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Forward-Backward Translation and Psychometric Testing of Fugl-Meyer Assessment Scale for Igbo Stroke Survivors

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Stroke survivors experience impaired motor function of affected limbs. However, improvements in motor function are possible and important as it helps reduce its negative effects on the activities of daily living, contributing to better quality of life. Fugl-Meyer Assessment (FMA) is a tool for determining impaired motor functions. This has not been translated to Igbo language and so poses some restrictions for most stroke survivors not literate enough. Hence this study was designed to test psychometrically a cross-culturally adapted Fugl-Meyer Assessment for Igbo stroke survivors. A total of 40 participants, involving 20 stroke survivors and 20 age- and sex-matched normal subjects completed an Igbo version of the FMA. The internal consistency and test-retest reliability of the Igbo translated FMA tool were assessed using cronbach-α and Spearman correlation respectively while the construct and criterion-related validities were evaluated using independent t-test and Spearman correlation respectively. Level of significance was set at α = 0.05. The items of the FMA instruments, demonstrated an excellent internal consistency with a Cronbach's alpha of 0.90. The FMA Igbo version had a good test-retest reliability for both the upper extremity (r = 0.636, p = 0.003), and the lower extremity (r = 0.580, p = 0.007). It has an excellent criterion-related validity for both the upper extremity (r = 0.833, p = 0.001), and the lower extremity (r = 0.708, p = 0.001). Finally, it has a excellent construct validity for both the upper extremity (t = 14.497, p < 0.001) and the lower extremity (t = 11.289, p < 0.001). The Igbo version of Fugl-Meyer Assessment Scale (for both upper and lower extremities) is a valid and reliable form of the original English version. This Igbo translated version can therefore be used to assess motor functions in Igbo speaking stroke survivors.

Keywords: Motor Function, Igbo, Fugl-Meyer Assessment Scale, Psychometric Testing, Stroke Survivors.

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INTRODUCTION

Stroke is the leading cause of disability globally (Katan & Luft, 2018). The incidence and global burden of stroke is increasingly particular in low- and middle-income countries (Ekechukwu et al, 2020). Hemiparesis is the most frequent motor sequel after stroke which hampers the ability to undertake, maintain, modify, and control movements of the contralesional side (Barbosa, et al, 2018). Poor motor control, muscle weakness, altered muscle coupling, and co-activation are common motor deficits that often can be more prominent in distal parts of the body particularly when corticospinal, descending and ascending neural pathways are involved in the injury (Sanchez, et al., 2017). Deficit of the upper and lower extremity motor function influence activities of daily living, balance, gait and mobility, which all are identified as top 10 research priorities by the stroke survivors, caregivers, and health professionals (Pollock, et al., 2014).

Assessment of motor function is essential for understanding the mechanisms of motor control and motor learning during patient's rehabilitation (Ekechukwu et al, 2017). Multiple clinical scales are available to determine the functional ability and motor function in individuals with hemiparesis (Sullivan, et al., 2013; Murphy, et al., 2015). Use of standardized and validated scales allows more precise assessment of the degree of impairment and will allow more optimal prediction and evaluation of rehabilitation outcome (Salter, et al., 2005; Kwakkel, et al., 2017). These scales should be robust, easily administered, valid, reliable, and able to capture change over time (Sullivan, et al., 2013; Murphy, et al., 2015).

The Fugl-Meyer Assessment (FMA) developed and introduced in 1975 by Fugl-Meyer et al. (1975) was originally published both in English and Swedish. It was the first quantitative instrument for evaluation of hemiparetic patients. FMA is valid, reliable, responsive, and most widely used standardized clinical scale for evaluation of sensorimotor function after stroke (Sullivan, et al., 2013; Murphy, et al., 2015; Santisteban, et al., 2016). FMA is increasingly being used in research in many countries but most in Canada, Italy, Japan, the Netherlands, and USA (Santisteban, et al., 2016). The original FMA consists of several parts including evaluation of motor function, balance, sensation, passive range of motion, and pain Fugl-Meyer, et al. (1975) but the motor evaluation of upper and lower extremity have been most used (Santisteban, et al., 2016). Several studies have suggested that the FMA can be interpreted in various ways because the original text is long and complex, and therefore, may result in differences in the evaluation depending on interpretation (Sullivan, et al., 2011; See, et al., 2013). This issue becomes more important when the FMA is used in countries that use languages other than English, since confusion may arise with each clinician translating it into their native languages (Tae-lim Kim, et al., 2021).

Cross-cultural adaptation is a process that looks at both translation and cultural adaptation issues in the when preparing a questionnaire for use in another setting (Beaton et al., 2000) that ensures the attainment of semantic, idiomatic, experiential and conceptual equivalence between the source and the target questionnaires. It is the deliberate modification of some features of a questionnaire to better fit a particular target population (Harkness, 2011). Most questionnaires that clinicians use were originally developed in the English language. Cross-cultural adaptation of existing English language questionnaires would enable comparisons of different populations and permit the exchange of information across cultural and linguistic barriers (Maher, et al., 2007). It is inappropriate to simply translate and use a questionnaire in another linguistic context (Wang, et al., 2006; Giersing, et al., 2010). Studies may have a comprehensive linguistic translation process, but this still do not ensure construct validity and reliability (Beaton, et al., 2000; Giersing, et al., 2010).

Multiple studies have translated the FMA into other languages, including Japanese, Spanish, Danish, and Brazilian, followed by verification of validity and reliability (Michaelsen, et al., 2011; Lundquist & Maribo, 2017; Amano, et al., 2018; Barbosa, et al., 2019). However, FMA assessment tool has not been adapted and psychometrically tested for use among Igbo speaking stroke survivors. Igbo is the principal native language of the Igbo people, an ethnic group of south-eastern Nigeria (Marufat, et al., 2020). It is spoken by about 27 million speakers mostly from eastern Nigeria and minority language in Equatorial Guinea (Slattery, 2010; Eberhard, et al., 2019). Non-availability of the Igbo version FMA would have contributed to the limitation in its usage among Igbo stroke survivors. Hence this study aimed to psychometrically test a cross-cultural adapted FMA tool for Igbo speaking stroke survivors.

METHODS

Participants

In total, the study involved 40 participants, 20 community-dwelling stroke survivors u(recruited from tertiary hospitals in Enugu, South-east, Nigeria), and 20 other community-dwelling age- and sex-matched normal individuals as control. Subjects

were only recruited if (i) they have no other neurological condition that could influence reintegration other than stroke, (ii) were able to communicate in English and Igbo languages conveniently and (iii) are community-dwelling adults.

Fugl-Meyer Assessment (FMA) Scale

The original FMA scale is a 226-point multi-item Likert-type scale developed as an evaluative measure of recovery from hemiplegic stroke. It is divided into 5 domains: motor function, sensory function, balance, joint range of motion, and joint pain. Each domain contains multiple items, each scored on a 3-point ordinal scale (0 = cannot perform, 1 = per- forms partially, 2 = performs fully) (Fugl-Meyer, 1975). The motor domain includes items measuring movement, coordination, and reflex action about the shoulder, elbow, forearm, wrist, hand, hip, knee, and ankle. The motor score ranges from 0 (hemiplegia) to a maximum of 100 points (normal motor performance). It is divided into 66 points for the upper extremity and 34 points for the lower extremity. Similarly, there is a maximum of 24 points for sensation, 14 points for sitting and standing balance, 44 points for joint range of motion, and 44 points for joint pain. The FMA scale is best administered by a trained Physiotherapist on a one-to-one basis with the patient. It takes approximately 30 minutes to administer.

Procedure

Ethical approval for this study was sought and obtained from the Health and Research Ethics Committee, University of Nigeria Teaching Hospital, Enugu. Informed consents of all the participants were also duly sought and competently obtained. Forward and back translations were done by two Linguists from the department of Nigeria and African Languages, University of Nigeria Nsukka. The consensus back translation into the original language was done by two independent translators who were blinded to the forward translation.

Data analysis

The data were analyzed using version 20 of the SPSS software suit. Descriptive statistics of frequency and percentages were used to summarise the demographic and clinical variables of the participants. Internal consistency and test-retest reliability were evaluated using Cronbach's alpha coefficient and Spearman's correlation coefficients respectively. Also, Spearman's correlation coefficient and independent t-test were used to establish the criterion-related and construct validities of the Igbo translated version of FMA. The level of significance was set at 0.05.

RESULTS

Characteristics of the subjects

In this study, majority of the participants were male (60%), and between 55 – 69 years (70%). Among the stroke survivors, most of them had ischaemic type of stroke (70%) predominantly on the left sides of their bodies (60%), most of whom had had the condition for 3-4 years (45%) and had received physiotherapy for 4 – 7 months (40%) as shown in table 1.

Test-retest Reliability

The Igbo translated version of the FMA instruments test-retest reliability were established by correlating the scores obtained on two consecutive administrations of the instruments using spearman correlation. There was a strong and significant correlation between the tests of the translated instruments for the upper extremity ($r = 0.636$, $p = 0.003$), as well as for the lower extremity ($r = 0.580$, $p = 0.007$) as shown in table 2.

Criterion-related validity

There was a strong and significant correlation between the English version and the Igbo translated version of the FMA instrument for both the upper extremity ($r = 0.833$, $p = 0.001$), and the lower extremity ($r = 0.708$, $p = 0.001$) as shown in table 3.

Construct validity

The construct validity of the Igbo translated version of the FMA scale was confirmed by comparing between the scores of stroke survivors and their age/sex matched control on the scale. The control participants had a significantly higher scores than those with stroke in both the upper extremity ($t = 14.497$, $p < 0.001$), as well as the lower extremity ($t = 11.289$, $p < 0.001$) as shown in table 4.

DISCUSSION

Stroke survivors commonly experience long-term impairments, including motor and cognitive impairment, activity limitation, and decreased participation in social life (Langhorne, et al., 2009; Hamzat et al, 2014; Okonkwo et al, 2018). Impaired motor function makes it difficult to carry out basic movements and daily tasks in an efficient way (Bernal, 2009; Hamzat and Ekechukwu, 2015). Upper and Lower limb impairment after stroke is commonly assessed by using the Fugl-Meyer Assessment (Ekechukwu et al, 2020). It is often considered as the gold standard and is the only impairment level measure recommended for stroke trials (Kwakkel, et al., 2017). To be clinically useful, a scale must be scientifically sound in terms of 3 basic psychometric properties: reliability, validity, and responsiveness (Wade, 1992; Hobart, et al., 1996; Streiner & Noman, 1995). The FMA upper and lower extremity is well established internationally, clinically feasible and shows excellent reliability, validity and responsiveness (Murphy, et al., 2015; Duncan, et al., 2019). The psychometric properties of a scale are dependent on the language, population, and setting (Edgar et al, 2020), there is a need to assess reliability and validity of the Igbo version of the FMA. Igbo is the major

Table 1: Descriptive Analysis of the clinical and demographic data of participants

Variables	Categories	Frequency	Percentage
SEX	Male	24	60
	Female	16	40
AGE	45-49	6	15
	50-54	2	5
	55-59	10	25
	60-64	10	25
	65-69	8	20
	70-74	4	10
Type of Stroke	Ischaemic	14	70
	Haemorrhagic	6	30
Side of Stroke	Left	12	60
	Right	8	40
Duration of Stroke	≤ 2 years	8	35
	3 -4 years	9	45
	≥ 5 years	1	5
	Unknown	2	10
Duration of PT	≤ 3 months	6	30
	4 – 7 months	8	40
	≥ 8 months	6	30

Table 2: Test-Retest Reliability of the Igbo translated version of FMA (n=40)

Domain	N	Mean (Standard Deviation)		Spearman Correlation Coefficient (p-value)
		Test	Retest	
FMA (Upper Extremity)	20	53.85 (22.19)	58.10 (22.84)	0.636 (0.003)*
FMA (Lower Extremity)	20	36.00 (19.61)	41.00 (18.19)	0.580 (0.007)*

Table 3: Correlation between the Igbo translated version of FMA and the English version

Domain	N	Means (Standard Deviation)		Spearman Correlation Coefficient	p-value
		English Version	Igbo Version		
FMA. (Upper Extremity)	20	53.85 (22.19)	53.85 (22.19)	0.833	< 0.001*
FMA. (Lower Extremity)	20	36.00 (19.61)	36.00 (19.61)	0.708	< 0.001*

Table 4: Comparison between Stroke Survivors and Matched Control Scores of the Igbo FMA Version (N = 40)

Domain	X ± SD		t-value	p-value
	Stroke Survivors (n = 20)	Control (n = 20)		
FMA (Upper Extremity)	53.85 ± 22.19	125.80 ± 0.62	14.497	P < 0.001
FMA (Lower Extremity)	36.00 ± 19.61	85.65 ± 1.57	11.289	P < 0.001

native language of the Igbo people, an ethnic group of south-eastern Nigeria (Marufat, et al., 2020). It is spoken by about 27 million speakers mostly from eastern Nigeria and minority language in Equatorial Guinea (Eberhard, et al., 2019; Slattery, 2010). The primary Igbo States in Nigeria are Anambra, Abia, Ebonyi, Enugu and Imo States.

The findings from this study revealed a male preponderance, consistent with reports of previous studies (Boosman, et al., 2010; Lin et al, 2010; Lin et al, 2011; Akinpelu et al, 2012; Chen et al, 2012). Majority of the stroke survivors were above 54years and this implicates age as an important risk factor of stroke. These findings support the earlier reports that stroke occurs more frequently in middle age (Boosman et al, 2010; Lin, et al., 2010; Chen, et al., 2012; Hamzat et al, 2014; Odetunde, et al., 2017). Although, strokes can occur at any age, its risk increases with age (Smailovic, 2015). Ischaemic type of stroke were reported to be more common than haemorrhagic stroke and this also settles well in alignment with previous studies (Vijaya, et al., 2008; Andersen et al, 2009; Hamzat and Ekechukwu, 2014; Ekechukwu et al, 2017; Nwankwo et al, 2021). In addition, majority of the stroke survivors had left sided affectation, this is in contrast to other studies (Hedna, et al., 2013; Ahmed, et al., 2018), as they reported right sided affectation; the disparity in reports may be due to differences in study design and environment.

The results of the study revealed an excellent internal consistency and test-retest reliability of the Igbo FMA version since there was a strong significant correlation between the scores obtained on the two consecutive administration of the FMA instrument. This indicates that the scale is reliable in presenting stable repeated results. This is in consistency with findings from other studies (Camilla & Thomas, 2016; Hernandez, et al., 2019; Barbosa, et al., 2020; Tae-Lim kim, et al., 2021) and similar with the study carried out by Hseuh, et al., (2018) on the Psychometric Comparisons of 2 versions of the Fugl-Meyer motor scale and two versions of the Stroke Rehabilitation Assessment of Movement..

Furthermore, this study reported an excellent criterion-related validity for the Igbo version of FMA as there was a strong significant correlation between the English version and the Igbo translated version of the FMA. This findings in agreement with the reports of previous studies (Camilla & Maribo, 2016; Barbosa, et al., 2018; Hseuh,et al., 2018; Cecchi, et al., 2020; Tae-lim kim, et al., 2021) for several languages and cohorts.

Finally, the construct validity of the FMA scale was confirmed by comparing the scores of stroke survivors and the control participants. The study revealed that the participants with stroke had significantly lower scores than their age- and sex-matched control. These results therefore imply that the Igbo FMA version has an excellent construct validity and is useful for assessing upper and lower extremity motor function among stroke survivors given. It further establishes that this Igbo version of FMA is able to distinguish motor impairments between stroke from non-stroke individuals. Similar reports for several languages and cohort also exist (Camilla & Maribo, 2016; Lundquist & Marino, 2017; Barbosa, et al., 2018; Hseuh,et al., 2018; Cecchi, et al., 2020; Tae-lim kim, et al., 2021).

CONCLUSION

The Igbo translated FMA version is a reliable and valid tool for assessing motor function among Igbo speaking stroke survivors. This tool is therefore recommended for use among this cohorts for evidence based stroke rehabilitation.

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