VALIDITY AND RELIABILITY OF GUJARATI VERSION OF NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS)

[1] Dr. Bhumika S. Patel, [2] Dr. Rushikesh K. Joshi, [3] Dr. Shivani I. Solanki

[1]MPT Scholar KSPR, KPGU, Vadodara, [2] Assistance professor, [3] MPT Scholar KSPR, KPGU, Vadodara.

[1]MPT in Neurological & Psychosomatic disorders,

[1]Krishna School of Physiotherapy & Rehabilitation (KSPR), KPGU, Vadodara, India

Abstract: **Background:** A clinical evaluation tool that is frequently used in clinical trials and daily practice to assess stroke-related neurological impairments is the National Institutes of Health Stroke Scale (NIHSS). English-written, 15-point evaluation form intended to measure neurological deficits in patients with recent strokes. **Aim and Objectives:** To determine the reliability and validity of the NIHSS with the Gujarati and Indian adaptation of item 9 and 10. **Methodology:** In this study, NIHSS items 9 and 10 were modified and culturally adapted were performed according to the guidelines. G-NIHSS was applied by seven independent investigators on 30 patients with stroke. Inter-observer agreement and intra-class correlation coefficients were calculated. The predictive validity of the G-NIHSS was calculated using functional outcome after three months in the form of Barthel Index (BI). **Result:** The G-NIHSS content validity index reached between 0.83 to 1.The G-NIHSS has a significantly negative correlation with both Glasgow Coma Scale ($r = -0.824$, $p < 0.001$), and BI($r = -0.683$, $p < 0.008$) is significant for $p < 0.01$. And the Pearson's rho= 0.800, ($p < 0.001$) was correlation with the BI at 90 days was significantly Positive. The ICC for the overall score on the G-NIHSS was 1 (95% CI, 1.0-1.0). The reliability of the G-NIHSS is significant. The Cronbach's α coefficient of 0.96 for the G-NIHSS was considerate reliable. **Conclusion:** The G-NIHSS is reliable and valid Scale for the clinical assessment of neurological deficit in Gujarati acute stroke patients.

Keywords: National Institute of Health Stroke Scale, Barthel Index, Glasgow Coma Scale, Reliability, Validity

I. INTRODUCTION

Stroke is the second leading cause of death in the world, after heart disease.[1] Stroke is usually categorized into two types: ischemic and hemorrhagic, based on the disruptions in brain circulation. Ischemic stroke occurs when a cerebral artery is blocked by an embolus or a thrombus, causing ischemia in a portion or all of the area supplied by the occluded artery. Hemorrhagic stroke, on the other hand, is mostly caused by arteriolar hypertensive illnesses, with coagulation disorders, brain abnormalities, and nutrition playing a minor role.[2]

The National Institutes of Health Stroke Scale (NIHSS) is a clinically validated quantitative assessment of stroke-related neurological impairment.[3] The NIHSS is a standardised screening instrument for determining the neurological impairments most commonly found in acute stroke patients. It was created by Thomas Brott, MD, and colleagues at the University of Cincinnati Ohio, and the first report on it was in 1989.[3] The NIHSS was created with English-speaking people, and it includes tasks that require you to read English words and phrases. Many individuals in our nation are unable to read or write English.[4]

The NIHSS is an ordinal scale that does not follow a linear pattern. A total of 15 elements are included on the scale. Individual items have response scales ranging from 0 to 4 on a 3- or 4-point response scale. Values range from 0 to 42, with higher scores indicating more deficiencies. The scale is administered in 5 to 8 minutes.[3,7] Level of awareness, extraocular movements, visual fields; facial muscle function, extremities strength, sensory function, coordination, language, speech and hemi-inattention are all assessed on this scale.[6,7]

For use in prospective clinical research, the NIHSS has demonstrated reliability and validity, as well as predictive validity for long-term stroke outcome.[3,7] The Scale's intraobserver Reliability was Strong, with an Interclass correlation Coefficient of 0.93 and overall ICC of 0.95, interobserver reliability was similarly good.[8]

In this study, NIHSS was translated from the English version into the Gujarati version. However, there is no study done to convert NIHSS from the English version to the Gujarati version. So, in this study, we translated NIHSS from the English version into the Gujarati version and check the reliability and validity of Gujarati translated version.

AIM

To validate translated Gujarati Version of National Institutes of Health Stroke Scale.

OBJECTIVES

To Translate English version of NIHSS into Gujarati Language.

To Determine the Reliability of Gujarati Version of NIHSS.

To Determine the Validity of Gujarati version of NIHSS.

RESEARCH METHODOLOGY

Population and Sample

The Sample Size was calculated using G Power Software version 3.1.9.4 based on the previous study Conducted by **Sun, T. K. (2006).**The main outcome variable Glasgow Coma Scale (Reliability-0.82) and Barthel index Scale (Reliability-0.68). Keeping (∝ error 0.05) (95% Confidence level) and β error 0.2 (80% Power),the calculated sample size was 30. In this study required 30 Acute Stroke Patients.

Data and Sources of Data

For this study data has been collected in Sunshine Global Hospital, Vadodara, Shukan Multispeciality Hospital & Trauma Centre, Vadodara.The data collection period is ranging from 5 March 23 to Dec 2023.

Theoretical framework

Study Design
Descriptive

Inclusion criteria
Adult Patients (More than 18 year)
Male and female both
Willingness and ability to complete all neuropsychological evaluation
Diagnosis of stroke within 1 month of onset
Clinical diagnosed Stroke Patients

Exclusion criteria
Who are not able to read Gujarati Language
Patient who did not give informed verbal consent
Altered consciousness/Unconscious
Non-cooperative

Step 1: Translation of the G-NIHSS[9]
A Vocabulary specialist was contracted to translate the E-NIHSS into G-NIHSS. Translation precision was confirmed by Specialist. The G-NIHSS was then converted back into English after being edited once again by a language specialist and also another expert from the Department of English. The Language specialist was evaluated by comparing these two English versions to check for differences.

Step 2: Content validity of the G-NIHSS
According to Lynn Suggest that at least 5 specialists are necessary to ensure a high level of validity in evaluation.[10] In this research, five specialists, each with over five years of work in the care of acute stroke patients, were enrolled from the Health centre. Five experts evaluated each G-NIHSS item's accuracy in reflecting the original version using a 4 point scoring system.

  I.   A experts was given a score of 1 if it was absolutely improper and required to be thoroughly redone.
  II.   A experts was given a score of 2 signified that the majority of it needed to be rewritten.
  III. A experts was given a score of 3 indicated that it was mainly acceptable but still required improvement.
  IV.   A experts was given a score of 4 indicated that it was completely suitable and didn't require any revisions.
        Items that receive low (<3) points will be rewritten by the experts. Results above 3 will be considered valid along with those with a Significant (<0.78) index of content validity.

Step 3: Examination of reliability
Inter-rater agreement
Inter-rater agreement was used in this investigation to assess the G-NIHSS. Six clinicians (3 Physiotherapist (specialised in Neurology) and 3 nurses) from the Hospital were instructed by a certified instructor on the components of the scale and the procedures it uses.

All seven (instructor and six raters) were used G-NIHSS to examined our ten acute stroke patients. The inter-rater consistency of analysis was separately scored between the instructor and six raters using Kappa agreement. Every NIHSS item was a sequential variable, and the Kappa agreement was used to compare the reliability of the original scale with its translation.

Internal consistency reliability:
For the whole G-NIHSS, the Chronbach's α coefficient—a widely used reliability indicator was calculated. The degree to which all of the components were evaluating the same attribute is known as internal consistency, also known as homogeneity, of dependability.

Step 4: Criterion related validity
30 individuals were evaluated using the GCS, BI, and G-NIHSS. Pearson's correlation was used to evaluate the validity associated to the criterion. A well-known measure used to evaluate activities of daily life is the BI. It was used to create plans for the patients when they were discharged from acute medical care and was shown to be helpful in estimating how long patients would stay in the hospital. The predictive value of the baseline G-NIHSS was evaluated by compared with the 90-day outcome, Face to Face evaluation was taken on the 1st Day of the Data Collection, while a second judgement was performed through a phone call after 90 Days.

The construct validity of the G-NIHSS was assessed through comparison with the GCS. The GCS provides a global score of a patient's status and is a reliable method for estimating the status of patients with acute neurological diseases. During 48 hours of hospitalization, each patient was evaluated using the G-NIHSS and GCS. The G-NIHSS and the GCS scores were compared.

OUTCOME MEASURE
National Institutes of Health Stroke Scale Gujarati version
Glasgow Coma Scale
Barthel index

Figure.1.1 Sentences and word Reading by Patient

Statistical tools and econometric models
- Data were keyed in and double checked, then analysed using the Statistic Package for the social sciences (SPSS), Version 21.
- Data Entered In Excel Sheet.

Descriptive Statistics
- Kappa agreement used to inter-rater agreement evaluated between the instructor and Six rater.
- Cronbach alpha (∝) coefficient were calculated for item scale correlation (reliability of questionnaire) or internal consistency along with ICC for G-NIHSS language questionnaires.
- Pearson's correlation was used when Scores had normal Distribution. Pearson's correlation co-efficient was examined between G-NIHSS and baseline GCS, BI to evaluate were obtained to check concurrent validity, Content validity, Predict validity.

RESULT

A total 30 patients participated in the study. The participants consisted of 15 male and 15 female Patients; their mean age was 60.73 years, Ischemic Stroke 61.70, Hemorrhagic Stroke 59.46.

Table1.1. Demographic Data of Subjects

	N	Mean	Std. Deviation (SD)
Age	30	60.73	7.62904
Hemorrhage Stroke	13	59.4615	8.70455
Ischemic Stroke	17	61.7059	6.80776
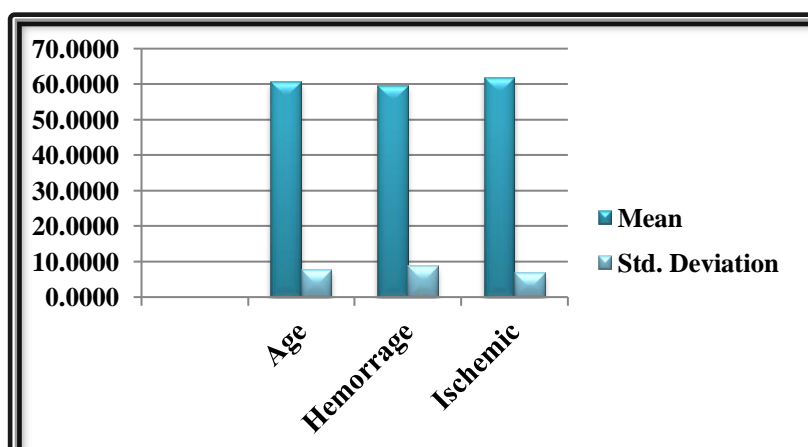
Figure:1.2 Graphical presentation of Descriptive characteristics of participants

Ischemic Stroke can be seen more in female than the male. Hemorrhagic stroke seen more in male than the female. In our study out of 30 participants 50% were male and 50% were female.

Content Validity

Seven experts analysed "the applicability of translated phrases". In the item of "Best Language" and "Dysarthria" On a 4 point rankings Measurement tool the average Score of the CVI for every item. All component score between 0.83-1 from all seven expert, Based on the experts evaluation, the index of G-NIHSS Content validity 0.83-1.00 meaning appropriated and valid material.

Table1.2. Content validity of index for the Gujarati version of NIHSS

Items		Mean	CVI
1a	LOC	5.71	1
1b	LOC questions	5.71	0.83
1c	LOC Command	5.85	0.83
2	Gaze	5.42	1
3	Visual fields	5.71	1
4	Facial Weakness	5.71	0.83
5a	Motor left arm	5.71	0.83
5b	Motor right arm	5.71	0.83
6a	Motor left leg	5.42	1
6b	Motor right leg	5.71	0.83
7	Ataxia	5.85	0.83
8	Sensory	5.71	0.83
9	Aphasia	5.85	0.83
10	Dysarthria	5.85	0.83
11	Extinction	5.42	1

Predictive Validity

A Follow-up conducted 90 days after the phone interviews with 30 patients. BI was 34.16 ± 20.59 in a face to face interview, and BI was 72.33 ± 13.04 after 9o days. the Pearson's correlation coefficient between the G NIHSS at baseline and the BI. The G NIHSS also showed a significantly significant correlation with 90 days after BI. Pearson's rho = 0.800; p 0.001). The 90-day BI showed a substantially Positive association.

Table1.3. Predict validity

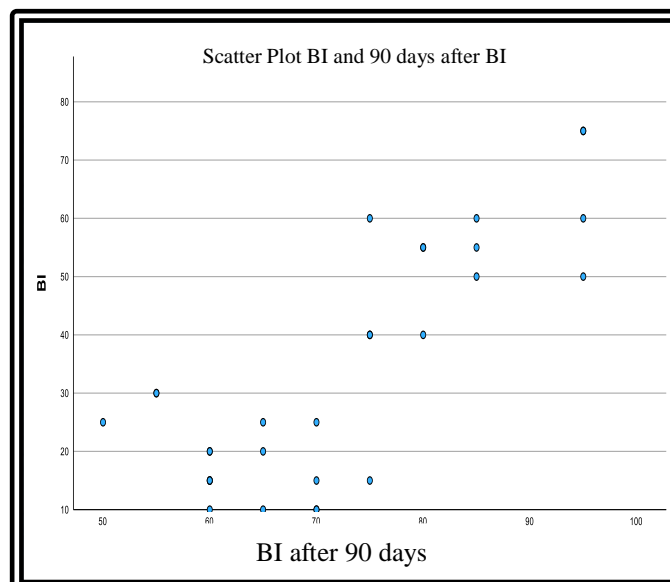|	Mean	SD
BI	34.16	20.59
BI 90 days after	72.33	13.04
N	30	30

Figure.1.3: Correlation Between BI and BI after 90 days

Criteria validity

Criterion-related validity Pearson's product–moment correlation coefficient was used to test the degree of correlation of 30 subjects' G-NIHSS score to the scores of GCS, and the scores of BI. A G-NIHSS correlation coefficient to GCS ($r = -0.824$, $p < 0.001$), and BI ($r = -0.683$, $p < 0.008$) is significant for $p < 0.01$. Were moderately Positive correlations, meaning the criterion related validity of G NIHSS was acceptable.
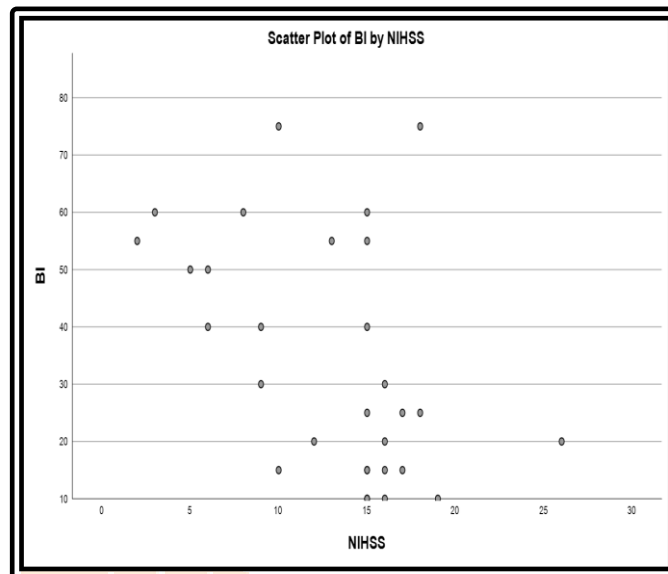

Figure.1.4: Correlation between NIHSS and BI

Interrater reliability

The values indicating interobserver agreement for each item of the G-NIHSS, obtained using the unweighted kappa for multiple raters, are given in below table. The unweighted kappa scores were 1 for all of the Items. The ICC for the overall score on the G-NIHSS was 1 (95% CI, 1-1). The reliability of the G-NIHSS is significant.

Table1.4.The Mean and SD G-NIHSS Questionnaire score by seven Raters

	Mean	SD
Rater 1	5.53	0.51
Rater 2	5.69	0.48
Rater 3	5.69	0.48
Rater 4	5.69	0.27
Rater 5	5.91	0.48
Rater 6	5.85	0.48
Rater 7	5.61	0.50

Table.1.5 Interrater reliability-7 Raters

Item		G-NIHSS 7 raters , 10 subjects		Sig. p-value
		Kappa	**95% CI**	
1a	**LOC**	1	0.86 - 1.13	<0.001
1b	**LOC questions**	1	0.86 - 1.13	<0.001
1c	**LOC command**	1	0.86 - 1.13	<0.001
2	**Gaze**	1	0.86 - 1.13	<0.001
3	**Visual fields**	1	0.86 - 1.13	<0.001
4	**Facial weakness**	1	0.86 - 1.13	<0.001
5a	**Motor left arm**	1	0.86 - 1.13	<0.001
5b	**Motor right arm**	1	0.86 - 1.13	<0.001
6a	**Motor left leg**	1	0.86 - 1.13	<0.001
6b	**Motor right leg**	1	0.86 - 1.13	<0.001
7	**Ataxia**	1	0.86 - 1.13	<0.001
8	**Sensory**	1	0.86 - 1.13	<0.001
9	**Aphasia**	1	0.86 - 1.13	<0.001
10	**Dysarthria**	1	0.86 - 1.13	<0.001
11	**Extinction**	1	0.86 - 1.13	<0.001
	Overall scores	**ICC**	**95% CI**	
		1	1.0 - 1.0	

Internal Consistency reliability:

G-NIHSS assessments of 30 Data on the subjects were gathered, their internal consistency was examined, and a Cronbach's α coefficient of 1 was obtained. The size of the sample that was employed for the data analysis determined the appropriate dependability. Extremely high coefficients could be a sign of item redundancy. In our trials, the mean intermittent correlation was 1. As a result, the G-NIHSS' Cronbach's α coefficient of 0.96 was deemed to be accurate.

Table.1.6 Intrarater Reliability

Item		G-NIHSS	
		Cronbach's α item	**95% CI**
1a	**LOC**	0.95	0.845 - 1.135
1b	**LOC questions**	0.89	0.889 - 1.135
1c	**LOC command**	0.86	0.867 - 1.135
2	**Gaze**	0.86	0.868 - 1.135
3	**Visual fields**	0.95	0.865 - 1.135
4	**Facial weakness**	0.95	0.865 - 1.135
5a	**Motor left arm**	0.95	0.869 - 1.135
5b	**Motor right arm**	0.96	0.870 - 1.135
6a	**Motor left leg**	0.96	0.871 - 1.135
6b	**Motor right leg**	0.95	0.874 - 1.135
7	**Ataxia**	0.96	0.870 - 1.135
8	**Sensory**	0.95	0.865 - 1.135
9	**Aphasia**	0.96	0.881 - 1.135
10	**Dysarthria**	0.96	0.880 - 1.135
11	**Extinction**	0.96	0.870 - 1.135
	Overall scores	**ICC**	**95% CI**
		1	1.0 - 1.0

DISCUSSION:

A stroke is a rapidly progressing clinical manifestation of localized (or worldwide) disturbance of brain function with symptoms lasting 24 hours or longer with no apparent underlying cause other than a vascular origin. Conversely, neurological functions display symptoms of dyslexia, dysphasia, altered tone, postural control, muscular weakness, balance issues, and problems with perception and cognition.[5]

The NIHSS is used to assess acute stroke care, plan inpatient care, design rehabilitation programmes, and keep record of patients receiving home care or long-term care.[11]

Translation:

Also, cultural characteristics that could affect a scale's rating are not properly taken into consideration by direct translation. To convert the E-NIHSS into the G-NIHSS, a linguist was hired. Translation consistency was checked by Specialist. The Gujarati version of the NIHSS was then updated by a language expert and a member of the English department. The G-NIHSS was again translated into English. These words points extremely well on the questionnaire's pretest for understanding and acceptance. According to the reliability and validity tests, it was determined that the items in the NIHSS Gujarati version were equivalent to those in the original form.

Reliability and Validity

NIHSS Gujarati version having a Great Content Validity. The visual field defects evaluation item had a CVI of 0.91, while all other items had a CVI of 1. A measure must have a CVI of at least 0.80 to be considered appropriate after being examined by seven experts.[12] Within 7 days following the beginning of symptoms, the GCS scored the patient's overall health and showed a substantial correlation with the baseline G-NIHSS. Additionally, at the 90-day follow-up, the G-NIHSS showed a good to excellent association with the outcome scales (BI). The results of our study show that, in line with the original NIHSS's characteristics, the G-NIHSS not only accurately tested the severity of acute neurological deficit but also accurately forecasts the outcome after 90 days.[13,14]

Only acute stroke patients were enrolled in that study, and the scale has not been used with chronic stroke patients.[12] The interrater reliability was assessed using kappa agreement and intrarater reliability was assessed using the Cronbach's α coefficient. The kappa agreement results among pairs of seven raters found inconsistency among MPT Neuro Physiotherapist, Nurses and Instructor used G-NIHSS to evaluate our ten acute stroke subjects. Our sample was 30 subjects, and the inter-rater agreement of 15 item reached the above level "acceptable" (if k>0.40). We found that the inter-rater reliability is 1. In our study Intra-rater reliability was acceptable 0.96. (if at least 0.80 is adequate for an instrument in mid- stages of development and minimum reliability need to be 0.90 when the scale is used clinically. the Cronbach's α coefficient of 0.96 for the G-NIHSS was considerate reliable. Cronbach's α interpretation is 0.91- 1 Excellent, 0.81-0.90 is good, 0.71-0.80 is good and Acceptable, 0.61-0.70 is acceptable, 0.01-0.60 not acceptable.

In our research study the Cronbach alpha and kappa were within normal limits. These values of the properties in our study suggest the Gujarati version of NIHSS have Excellent reliable and valid. Although the Reliability and validity of G-NIHSS Scale were Excellent but it was comparatively more than the other translated versions like Korean, Hindi,Chinese. We have only received the responses from the Acute Stroke participants only. This translated Gujarati version of NIHSS is acceptable.

In Previous studies like the Polish version, the test-retest shows good reliability and it was significant (ICC 0.90 p<0.001).[15] In this Review of Literature, a valid and reliable tool for evaluating stroke severity in individuals who spoke Polish was created. The aim was on moderate psychometric characteristics without limiting its therapeutic use.

In our Study the Cronbach alpha and kappa were within normal limits. These results of our Study's qualities indicate that the Gujarati version of the NIHSS is extremely reliable and valid. In comparison to other languages, there were several opportunities for reduced dependability and validity. Only the individuals who had acute Strokes responded to uor survey. This NIHSS translation into gujarati is appropriate.

CONCLUSION:

The Gujarati version of (G-NIHSS) was successfully cross- culturally adapted and validated for use in Gujarati speaking populations. The results of the present study indicate that the translated Gujarati version of NIHSS questionnaires are equivalent to its original version, has satisfactory test-retest reliability, and is a valid tool to assess acute Stroke Patients.

LIMITATION:

Our Research has Several Limitation. Initially, within Five Days After the beginning of symptoms, we included Patients with Acute Ischemic Stroke and Hemorrhagic Stroke.

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