

## Research Paper

## Investigating the Validity and Reliability of Bengali Version of Communication Outcome After Stroke Scale



Nahar Afrin<sup>1</sup>, Mohammad Shaikhul Hasan<sup>2\*</sup>, Nahid Parvez Tonmay<sup>1</sup>, Nayeema Ahmed<sup>3</sup>, Hasnat M. Alamgir<sup>4</sup>

1. Department of Speech and Language Therapy, Center for the Rehabilitation of the Paralyzed, Bangladesh Health Professions Institute, Dhaka, Bangladesh.

2. Department of Research, Monitoring & Evaluation, Center for the Rehabilitation of the Paralyzed, Dhaka, Bangladesh.

3. Department of Medicine, Faculty of Public Health, Center for Learning Innovation, University of Minnesota Rochester, Rochester, United States.

4. Department of Health Science, Faculty of Public Health, State University of Bangladesh, Dhaka, Bangladesh.



**Citation** Afrin N, Shaikhul Hasan M, Tonmay NP, Ahmed N, Alamgir HM. Investigating the Validity and Reliability of Bengali Version of Communication Outcome After Stroke Scale. *Iranian Rehabilitation Journal*. 2024; 22(3):383-394. <https://crossmark.crossref.org/dialog/?doi=10.32598/irj.22.3.1114.3>

**doi** <http://dx.doi.org/10.32598/irj.22.3.1114.3>

## Article info:

Received: 13 Nov 2023

Accepted: 22 Jan 2024

Available Online: 01 Sep 2024

**ABSTRACT**

**Objectives:** The speech and language therapy (SLT) profession in Bangladesh has been around for a decade. Yet, therapists are facing challenges in measuring the effectiveness of SLT services after providing this therapeutic intervention to the patient for a certain period. Due to patients' demands, there is an increasing need to develop and adapt outcome measurement tools for patients with communication difficulties. Accordingly, this study examines the validity and reliability of communication outcomes after the stroke scale developed in the Bengali language for individuals with stroke.

**Methods:** Content validity of the communication outcome after stroke Bengali (COAST-BD) scale was determined by item objective congruence (IOC) as  $\geq 0.67$  of three experts. Meanwhile, 110 stroke survivors and their caregivers from the SLT department of CRP hospital were enrolled in this study, considering one-to-two-week intervals for examining the test re-test reliability of the scale. The Cronbach  $\alpha$ , correlation matrix, the Kaiser-Meyer-Olkin (KMO) test and the Bartlett test ( $\chi^2$ ), in addition to the intraclass correlation coefficient, were applied to compute the psychometric properties of the scale. Exploratory factor analysis was applied to identify the potential item structure in the scale.

**Results:** The Cronbach  $\alpha$  coefficient for the internal consistency of the overall scale was 0.97 and 0.89. The interclass correlation coefficient for the test re-test reliability of the COAST-BD scale was 0.96 and the composite reliability score ranged from 0.70 to 0.91. The COAST-BD scale estimated correlated values among its subscales on visit-1 (0.370 to 0.661) and visit-2 (0.288 to 0.520), respectively. The KMO test and  $\chi^2$  were also calculated correlation values on visit-1 (KMO=0.628;  $\chi^2=82.90$ ) and visit-2 (KMO=0.614;  $\chi^2=48.10$ ), respectively.

**Discussion:** The COAST-BD scale showed significant internal consistency, test re-test reliability, correlation matrix, and construct validity.

**Keywords:**

Cultural adaptation, Validation, Reliability, Communication, Post-stroke, Communication outcome after stroke (COAST)

## \* Corresponding Author:

Mohammad Shaikhul Hasan

Address: Department of Research, Monitoring & Evaluation, Center for the Rehabilitation of the Paralyzed, Dhaka, Bangladesh.

Tel: +88 (018) 13886046

E-mail: [mdshaikhulh59@nu.ac.th](mailto:mdshaikhulh59@nu.ac.th), [nironst@gmail.com](mailto:nironst@gmail.com), [shaikhul.hasan@crp-bangladesh.org](mailto:shaikhul.hasan@crp-bangladesh.org)



Copyright © 2024 The Author(s).

This is an open access article distributed under the terms of the Creative Commons Attribution License (CC-BY-NC: <https://creativecommons.org/licenses/by-nc/4.0/legalcode.en>), which permits use, distribution, and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

## Highlights

- Communication outcome after stroke Bengali (COAST-BD) scale is a patient- and caregiver-centered measurement scale for examining functional communication level in their daily life and exactly of communication effectiveness.
- This scale is focused on the perspective of the quality of life (QoL) of individuals with stroke.
- The COAST-BD scale shows quickness and easiness of administration, which helps to make the scale practicable during clinical practice

## Plain Language Summary

Communication skill plays a vital role in leading a successful conversation during regular activities. In Bangladesh, qualified speech and language therapists have been working to develop several therapeutic intervention tools to assess the population with stroke and dysarthria. Yet, there are numerous possibilities to develop different intervention tools to assess the communication outcomes of patients with stroke in the speech and language therapy (SLT) services of Bangladesh. Particularly, constructive quantitative or qualitative research is desirable to develop this profession by understanding the appropriate effectiveness of SLT interventions in Bangladesh for individuals with communication difficulties. Therefore, this study illustrates a details procedure of linguistic validation and psychometric properties of the COAST scale into the Bengali context to assess the outcomes of after-stroke patients in the SLT services.

## Introduction

**N**oncommunicable diseases are currently the leading causes of long-term disability and death worldwide [1]. Among the wide range of noncommunicable diseases, stroke is one of the most life-threatening conditions [2]. It creates a massive impact on individuals, societies and healthcare systems in terms of mortality, morbidity and socioeconomic perspectives. Moreover, along with the growing burden of non-communicable diseases, the need for rehabilitation services is increasing, so that the burden on affected individuals, their families and overall healthcare systems worldwide can be lowered. Bangladesh is one of the most densely populated countries in South Asia. The aging population is increasing and the incidence and impact of stroke in Bangladesh are simultaneously rising. The healthcare systems of Bangladesh are struggling to create and ensure appropriate opportunities for reducing the health risks of another stroke [3]. According to the study of Hasan et al. [4], stroke is the second leading cause of death in Bangladesh. The impairments after a stroke may include a patient's speech, swallowing and communication capabilities.

Comprehensive rehabilitation, including physical therapy, occupational therapy, speech and language therapy (SLT) and other therapeutic services play vital roles in

recovering functional independence [5]. The main objective of this rehabilitation is to reduce the effect of stroke-related brain damage through routine activity with the help of research-based therapeutic interventions. SLT as a rehabilitation profession in Bangladesh has been treating patients since its initiation in the year 2004. SLT service improves speech, language, communication and swallowing of patients in their regular life [6].

For the last decade, SLT experts have been working collaboratively with different health professionals to alleviate symptoms and improve the communication abilities of individuals with stroke at tertiary-level specialized hospitals. Particularly, the [Centre for the Rehabilitation of the Paralyzed \(CRP\)](#) in Bangladesh has been playing a pivotal role in fulfilling the SLT service needs across the country [7]. The SLT department at CRP has developed and continuously been working for captivating up-to-date therapeutic interventions. They have developed various intervention tools that were not adapted to follow scientific standards. Accordingly, SLT professionals in Bangladesh are using several assessment tools, such as voice handicap index, stammering assessment, Western aphasia battery (WAB), articulation assessment, Frenchay dysarthria assessment (FDA), orofacial examination tools, and so on without cross-cultural adaptation and validation. One study has been conducted on cross-cultural adaptation and validation of WAB in Kolkata, India; yet, that is not being used in Bangladesh. Nev-

ertheless, there is no specific tool to measure the communication outcomes of patients after receiving SLT service in Bangladesh. Therefore, it would be challenging to identify a noticeable improvement between the first and last therapy sessions of the patient in the SLT department. Nowadays, patients are more aware of therapeutic services and prominently perceptible effectiveness is their common demand.

To meet the patients' demands, Long et al. [8] developed the communication outcome after stroke (COAST) scale, which is a widely used tool and is particularly being used for measuring the effectiveness of receiving SLT service for stroke survivors. Few European countries, such as Italy, Spain and France have developed and culturally adapted the COAST scale into their language [9, 10].

Cross-cultural adaptation and linguistic validation research have prodigious clinical implications for various medical professionals who provide healthcare services for assorted populations. This type of research is important since the quality of healthcare service delivery relies on the truthful appraisal and greater awareness of a patient's cultural, linguistic and indigenous background [11]. Worldwide, diversified cultural people is increasing, where cross-cultural, or multinational research is needed for enhancing medical and rehabilitative, in addition to the researcher's admittance on reliable and valid tools of numerous languages. That kind of process would enrich the generalization of findings of various cross-cultural healthcare research [12]. Besides, this type of research gives a strong outline of methodology for conducting studies on the adaptation and validation of instruments. In Bangladesh, a communication outcome measurement tool is needed to facilitate the therapist to measure the impact of SLT service for patients with communication difficulties. In due course, COAST is a tool that plays a significant role in measuring communicational impact and it helps to minimize the gap between therapist and patient in terms of service effectiveness. Therefore, this study examines internal consistency, test re-test reliability, composite reliability, construct validity, and exploratory factor analysis for checking items structure of the communication outcome after stroke Bengali (COAST-BD) scale, which was developed by considering the Bengali language.

### Research questions

The research questions guiding this study are as follows:

1) What is the validity and reliability of the COAST-BD scale? 2) What are the item structures of the COAST-BD scale?

### Characteristics of COAST

COAST scale was jointly developed, during the "ACT Now" feasibility study of the [University of Manchester](#) and [University of Leeds](#). COAST is designed to measure patients' communication effectiveness from the perceptions of patients and caregivers. This is a self-reported scale and is typically focused on the patient-centered approach to develop this scale. Additionally, this scale helps to build a conceptual framework for the communication abilities of stroke patients. It has two versions, namely one is patient-oriented COAST and the other is caregiver-oriented. Particularly, a caregiver-oriented COAST is applied for patients whose caregivers need support to measure communication outcomes after SLT service. COAST scale explores patients' abilities to communicate and participate in society since the assumption behind developing the COAST tool was to measure both verbal and non-verbal abilities as well as determine the overall impact of interactive communication skills on quality of life (QoL) [8]. The COAST scale consists of 20 items. These are further divided into three subscales as follows: Interactive communication subscale (items 1–12), overview of communication subscale (items 13–15) and QoL subscale (items 16–20). Every single item is visually presented on a table, and all the written questions are complemented by contextually appropriate drawings or pictures. All the question items are presented by using a 5-point Likert response scale (from "excellent" to "poor"). There are also some linguistic expressions to support the interpretation of the respondent choices and linguistic descriptions which are placed with either smiley or unhappy faces as the positive and negative responses of the scale.

### Materials and Methods

Linguistic validation method of Pault [13] was followed to validate the COAST-BD tool. Similarly, an adaptation process of Beaton's protocol was applied to the adaptation and translation processes [11]. After linguistic validation, a cross-sectional questionnaire survey was administered with the proposed scale to check its reliability and validity. Approval from the instrument developers was obtained before initiating the validation and adaptation process.

### Translation, cross-cultural adaptation and linguistic validation

In line with the linguistic validation process of Piau et al. [13], this study followed Beaton's guidelines to maintain the sequence of the validation and adaptation process for developing the COAST instrument into the Bengali language. Several steps were followed during the translation, cross-adaptation and validation process, such as translation of mother tools, synthesis of forward translation, back translation, analysis by a team of specialists, pre-testing of the adaptation version, submission, and review of all written reports by developers/committee [11].

During the forward translation process, two forward translators were employed (FT1 and FT2). Those translators were from two faculties of the University of Dhaka, the Faculty of English and the Faculty of SLT bachelor courses. The translators were proficient in English and Bangla languages but were not familiar with the scale and its use. Translators followed the COAST manual during the translation process. After a one-week interval, investigators collected the forward translation copies from two translators along with the feedback on pictures of each of the items. Two interpreters synthesized the interpretations to create one common interpretation FT-12 (FT1+FT2)

FT-12 form was checked by utilizing the item objective congruence (IOC) strategy, which is proposed by Rovinelli and Hambleton [14] to measure the content validity of any research tool. In this process, this study elected three experts in the panel from diverse backgrounds, including linguistics, rehabilitation therapists, academia, and research. Those three experts checked the FT-12 form of scale and rated the point by following the IOC score range between -1 and +1.

Congruent=+1, Questionable=0, Incongruent=-1

The formula for calculating the IOC scores of this study is presented as Equation 1:

$$1. \text{IOC} = \frac{\sum \text{en}}{N}$$

The summation of all raters point ( $\sum \text{en}$ ) was divided by the total number of raters (N). If any item got a score <0.67, those items were revised again. Besides, the items got reserved with scores between  $\geq 0.67$  and 1.

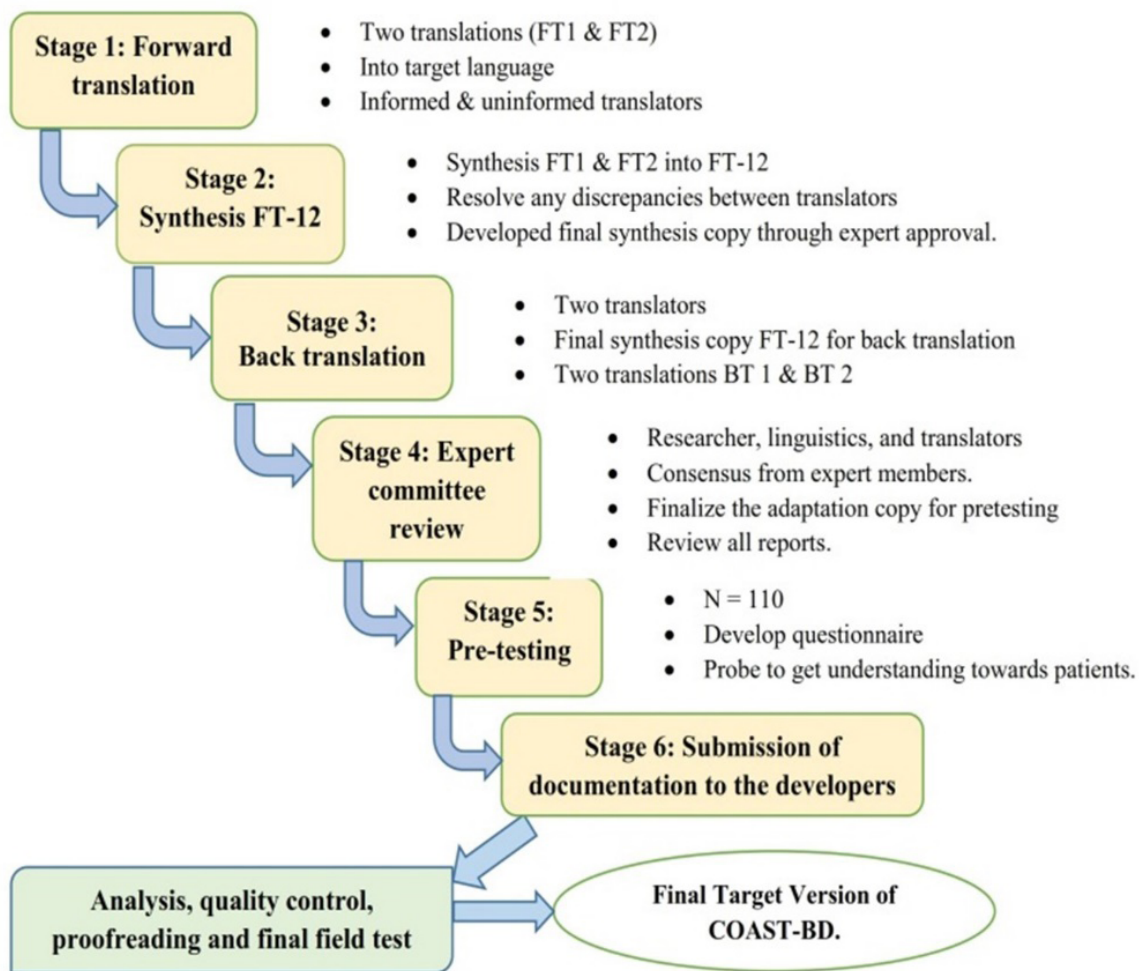
With the same process of forward translation, the instrument was then translated back into English. Both

translators, including the back translator-1 (BT-1) and back translator-2 (BT-2), translated the forward translation FT-12 version. After completing all these steps, investigators formed an expert committee and met all the experts to review all the reports, such as forward translation copy 1+2, synthesis copy FT-12, back translation and synthesis copy, tool pictures according to items, and main tools with its manual. The overall process of linguistic validation and adaptation according to this study is shown in Figure 1.

Furthermore, the study investigator was finalized by an expert who reviewed the copy of the COAST-BD scale for field testing or checking the appropriateness in the sociocultural context of Bangladesh. Table 1 illustrates the IOC scores of COAST-BD scales and all the items of this scale showed  $\geq 0.67$  scores by the second trial.

### Study participants

According to the guideline proposed by Beaton et al. [11], a minimum of 30 to 40 study participants were needed, so that the pre-final version of the scale could be tested for the format, flow, and accuracy. Meanwhile, the Italian version of the COAST scale enrolled 28 participants as the study respondents [9]. However, the current study applied a convenience sampling method and selected 110 patients and caregivers of stroke survivors who had communication difficulties and were receiving SLT services from the CRP. Particularly, the certified SLT used FDA and WAB to assess stroke patients for diagnosing dysarthria and aphasia. Communication disability as aphasia is an acquired impairment of language modalities caused by focal brain damage [15] and dysarthria is a group of motor speech disorders resulting from a disturbance in neuromuscular control [16]. Individuals who had a history of communication difficulties after the stroke were included in this study. Investigators only selected individuals who had strokes within 4 to 12 months before the data collection. The medical diagnosis, such as cerebrovascular accident, was confirmed by the neurologist, and the site of the lesion was confirmed for all cases by examining the CT scan or magnetic resonance imaging reports. Table 2 demonstrates the demographic information about the participants. The age range of the participants was from 30 to 70 years. Among all the participants 81(73.6%) were male and 29(26.4%) were female. >50% of participants were diagnosed with ischemic stroke (n=65[59.1%]), where 75.5% of participants had high cholesterol in their blood, 66.4% had a smoking history, and most importantly 13.6% of participants got stroke after their COVID infection. More than half of the participants were diagnosed with dysarthria (51.8%).



**Figure 1.** Process of linguistic validation and adaptation of COAST-BD scale

Meanwhile, 48% of the participants had aphasia as reported by the certified clinical SLTs. Among the participants, 69% (n=76) were patients and the rest of 31% (n=34) were their usual caregivers including spouses, siblings, children, and others (uncle/aunt, nephew/niece).

### Testing procedures

The questionnaire survey method was applied to collect data from the participants. Data was collected by two SLTs who completed their undergraduate course. The face-to-face contact method of data collection was considered to gather the information from the study respondents. A structured consent form was administered to the participants before moving to the questionnaire survey. After collecting written consent in considering the willingness of the participants, the researcher originated this survey. The data collection form contained two parts as follows: Demographic and COAST-BD scale checklist. The patients and caregivers completed the question-

naire. Study participants who were unable to fill up the questionnaire were assisted by the data collector. It took 15-20 min to complete the full questionnaire. Informed consent was obtained before a participant could start a survey. The data collection procedure included two visits to the SLT department of CRP, with a duration of one-to-two-week intervals, which were applied for measuring the test re-test reliability [9].

### Scoring process

COAST-BD adopted the same scoring system as the COAST English version. For each item of COAST-BD, the response based on the 5-point Likert scale was converted into scores from 0 to 4. A score of 0 represented the worst condition and a score of 4 represented the best condition of the participants. The participants could also choose the "not applicable" option if any item was perceived as unreliable. A final score was considered invalid if 10% of the responses on COAST-BD items were missing.

**Table 1.** IOC scoring by three expert members

Trial		Trial 1		Trial 2	
Subscales of COAST-BD Scale	Item	IOC	Accepted (+)/Rejected (-)	IOC	Accepted (+)/Rejected (-)
Interactive communication subscale	1	0	-	1*	+
	2	0.33	-	1*	+
	3	0.33	-	0.67*	+
	4	0.33	-	1*	+
	5	0.33	-	0.67*	+
	6	0.33	-	1*	+
	7	0.33	-	1*	+
	8	0	-	0.67*	+
	9	-0.33	-	0.67*	+
	10	0.33	-	1*	+
	11	0.33	-	1*	+
	12	-0.33	-	1*	+
Overview of communication subscale	13	0	-	1*	+
	14	0.33	-	0.67*	+
	15	0	-	0.67*	+
QoL subscale	16	0.33	-	1*	+
	17	0.33	-	1*	+
	18	0.33	-	0.67*	+
	19	0	-	1*	+
	20	-0.33	-	0.67*	+

\*Qualified items that have scored  $\geq 0.67$ , which is linguistically accepted.

IOC: Item objective congruence.

### Statistical analysis

Descriptive statistical analysis, including Mean $\pm$ SD, frequency, and percentages was measured after collecting information from the participants. Meanwhile, the Cronbach  $\alpha$  coefficient was applied to analyze the reliability of the questionnaire, and the score was set at  $\alpha \geq 0.7$  [17]. The interclass correlation coefficient (ICC) method was applied to measure test re-test reliability of the scale [10]. Exploratory factor analysis was applied to check the impending item structure of this COAST-BD scale [18]. All statistical analyses were conducted by using SPSS software, version 20 with the 95% confidence interval (CI) [19].

### Results

Descriptive statistical values were obtained from the collected information based on the COAST-BD scale and the overall items Mean $\pm$ SD score was 2.24 $\pm$ 0.47 in visit 1. Meanwhile, 13 participants were missing during visit 2; nonetheless, almost a similar score was reported during the second visit as 2.33 $\pm$ 0.42 (Table 3).

**Table 2.** Demographic and clinical characteristics of the participants of the study (n=110)

Demographic Information	Categories	No. (%)
		Participants
Age (y)	30-40	3(2.7)
	41-50	28(25.5)
	51-60	49(44.5)
	61-70	30(27.3)
Gender	Female	29(26.4)
	Male	81(73.6)
Occupation (s)	Employed	41 (37.3)
	Business	36(32.7)
	Educator	9(8.2)
	Farmer	3(2.7)
	Housewife	18(16.4)
	Unemployed	3(2.7)
Education	Class V to X	12 (10.9)
	SSC	20(18.2)
	HSC	21(19.1)
	Bachelor	36(32.7)
	Masters or above	9(8.2)
Type of stroke	Illiterate	12(10.9)
	Ischemic stroke	65(59.1)
Stroke etiology	Hemorrhagic stroke	45(40.9)
	High blood pressure	57 (51.8)
	Cigarette smoking	73(66.4)
	High cholesterol	83(75.5)
	Obesity	18(16.4)
	Diabetics	45(40.9)
	Obstructive sleep apnea	28(25.5)
	Cardiovascular disease	63(57.3)
	Family history of stroke	12(10.9)
	COVID-19 infection	15(13.6)
History of stroke	First time	79(71.8)
	Second times	22(20.0)
	More than that	9(8.2)
SLT diagnosis (according to CSLT's statement)	Global aphasia	11(10)
	Broca's aphasia	12(10.9)
	Wernicke's aphasia	6(5.5)
	Anomic aphasia	6(5.5)
	Conduction aphasia	3(2.7)
	Subcortical aphasia	3(2.7)
	Transcortical motor aphasia	9(8.2)
	Mixed transcortical aphasia	3(2.7)
	Dysarthria	57(51.8)
Relation to the patient	Spouse	54(49.1)
	Children's	32(29.1)
	Siblings	09(8.2)
	Others	15(13.6)
Location of the patient and caregiver	In the same place	101(91.8)
	Within a short distance	09(8.2)
Respondents	Patients	76(69)
	Caregivers	34(31)

**Table 3.** Psychometrics statistics of COAST-BD scale

COAST-BD Scale	Mean±SD		Internal Consistency (α)		ICC	r
	Visit-1 (n=110)	Visit-2 (n=97)	Visit-1 (n=110)	Visit-2 (n=97)		
COAST-BD scale total items	2.24±0.47	2.34±0.42	0.97*	0.89*	0.96**	0.92**
Interactive communication sub-scale	2.20±0.51	2.30±0.46	0.92*	0.98*	0.97**	0.94**
Overview of communication sub-scale	2.23±0.76	2.40±0.70	0.90*	0.86*	0.94**	0.89**
QoL sub-scale	2.34±0.57	2.42±0.55	0.98*	0.91*	0.97**	0.94**

\*α≥0.70, ICC significance at 0.000, \*\*Pearson correlation is significant at 0.01 level.

Iranian Rehabilitation Journal

Abbreviations: SD: Standard deviation; ICC: Intraclass correlation coefficient; COAST-BD: Communication outcome after stroke Bengali scale.

### Reliability estimates

Table 3 illustrates the reliability estimates. The Cronbach α coefficient for the internal consistency of the overall COAST-BD scale was 0.97 and 0.89, respectively, for two visits. All the sub-scales included the interactive communication sub-scale estimated at α=0.92 and 0.98. The overview of the communication sub-scale was calculated at α=0.90 and 0.86. Also, the QoL sub-scale was considered α=0.98 and 0.91.

### Test re-test reliability

Table 3 also shows the test re-test reliability estimate of the COAST-BD scale. The ICC of test re-test reliability estimated that between two visits it was 0.96. Three sub-scales of the COAST-BD scale considered test re-test reliability scores differ from 0.94 to 0.97.

### Correlation, Kaiser-Meyer-Olkin (KMO) and Bartlett’s test

The Pearson correlation was calculated as r=0.92 value between the two visits, and all sub-scales estimated correlation values varied from r=0.89 to 0.94. Table 4 shows correlation values among its all-sub-scales. All sub-scales estimated correlation values ranging from 0.370 to 0.661 in visit-1 and 0.288 to 0.520 in visit-2, respectively. The KMO measure of sampling adequacy and Bartlett’s test (χ²) were also considered correlation values on both visit-1 (KMO=0.628, χ²=82.90) and visit-2 (KMO=0.614, χ²=48.10), respectively.

### Comparison of reliability

Table 5 illustrates the comparison scores of reliability tests between COAST-BD and the Italian COAST scales. These values were α=0.89 with ICC=0.96 and α=0.95 with ICC=0.88, respectively.

**Table 4.** Psychometrics statistics of COAST-BD scale (correlation, KMO and Bartlett’s test)

Correlation Matrix	Visit-1				Visit-2			
	F-1	F-2	F-3	KMO and Bartlett’s Test (χ²)	F-1	F-2	F-3	KMO and Bartlett’s Test (χ²)
F-1 Dimension of interactive communication sub-scale	1.000	0.403**	0.661**		1.000			
F-2 Dimension of overview of communication sub-scales		1.000	0.370**	0.628** χ²=82.90	0.326**	1.000		0.614** χ²=48.10
F-3 Dimension of QoL sub-scales			1.000		0.520**	0.288**	1.000	

Iranian Rehabilitation Journal

KMO: Kaiser-Meyer-Olkin; COAST-BD: Communication outcome after stroke Bengali scale.

\*\*P<0.001.



Table 5. Factor structure of the COAST-BD scale

		Factor Loading	Factors		
			F1	F2	F3
F1: Interactive communication subscales	Item 12	Nowadays, how well can you/your relative deal with money?	0.717		
	Item 6	Nowadays, how well can you/your relative make themselves understood in longer sentences?	0.689		
	Item 4	In the past week or so, how well could you/your relative have a short conversation with an unfamiliar person?	0.667		
	Item 5	In the past week or so, how well could you/your relative Join in a conversation with a group of people?	0.703		
	Item 1	In the past week, how well could you/your relative Show that they mean yes or no?	0.651		
	Item 10	In the past week or so, how well could your relative read?	0.595		
	Item 2	Nowadays, how well can your relative Use other ways to help them communicate?	0.512		
	Item 11	In the past week or so, how well could you/your relative write?	0.595		
	Item 9	In the past week or so, how well could you/your relative follow a change of subject in conversation?	0.748		
	Item 7	In the past week or so, how well could you/your relative understand simple spoken information?	0.804		
F2: Overview of communication subscales	Item 8	Nowadays, how well can you/your relative show that they do not understand?	0.635		
	Item 3	In the past week or so, how well could you/your relative Have a chat with someone they know well?	0.877		
	Item 14	What do you think about you/your relative's communication now?		0.821	
F3: QoL subscales	Item 13	How much have you/your relative's communication changed since just after their stroke?		0.653	
	Item 15	How often does you/your relative's confidence about communicating affect what they do?		0.484	
	Item 18	Nowadays, what effect do you/your relative's speech or language problems have on your interests or hobbies?			0.537
	Item 19	How often do you/your relative's difficulties communicating make you unhappy?			0.777
	Item 17	Nowadays, what effect do you/your relative's speech or language problems have on your social life?			0.784
	Item 16	Nowadays, what effect do you/your relative's speech or language problems have on your family life?			0.610
	Item 20	How do you rate your overall QoL?			0.608
Average variance extracted			0.39	0.48	0.43
Composite reliability			0.91	0.70	0.80
Percentage of variance			14.91	11.58	10.45
Cumulative percentage of variance			14.91	26.49	36.94

COAST-BD: Communication outcome after stroke Bengali scale.

**Table 6.** Comparison of the reliability test scores between COAST-BD and COAST-IT

Variables	COAST-BD		COAST-IT	
	Internal Consistency (Cronbach $\alpha$ ) Visit-2	Test re-test Reliability	Internal Consistency (Cronbach $\alpha$ ) Visit 2	Test Re-test Reliability
Total	0.89*	0.96*	0.95*	0.88*
Interactive communication subscale	0.98*	0.97*	0.95*	0.94*
Overview of communication subscale	0.86*	0.94*	0.79*	0.80*
QoL subscale	0.91*	0.97*	0.87*	0.85*

\*Significance at  $\alpha$  (alpha)  $\geq 0.70$ .

Iranian Rehabilitation Journal

COAST-BD: Communication outcome after stroke Bengali scale; COAST-IT: Communication outcome after stroke Italian scale.

### Composite reliability

This study estimated composite reliability (CR) via the Equation 2:

$$2. CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i^2 + (\sum \varepsilon_i)^2)}$$

In this formula,  $\lambda$  is the standardized factor loading for item  $i$ , and  $\varepsilon$  is the respective error variance for item  $i$ . The error variance ( $\varepsilon$ ) is estimated based on the value of the standardized loading ( $\lambda$ ). The values of composite reliability for the factors vary from 0.70 to 0.91 (Table 6).

### Factor structures

Principal component analysis with varimax rotation was extracted to explore the factor structure of the COAST-BD scale [18]. Table 6 illustrates the overall factor structure of the COAST-BD scale.

Factor analysis appeared with 3 factors. Meanwhile, 20 out of 20 items were selected based on factor loading (i.e.  $>0.40$ ). The factor loading ranged from fair (0.484) to excellent (0.877). Three prominent factors were labelled as “interactive communication subscale,” “overview of communication subscale,” and “QoL subscale.”

### Discussion

This study examined the validity and reliability of the COAST-BD scale which was developed for assessing SLT service in Bangladesh. SLT is a relatively new and illuminating profession in Bangladesh. Communication skills, including speech, language, voice, articulation, and swallowing for an individual play a vital role in leading a successful conversation during regular activities. The prevalence of communication disorders along with post-stroke disabilities, such as aphasia, dysarthria,

etc. are increasing rapidly in Bangladesh. High blood pressure, diabetes, vitamin deficiency, smoking, and infectious diseases are the major causes of stroke in Bangladesh [20]. Additionally, the present study found COVID-19 infection as a possible cause of stroke [21]. The majority of the participants of this study were affected by ischemic stroke for the first time, and diagnosed as dysarthria, whereas Summaka et al. [22] claimed that there is a chance of motor speech disorder as dysarthria due to the effect of first-ever ischemic stroke.

Bangladesh is now a middle-income country and the adult literacy rate is increasing [23], even though, this study revealed that  $>10\%$  of post-stroke patients' have no illiteracy. Therefore, in considering patients' literacy, COAST-BD type of mixed composition including, lexical, and graphical image-based therapeutic tool is important to develop for ensuring healthcare services for all. Similarly, this study allowed usual caregivers of the patients to establish patient-centered health care services for all.

The COAST-BD tool was developed by following the guidelines of Pault and Beaton and several studies also followed similar methods for the adaptation and validation of scales [24, 25]. In line with the study of Kovacic [26], this study checked the content validity by using the IOC index and found that all the items showed a clear construct. Findings of factor loading suggested 20 items on 3 domains (subscales). Items were selected based on the factor loading value  $\geq 0.40$ .

In estimating the reliability of the COAST-BD scale, this study collected information from the same respondents with an interval. However, on the second visit, the study investigators were unable to contact some of the respondents ( $n=13$ ) due to their absenteeism in the CRP. The clinical SLT who were assigned to those patients in-

formed that due to their sickness and second stroke, they were admitted to other hospitals for curative treatment and few numbers returned to their home after regaining functional communication. Overall, the study findings supported the findings from the other studies conducted by Long et al. [8] and Bambini et al. [9]. The marking consistency in each of the items of the present study might be quite similar to the participants of other studies. The internal consistency of the Italian COAST and the English version of COAST was quite similar to the findings of the present study. One to two-week intervals were given between visit 1 and visit 2 to examine the test re-test reliability through the ICC test. The ICC is a widely used method to assess test re-test reliability [17] and with a 95% CI, the present study found an excellent test re-test reliability score. In a comparison of the COAST-BD scale with the existing outcome measurement tool, this study found some complexity in calculating the estimated score about the patient's feedback on different traits of communication difficulties. These tools that are used in the SLT department of CRP are not culturally adapted, such as Bengali WAB and FDA. This sort of constraint was impacted by the comparison of the effectiveness between COAST-BD and existing therapeutic tools in the SLT department of CRP. Hence, this study estimated and compared reliability and internal consistency scores with the COAST-IT scale. Whereas the COAST-BD scale reflected high reliability and internal consistency scores that were comparatively similar to the reliability scores of the Italian COAST [9]. Similarly, the factor loading analysis estimated a significant correlation among each of the factors (i.e. domains).

The COAST-BD is a scientifically valid and reliable tool for measuring the communication outcomes of after-stroke patients who are receiving SLT services at any hospital in Bangladesh.

## Conclusion

This study provides a Bangla-translated version of the COAST scale for assessing patients who are receiving SLT services. The COAST-BD scale has shown significant content validity, internal consistency, test re-test reliability, composite reliability, and comparison reliability. Therefore, this tool is scientifically reliable and culturally appropriate for assessing outcomes of SLT services at any hospital or clinic in Bangladesh.

## Study limitations

The present study faced some limitations. This study was limited to the post-stroke patients and their regular

caregivers. Due to limited information regarding WAB in the SLT department of CRP, this study was unable to compare the measurement scores of WAB and COAST-BD scales. A similar complexity was faced in the information of patients with dysarthria. This study considered two groups such as aphasia and dysarthria but for validity and reliability, it is best to have a cohesive group.

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethics Committee of Bangladesh Health Professions Institute (BHPI) (Code: CRP/BHPI/IRB/12/2020/410). A structured consent form was administered to the participants to confirm their written consent before moving to the questionnaire survey. Through this consent form, all the participants were informed about the aim and objectives of this study before their enrolment. Participation in this study was voluntary, and a participant could withdraw his/her participation from this study at any time.

### Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

### Authors' contributions

Study design: Mohammad Shaikhul Hasan; Data collection: Nahar Afrin; Conceptualization, data analysis, interpretation, writing the initial draft: Mohammad Shaikhul Hasan and Nahar Afrin; Review and editing: Nahid Parvez Tonmay, Nayeema Ahmed and Hasnat M. Alamgir.

### Conflict of interest

All authors declared no conflict of interest.

### Acknowledgments

The authors are deeply grateful to Audrey Bowen (the developer of the COAST scale) for extending her valuable feedback throughout the study and expressing their gratitude to all the translators and expert committee members for their valuable contributions and effective support throughout the adaptation process of this scale. Lastly and most importantly, the authors are thankful to all the post-stroke patients and their caregivers for participating in this study voluntarily.

## References

- [1] Feigin VL, Norrving B, Mensah GA. Global burden of stroke. *Circulation Research*. 2017; 120(3):439-48. [DOI:10.1161/CIRCRESAHA.116.308413] [PMID]
- [2] WHO. Noncommunicable diseases. Geneva: World Health Organization; 2018. [Link]
- [3] Ahmed SM, Alam BB, Anwar I, Begum T, Huque R, Khan JA, et al. Bangladesh health system review. *Asia Pacific observatory on health systems and policies. Health Systems in Transition*. 2015; 5(3). [Link]
- [4] Shaikhul Hasan M, Anusaksathien K, Siripornpibul T, Narattharaksa K. Assessing post-stroke outpatients' rehabilitation service quality gaps in Bangladesh. *Iranian Rehabilitation Journal*. 2020; 18(4):485-96. [DOI:10.32598/irj.18.4.1114.1]
- [5] Rehabilitation therapy after stroke [Internet]. National Stroke Association. 2017 [updated 2017 March].
- [6] Walker MF, Sunnerhagen KS, Fisher RJ. Evidence-based community stroke rehabilitation. *Stroke*. 2013; 44(1):293-7. [DOI:10.1161/STROKEAHA.111.639914] [PMID]
- [7] Hasan MS, Anusaksathien K, Narattharaksa K, Afrin N. Factors relating to the expectations and perceptions of post-stroke outpatients' in the rehabilitation services of Bangladesh. *International Journal of Statistics in Medical Research*. 2022; 11:27-40. [DOI:10.6000/1929-6029.2022.11.04]
- [8] Long A, Hesketh A, Paszek G, Booth M, Bowen A. Development of a reliable, self-report outcome measure for pragmatic trials of communication therapy following stroke: The Communication Outcome after Stroke (COAST) scale. *Clinical Rehabilitation*. 2008; 22(12):1083-94. [DOI:10.1177/0269215508090091] [PMID]
- [9] Bambini V, Arcara G, Aiachini B, Cattani B, Dichiarante ML, Moro A, et al. Assessing functional communication: Validation of the Italian versions of the Communication Outcome after Stroke (COAST) scales for speakers and caregivers. *Aphasiology*. 2017; 31(3):332-58. [DOI:10.1080/02687038.2016.1225275]
- [10] Long A, Hesketh A, Bowen A; ACT NoW Research Study. Communication outcome after stroke: A new measure of the carer's perspective. *Clinical Rehabilitation*. 2009; 23(9):846-56. [DOI:10.1177/0269215509336055] [PMID]
- [11] Beaton D, Bombardier C, Guillemin F, Ferraz MB. Recommendations for the cross-cultural adaptation of health status measures. New York: American Academy of Orthopaedic Surgeons; 2002. [Link]
- [12] Sousa VD, Zauszniewski JA, Mendes IA, Zanetti ML. Cross-cultural equivalence and psychometric properties of the Portuguese version of the Depressive Cognition Scale. *Journal of Nursing Measurement*. 2005; 13(2):87-99. [DOI:10.1891/jnum.2005.13.2.87] [PMID]
- [13] Piault E, Doshi S, Brandt BA, Angün C, Evans CJ, Bergqvist A, et al. Linguistic validation of translation of the Self-Assessment Goal Achievement (SAGA) questionnaire from English. *Health and Quality of Life Outcomes*. 2012; 10:40. [DOI:10.1186/1477-7525-10-40] [PMID]
- [14] Turner RC, Carlson L. Indexes of item-objective congruence for multidimensional items. *International Journal of Testing*. 2003; 3(2):163-71. [DOI:10.1207/S15327574IJT0302\_5]
- [15] Berg K, Isaksen J, Wallace SJ, Cruice M, Simmons-Mackie N, Worrall L. Establishing consensus on a definition of aphasia: An e-Delphi study of international aphasia researchers. *Aphasiology*. 2022; 36(4):385-400. [DOI:10.1080/02687038.2020.1852003]
- [16] Icht M, Bergerzon-Bitton O, Ben-David BM. Validation and cross-linguistic adaptation of the Frenchay Dysarthria Assessment (FDA-2) speech intelligibility tests: Hebrew version. *International Journal of Language & Communication Disorders*. 2022; 57(5):1023-49. [DOI:10.1111/1460-6984.12737] [PMID]
- [17] Dhipayom JP, Trevittaya P, Cheng ASK. Cross-cultural adaptation, validity, and reliability of the patient-rated Michigan Hand Outcomes Questionnaire for Thai patients. *Occupational Therapy International*. 2018; 2018:8319875. [DOI:10.1155/2018/8319875] [PMID]
- [18] Balqis-Ali NZ, Saw PS, Jailani AS, Fun WH, Mohd Saleh N, Tengku Bahanuddin TPZ, et al. Cross-cultural adaptation and exploratory factor analysis of the Person-centred Practice Inventory - Staff (PCPI-S) questionnaire among Malaysian primary healthcare providers. *BMC Health Services Research*. 2021; 21(1):32. [DOI:10.1186/s12913-020-06012-9] [PMID]
- [19] Alin A. Multicollinearity. *WIREs Computational Statistics*. 2010; 2(3):370-4. [DOI:10.1002/wics.84]
- [20] Venketasubramanian N, Yoon BW, Pandian J, Navarro JC. Stroke epidemiology in South, East, and South-East Asia: A review. *Journal of Stroke*. 2017; 19(3):286-94. [DOI:10.5853/jos.2017.00234] [PMID]
- [21] Ali MA, Islam A, Chowdhury RU, Islam SS, Aliuzzaman M, Mukherjee SK, et al. Acute ischemic stroke in relation of covid-19. *Bangladesh Journal of Neurosurgery*. 2021; 11(1):18-24. [Link]
- [22] Summaka M, Hannoun S, Harati H, Daoud R, Zein H, Estephan E, et al. Neuroanatomical regions associated with non-progressive dysarthria post-stroke: A systematic review. *BMC Neurology*. 2022; 22(1):353. [DOI:10.1186/s12883-022-02877-x] [PMID]
- [23] Robertson C. Education: No Take Off Without Adult Literacy. In: *The time-travelling economist*. Cham: Palgrave Macmillan; 2022. [DOI:10.1007/978-3-030-97597-5\_1]
- [24] Ioane BR. Cultural adaptation of research instruments—the case of Materialism Scales Culturally Adapted for Use in China. *Asian Business Research*. 2017; 2(2):7. [DOI:10.20849/abr.v2i2.148]
- [25] Jesus LM, Valente AR. Cross-cultural adaptation of health assessment instruments. University of Aveiro, Portugal. 2016; 8. [Link]
- [26] Kovacic D. Using the content validity index to determine the content validity of an instrument assessing health care providers' general knowledge of human trafficking. *Journal of Human Trafficking*. 2018; 4(4):327-35. [DOI:10.1080/2332705.2017.1364905]