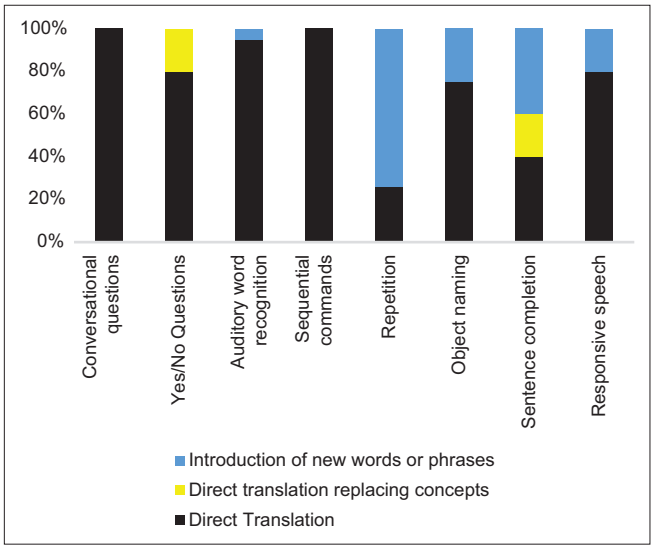

Figure 1: Types of adaptation in Record form part 1

adaptation because reading and writing are more complex than listening and speaking.[17,18] In this section, 43% was directly translated to Bangla whereas 57% required change as per the sociolinguistic requirements. Within that 57%, 5% required direct translation with concept replacement while the other 52% required the introduction of new words or phrases [Figures 1 and 2].

Bangla Western Aphasia Battery-Revised validation

Investigators have tested two types of the validation process. Those are content validity and construct validity. Internal consistency was also tested to validate the fact that the subsections of the test have high intercorrelation. The content validity was addressed by involving three professional translators who conducted the careful translation and back-translation process to achieve the final version of the translated WAB-R. Considering the steps followed by the translators and investigators to develop the Bangla test, it can be said that this measurement has a high content validity.

The second phase of the validation process was testing construct validity which was conducted by comparing the means and standard deviations (SDs) of the performance of normal controls with the aphasia group. This is a widely used technique of validation by discriminating between groups with known characteristics, i.e., average differences in the performance of known group by using statistical techniques of comparing means (*t*-test or ANOVA) and was used by previous researchers in test development.[19-21] In the current study, if the instrument is functioning as it should, participants with aphasia will perform differently (lower) than those who do not have aphasia (i.e., normal controls). If mean differences on the instrument are consistent with these expectations, we conclude that this is evidence that the instrument is differentiating between the groups in expected directions and supports claims about the construct being assessed. The *t*-test will be used for this purpose. The data obtained from the normal participants were converted into percentages for each subtest of Bangla WAB-R and were entered into MS Excel 2013. The mean and SD for each subtest of Record form part 1 and part 2 were calculated. The similar process was followed for the Bedside record form. Later, the test was given to the patients, using the same technique to analyze the obtained data. The Statistical Package for the Social Sciences, version 24.0 was used to analyze the data further. The data of Record form part 1 and Bedside record form (excluding reading, writing, and apraxia) were included in this analysis. Due to the incomplete data of Record form part 2, reading, writing, and apraxia subtests of the Bedside record form were excluded.

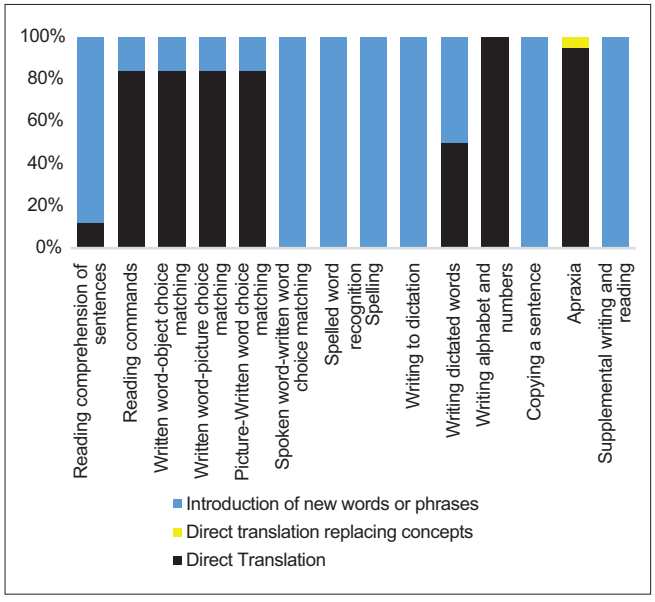

Figure 2: Types of adaptation in Record form part 2

After administering the Bangla WAB-R to the 27 normal controls, the primary investigator administered the Bangla WAB-R on 36 patients. The results shown in Table 1 provide the mean and SD of the Record form part 1 scores of 20 patients and Record form part 1 and part 2 scores of 27 normal controls.

The results shown in Table 2 provide the mean and SD of the Bedside record form scores of 27 normal participants and for the other 16 patients (excluding reading, writing, and apraxia scores).

The results show that significant differences exist between the mean and SD of the controls and the patients. Furthermore, the results from Independent sample *t*-test showed that the patients'

Table 1: Mean (%) and standard deviation of Bangla Western Aphasia Battery-Revised for the normal controls (Record form part 1 and Record form part 2) and patients (Record form part 1)

Test sections	Mean (SD)	
	Normal controls	Patients
Spontaneous speech	100 (0)	64.5 (28.88)
Auditory verbal comprehension	100 (0)	71.45 (27.12)
Repetition	98.74 (1.67)	61.0 (34.44)
Naming and word finding	95.85 (2.18)	65.7 (30.63)
Object naming - 60	100	
Word fluency - 20	79.25	
Sentence completion - 10	100	
Responsive speech - 10	100	
Reading	99.96 (0.192)	
Writing	99.37 (1.148)	
Apraxia	100 (0)	
Constructional, visuospatial, and calculation	90.92 (6.89)	
Drawing - 30	95.9	
BD - 9	78.1	
Calculation	100	
RCPM - 37	86.41	
Writing irregular words to dictation	100 (0)	
Writing nonwords to dictation	100 (0)	
Reading irregular words	100 (0)	
Reading nonwords	100 (0)	

RCPM: Raven's Coloured Progressive Matrices; BD: Block design; SD: Standard deviation

and controls' means were significantly different from each other across the subtests ($P < 0.001$). Tables 3 and 4 provide the *t*-test scores and significant values and degrees of freedom (df) for Record form part 1 and Bedside record form, respectively. Thus, it signifies that Bangla WAB-R was successful to discriminate between the healthy individuals and patients with aphasia.

Based on the primary language skills, the Bangla WAB-R effectively calculated the AQ and also differentiated the patients as per their types of aphasia. Table 5 shows the AQ scores and the types of aphasia of 20 patients who participated in the test (Record form part 1). Table 6 provides the bedside aphasia score and the aphasia types of other 16 patients. Thus, the evidence shows that the Bangla WAB-R can help to calculate the AQ and bedside aphasia score. It also differentiates the types of aphasia.

Finally, the internal consistency of the test's subsections was tested based on the Pearson's product–moment correlation coefficient. The reliability of the aphasia group's test scores was verified using the Cronbach's alpha because this group had variability in their test scores. The Cronbach's alpha value was 0.814 for the Record form part 1 and 0.991 for Bedside record form. Both the Cronbach's values signify that the patients' scores are highly reliable or homogeneous. However, the reliability scores of Record form part 1 are less than that of Bedside record form. Table 7 shows the Cronbach's alpha item-deleted values of Record form part 1 which indicates that naming and word finding subtest has the lowest item-deleted score. This score stands for the reliability score of Record form part 1 if the naming and word finding subtest is deleted from the test. Thus, this subtest has the highest reliability within all the subtests. To find the internal consistency of the test scores, two correlation matrices were produced based on the scores of Record form part 1 and Bedside record form. The correlation matrix of Record form part 1 [Table 8] identified the correlation between the different subtest scores and the correlation between the different subtest scores with AQ. The correlations between Record form part 1 subtests with AQ are above 0.75, and they are all statistically significant with the significant value <0.01. In addition, the correlations between the Record form part 1 subtest scores are above 0.60 with the significant value <0.01 which signifies that the correlations are statistically significant. Table 8 includes the details of separate correlation values for each combination. The same correlation matrix was produced for Bedside record form to identify the correlation between the different subtest scores and between the bedside aphasia scores with different subtest

Table 2: Mean (%) and standard deviation of Bangla Western Aphasia Battery-Revised Bedside record (excluding reading, writing, and apraxia scores)

Test sections	Mean (SD)	
	Normal controls	Patients
Content score	100 (0)	36.88 (40.45)
Fluency score	100 (0)	40 (40.33)
Auditory verbal comprehension score	100 (0)	48.75 (41.13)
Sequential commands score	100 (0)	40 (42.11)
Repetition	97.03 (4.44)	37.5 (41.55)
Object naming score	100 (0)	47.19 (37.81)
Reading score	100 (0)	
Writing score	100 (0)	
Apraxia	100 (0)	

SD: Standard deviation

Table 3: "Independent sample *t*-test" scores between patients' mean and controls' mean for Record form part 1

Test sections	*t*	Significant value (two tailed)	df
Spontaneous speech	5.498	0.000	45
Auditory verbal comprehension	4.709	0.000	45
Repetition	4.895	0.000	45
Naming and word finding	4.394	0.000	45

Table 4: "Independent sample *t*-test" scores between patients' mean and controls' mean for Bedside record form

Test sections	*t*	Significant value (two tailed)	df
Content score	6.242	0.000	41
Fluency score	5.951	0.000	41
Auditory verbal comprehension score	4.984	0.000	41
Sequential commands score	5.699	0.000	41
Repetition	5.712	0.000	41
Object naming score	5.587	0.000	41

Table 5: Aphasia quotient and aphasia types of twenty patients

AQ	Aphasia type
92.8	Anomia
83.9	Conduction
72.1	Wernicke's
75.8	Anomia
16.0	Global
72.8	Transcortical motor
59.7	Wernicke's
54.2	Conduction
93.8	No aphasia
61.2	Conduction
45.8	Wernicke's
90.0	Anomia
99.6	No aphasia
33.4	Wernicke's
37.0	Wernicke's
12.0	Global
42.2	Isolation
97.6	No aphasia
89.8	Conduction
80.6	Anomia

AQ: Aphasia quotient

scores (excluding reading, writing, and apraxia scores). Table 9 reports that there is a high correlation between the subtest scores, which is above 0.90 with the significant value <0.001. Furthermore, the correlations of bedside aphasia scores with the different subtest scores are also above 0.90 with the significant value <0.001, which means that the correlations are statistically significant. Table 9 includes the correlation details of Bedside aphasia form.

Table 6: Bedside aphasia score and aphasia types of 16 patients

Bedside aphasia score	Aphasia type
100	No aphasia
100	No aphasia
45.8	Broca's
0	Global
100	No aphasia
30.8	Broca's
16	Global
68.3	Conduction
34.1	Broca's
0	Global
48.3	Wernicke's
98	No aphasia
15	Global
0	Global
0	Global
10	Global

Discussions

This study aimed to conduct a sociocultural and linguistic adaptation of the WAB-R for Bangla speakers and to validate that adaptation. The actual WAB-R was developed in English, a typologically different language than Bangla; therefore, some linguistic adaptations were expected. Three professional translators used the translation and back-translation method introduced by Brislin (1970) to adapt the English WAB-R to Bangla. Our results indicated that numerous changes were needed to make the WAB-R culturally and linguistically acceptable in Bangla. The results of this study suggest that if clinicians perform spontaneous translations of WAB-R, then 25% of items in Record form part 1 and 57% in Record form part 2 may result in misleading aphasia diagnoses. These

Table 7: Cronbach's alpha item-deleted values of Record form part 1

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Spontaneous speech total	269.60	12,001.095	0.834	0.867
Auditory verbal comprehension total	139.60	4440.779	0.790	0.771
Repetition total	221.50	7636.053	0.709	0.731
Naming and word finding total	216.80	7200.695	0.952	0.633

Table 8: Correlation values of Record form part 1

Correlations					
	Spontaneous speech score	Auditory verbal comprehension score	Repetition score	Naming and word finding score	AQ
Spontaneous speech total					
Pearson's correlation	1	0.838**	0.614**	0.807**	0.876**
Significant (two tailed)		0.000	0.004	0.000	0.000
n	20	20	20	20	20
Auditory verbal comprehension score for AQ					
Pearson's correlation	0.838**	1	0.609**	0.877**	0.827**
Significant (two tailed)	0.000		0.004	0.000	0.000
n	20	20	20	20	20
Repetition score for AQ					
Pearson's correlation	0.614**	0.609**	1	0.830**	0.753**
Significant (two tailed)	0.004	0.004		0.000	0.000
n	20	20	20	20	20
Naming and word finding score for AQ					
Pearson's correlation	0.807**	0.877**	0.830**	1	0.895**
Significant (two tailed)	0.000	0.000	0.000		0.000
n	20	20	20	20	20
AQ					
Pearson's correlation	0.876**	0.827**	0.753**	0.895**	1
Significant (two tailed)	0.000	0.000	0.000	0.000	
n	20	20	20	20	20

**Correlation is significant at the 0.01 level (two tailed). AQ: Aphasia quotient

Table 9: Correlation values of Bedside record form

Correlations							
	Content score	Fluency score	Auditory verbal comprehension score	Sequential commands score	Repetition score	Object naming score	Bedside aphasia score
Content score							
Pearson's correlation	1	0.985**	0.951**	0.963**	0.975**	0.909**	0.986**
Significant (two tailed)		0.000	0.000	0.000	0.000	0.000	0.000
n	16	16	16	16	16	16	16
Fluency score							
Pearson's correlation	0.985**	1	0.956**	0.973**	0.991**	0.918**	0.993**
Significant (two tailed)	0.000		0.000	0.000	0.000	0.000	0.000
n	16	16	16	16	16	16	16
Auditory verbal comprehension score							
Pearson's correlation	0.951**	0.956**	1	0.955**	0.942**	0.913**	0.974**
Significant (two tailed)	0.000	0.000		0.000	0.000	0.000	0.000
n	16	16	16	16	16	16	16
Sequential commands score							
Pearson's correlation	0.963**	0.973**	0.955**	1	0.979**	0.919**	0.986**
Significant (two tailed)	0.000	0.000	0.000		0.000	0.000	0.000
n	16	16	16	16	16	16	16
Repetition score							
Pearson's correlation	0.975**	0.991**	0.942**	0.979**	1	0.903**	0.987**
Significant (two tailed)	0.000	0.000	0.000	0.000		0.000	0.000
n	16	16	16	16	16	16	16
Object naming score							
Pearson's correlation	0.909**	0.918**	0.913**	0.919**	0.903**	1	0.945**
Significant (two tailed)	0.000	0.000	0.000	0.000	0.000		0.000
n	16	16	16	16	16	16	16
Bedside aphasia score							
Pearson's correlation	0.986**	0.993**	0.974**	0.986**	0.987**	0.945**	1
Significant (two tailed)	0.000	0.000	0.000	0.000	0.000	0.000	
n	16	16	16	16	16	16	16

**Correlation is significant at the 0.01 level (two tailed)

results have serious implications for researchers and clinicians interested in adapting tests to different languages and cultures.

The results of testing the construct validity showed that normal participants achieved full points in most of the subtests, which implies that this test was easy to perform for them. However, there was minor deterioration observed in certain subtest scores (repetition task, word fluency task, reading, and writing). Age may be considered as one of the responsible factors of this minor deterioration. However, considering the age range of the sample size, lack of attention, the complexity of or unfamiliarity with a particular task, or fatigue could have accounted for this deterioration. Due to the small sample size of the normal control group, the previous findings/considerations need to be further investigated based on a bigger sample size with a diverse age range. The other groups, adapted WAB in different languages, had the similar findings.[7-9,12] However, they explained this change by considering the age range of their sample and stated that auditory selective attention abilities decrease with increasing age.[22] Furthermore, the greatest decline was observed in the constructional, visuospatial, and calculation tasks with normal elderly participants. The previous studies supported the current findings.[7,12] According to Harada, Natelson Love, and Triebel (2013), there is a substantial decline in human cognitive functions with normal aging. However, the linguistic abilities remain intact.[23]

The results of the patients' test scores were significantly lower than the test scores of normal participants. The mean and SD between the normal controls and patients' group were significantly dissimilar across all the subtests of Record form part 1 and Bedside record form. This finding was also supported by the previous findings.[7-9] The patients' range of SD was between 25 and 35 for Record form part 1 and 35–45 for Bedside record form (excluding reading, writing, and apraxia scores).

The results to test the internal consistency of the Bangla aphasia assessment showed that the test is consistent with its expectation and correlation values are large. The large correlation values signify that all the subtests in Record form part 1 have a strong positive linear relationship between each other and between the AQ and different subtest scores. This means that the

participants' performance was consistent. However, due to the difficulty level of some "repetition" subtest items, there is a moderate positive linear relationship between the spontaneous speech scores and repetition scores with the Pearson's R value of 0.614; auditory verbal comprehension scores and repetition scores with the Pearson's R value of 0.609. In Bedside record form, all the Pearson's R values (above 0.90) signify that there is a presence of a strong positive linear relationship between different subtests and between the subtests and bedside aphasia scores.

The results of the present study indicate that Bangla WAB-R demonstrated preliminary validity to be used in the diagnosis of severity and type of aphasia. Given that there are few alternatives at this time, clinicians might consider using the Bangla WAB-R to evaluate stroke patients suspected of having aphasia.

Limitations

The "picture description" of Bangla WAB-R included the same picnic picture used in the English WAB-R. Investigators did not change the picnic scenario to a culturally suitable one due to the researcher's time and financial constraints. Review of the validation results reflects that the WAB-R picnic picture in and of itself was not problematic for the participants. However, an experimental question remains about whether a "better" picture could elicit stronger language samples. This question will be addressed in future research. Finally, as compared to the existing validation studies of the WAB in other languages,[7-9,12] the sample size of the present study is relatively smaller because the entire study was conducted to accomplish the Master's thesis with a 3-month time frame to collect the data.

Future implications

The researchers of this study plan to conduct the validation study using a larger sample size in the future. After completion of this project, Bangla WAB-R will be standardized for Bangla speakers.

Conclusion

Previously, researchers reported on the adaptation and validation of WAB in Bangla.[12] However, they adapted the older version of WAB which is obsolete after the introduction of the WAB-R. The current study adapted the WAB-R in Bangla and conducted a preliminary validation study. Results indicated that the Bangla WAB-R successfully distinguished between controls and patients with aphasia. However, more research is needed for further validation and standardization of the Bangla WAB-R for clinicians and researchers.

Financial support and sponsorship

This study was financially supported by the University Grant Commission.

Conflicts of interest

There are no conflicts of interest.

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Appendices

Appendix 1a: Summary of the types of adaptation and changes for Record form part 1

Test subsections	English WAB-R	Bangla WAB-R	Types of adaptation	Linguistic/cultural change
Spontaneous language questions	Include basic questions related to the client's information	Directly translated into Bangla. Proposed the two different Bangla variations (t̪umɪ/ɑpnɪ) of English "You"	Direct translation	None
Picture description		No changes offered	None	None
Yes/no questions	Questions 1 and 2	English proper names were replaced with Bangla names within the same sentences	Direct translation replacing concepts	Cultural changes
	Question 16 ("Does March come before June?")	English months were replaced with Bangla days		
	Question 18 ("Does it snow in July?")	English month was replaced with a Bangla month and snow was replaced with winter, as snow is not common in Bangla culture		
	Question number 19 ("Is a horse larger than a dog?")	Animal names were replaced with culturally common animal names. Example: (bɑgʱ) "tiger" and "elephant" (hɑt̪ɪ)		
	Question 20 ("Do you cut the grass with an ax?")	The word "grass" and "ax" were replaced with more culturally associated words, for example (ʃobdʒɪ) "vegetable" and "scissor" (kɑ̃tʃɪ)		
Auditory word recognition	Real objects and pictured objects	The object "screwdriver" was replaced with a culturally associated concept (tʃɑbɪ) "key"	Direct translation and introduction of new words	Cultural changes
	Forms	Forms' name "cylinder" was replaced with (dʒog tʃɪnho) means "plus sign"		
Sequential commands		Directly translated into Bangla	Direct translation	None
Repetition		Most of the words and compound words were replaced with the culturally associated words and the structural complexity was maintained	Direct translation and introduction of new words and phrases	Cultural changes, for example: "bird eats ripe papaya" (pɑkhɪ pɑkɑ pẽpe khɑe) instead of "delicious freshly baked bread" Linguistic change, for example: "a type of sweet" (ɹɔʃogollɑ) instead of "snowball"
Word fluency		No changes offered	None	None
Object naming	Items 8, 11, 13, 18, and 19 were replaced	Five uncommon items (eraser, screwdriver, paper clip, tape, fork) were replaced with five culturally associated items for Bangla	Direct translation and introduction of new words and phrases	Cultural and linguistic change, for example: "candle" (mom bɑt̪ɪ) instead of "paper clip." This compound word is common in Bangla
Sentence completion	Items 3, 4, and 5 were replaced	Items were replaced as per cultural and linguistic need. Example "violet" is a culturally related concept	Direct translation replacing concepts and introduction of new phrases	Cultural change, for example: "violet" was replaced with "jasmine" (dʒuɪ) Linguistic change, for example: "grass color green" (gʰɑʃeɹ ɹɔŋ ʃobudʒ) instead of "grass is green"
Responsive speech	Item 5 was replaced	Instead of "stamp," the Bangla word for "vegetables" was used	Direct translation and direct translation replacing concepts	Cultural change, for example: "vegetables" (ʃɑk- ʃobdʒɪ) was used instead of "stamp."

WAB-R: Western Aphasia Battery-Revised

Appendix 1b: Summary of the types of adaptation and changes for Record form part 2

Test subsections	English WAB-R	Bangla WAB-R	Types of adaptation	Linguistic/cultural change
Comprehension of sentences	Item numbers 3, 4, 5, 6, 7, 8	All these six test items were culturally associated and unusual for Bangla culture. Translators proposed a new set of test items	Direct translation and introduction of new phrases	Cultural and linguistic changes. All the new phrases are provided considering the cultural and linguistic differences
	Item number 1	The direct translation of test item 1 was unusual. So, replaced with a new test item		
		Item number 2 was retained in the new adapted test as both the construction and concept are culturally acceptable in Bangla		
		The increased complexity of the test items was maintained		
Reading commands	Item number 2	"Waving goodbye" is not a common gesture in Bangla culture so that command was replaced with "make a fist" where hand is involved	Direct translation replacing concepts	Cultural changes
		Rest of the test items remain same and directly translated into Bangla		
Written word-object choice matching	Item number 6	As mentioned before in Record form part 1, the word "screwdriver" was replaced with Bangla translation of "key"	Direct translation replacing concepts	Cultural changes
Written word-picture choice matching	Item number 4	The same word "screwdriver" was replaced with Bangla translation of "key"	Direct translation replacing concepts	Cultural changes
Picture-written word choice matching	Item number 3	"Screwdriver" was replaced with Bangla translation of "key"	Direct translation replacing concepts	Cultural changes
Spoken word-written word choice matching	Item numbers 1, 2, 3, 4	All the test items were replaced with Bangla words considering the phonological differences between these two languages. The structural complexity was retained by maintaining the phonological complexity and providing enough foil to the response items	Introduction of new words	Linguistic changes. The words were chosen by native speaker's intuition
Letter discrimination		No changes	None	None
Spelled word recognition	Item numbers 1, 2, 3, 4, 5, 6	All the English words were replaced with Bangla words. These words have diacritics and conjunct letters as these are two important parts of Bangla orthography	Introduction of new words	Linguistic changes. The words were chosen by native speaker's intuition
Spelling	All items	All the English words were replaced with phonologically similar complexity Bangla words	Introduction of new words	Linguistic changes. The words were chosen by native speaker's intuition
Writing upon request		No changes	None	None
Writing output		No changes	None	None
Writing to dictation		English sentence was replaced with a Bangla sentence of similar syntactic complexity	Introduction of new phrase	Linguistic changes
Writing dictated words	Item numbers 1, 5, 6	These three test items were replaced with similar complexity level of Bangla words	Direct translation and introduction of new phrases	Cultural and linguistic changes
Alphabet and numbers	All items	Bangla alphabets and numbers were proposed	None	Linguistic changes
Dictated letters and numbers	All items	Bangla letters and numbers were provided	Direct translation	None
Copying a sentence		Bangla sentence was offered to the new adapted test considering all syntactic complexities of the English one	Introduction of new phrases	Linguistic change
Apraxia	Item number 20	"Piano" was replaced with a more culturally associated musical instrument "harmonium" as people may not know how to play piano	Direct translation replacing concepts	Cultural change
Constructional, visuospatial, and calculation		No changes offered for this task. Only the Bangla fonts were used for English number in calculation task	None	None

Contd...

Appendix 1b: Contd...

Test subsections	English WAB-R	Bangla WAB-R	Types of adaptation	Linguistic/cultural change
Supplemental writing and reading	Writing irregular words to dictation and reading irregular words	After considering the phonological and morphological differences, the translators proposed a set of uncommon Bangla words with similar level of complexity	Introduction of new words	Linguistic change
	Writing nonwords to dictation and reading nonwords	Translators created a set of new Bangla words which were considered as an accidental gap (words do not exist in the dictionary but have the potential to be words) in a language with the similar complexity level		

WAB-R: Western Aphasia Battery-Revised