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VALIDITY EVIDENCE OF ADAPTED HAUSA VERSION OF 8-ITEM MORISKY MEDICATION ADHERENCE SCALE IN PATIENTS WITH HYPERTENSION IN NORTH-WESTERN NIGERIA

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ABSTRACT
Adherence to antihypertensive medication is the cornerstone for achieving hypertension control. Morisky Medication Adherence Scale (MMAS-8) is one of the most widely used self-reported medication adherence measures. The aim of this study was to examine the evidence of the validity of adapted Hausa MMAS-8 in assessing adherence among hypertensive patients in North-western Nigeria. In a longitudinal interventional study of individuals with hypertension, self-reported adherence to the antihypertensive drug treatment was measured using the Morisky Medication Adherence Scale-8. The internal consistency of the Morisky Medication Adherence Scale-8 with Cronbach's alpha, and factorial validity was assessed by identifying the underlying components using principal component analyses (PCA). A total of 130 individuals completed the study. Cronbach's alpha was 0.79. Two components were identified. One component comprised six items: stopping medication when hypertension is under control, stopping when feeling hassled about sticking to the prescription. The second component comprised two other items that were all related to forgetfulness. A significant relationship between MMAS and diastolic blood pressure control ($t = 2.2$; $p = .030$), ($x^2 = 6.6$; $p = .036$) was found. The MMAS sensitivity and specificity, with positive and negative predictive values were 36%, 77%, 64%, and 52% respectively. The results suggest that the adapted Hausa Morisky Medication Adherence Scale-8 is a two-dimensional scale assessing intentional (first component) and unintentional (second component) non-adherence to the antihypertensive drug treatment. The findings of this validation study indicate that the Hausa version of the MMAS is a reliable and valid measure of medication adherence among hypertensive patients in North-western Nigeria.
Keywords: Adherence; Hypertension; MMAS-8; Validation.

INTRODUCTION

Cardiovascular disease has been considered the leading cause of early disability and death worldwide, and hypertension is the most important preventable risk factor for the development of cardiovascular disease (de Oliveira-Filho *et al.*, 2014; Irazola *et al.*, 2016). Adherence to blood pressure lowering agents has been shown to be the cornerstone for achieving hypertension control, however, in the developing countries, the effective treatment of blood pressure among people taking antihypertensive medication, was below average, particularly due to non-adherence (Abegaz *et al.*, 2017; Irazola *et al.*, 2016; Lloyd-Sherlock *et al.*, 2014; Gwadry-Sridhar *et al.*, 2013). Morisky medication adherence scale (MMAS-8) is one of the most widely used self-reported medication adherence measure, and different language versions have been in use worldwide, including the Hausa version (Bolarinwa *et al.*, 2017; Zongo *et al.*, 2016; Ibrahim *et al.*, 2015; de Oliveira-Filho *et al.*, 2014; Al-Qazaz *et al.*, 2010; Sakthong *et al.*, 2009). The aim of this study was to determine the psychometric properties of adapted Hausa MMAS-8 among hypertensive patients in North-western Nigeria.

MATERIALS AND METHODS

Study setting

The study was conducted at Ahmadu Bello University Teaching Hospital Zaria, North-western Nigeria. The hospital has twenty clinical departments and provides twenty-four hour specialist medical care including stroke and heart conditions. Over 800 hypertensive outpatients were seen every month. Hypertensive patients were recruited from the Medical Outpatient Department during Cardiac Clinics that runs every Monday and Friday. Ethical clearance was obtained from Health Research Ethics Committee of Ahmadu Bello University Teaching Hospital, Zaria.

Participants and study design

This was an interventional longitudinal study conducted between February, 2016 and February, 2017. One hundred and thirty patients who met the inclusion criteria and consented to participate were randomly selected from the patients' waiting area prior to doctors' consultation. To be included in the study patient had to (1) be hypertensive and on medication (at least one drug), (2) be older than 18 years, (3) have active telephone line, (4) sign an informed consent, and be able to speak Hausa. At the start of the intervention, questionnaires were administered by a pharmacist and then administered again at the end of the intervention.

The 8-item MMAS questionnaire

This is a structured questionnaire that consist of 8 items designed to aid the identification of barriers to and behaviors associated with adherence to hypertensive medication (Korb-Savoldelli *et al.,* 2012; Jankowska-Polanska *et al.,* 2016). All questions have dichotomised (yes/no) response except the eighth item, which has 5-point Likert scale. Items 1 through 7 are scored as either '0' or '1' for 'yes' or 'no' response respectively, except for item 5 that has reversed scoring, and item 8 is scored as 1, 0.75, 0.5, 0.25 or 0. Scores obtained are summed up to give total scale score, which range from 0 to 8, with score of 8 reflecting high adherence, 6 < 8 as moderate adherence, and < 6 reflecting low adherence. The adapted Hausa version of the MMAS-8 was originally used to measure adherence among patients with schizophrenia and bipolar disorder in North-eastern Nigeria by Ibrahim *et al.,* (2015).

Data collection

The method for the collection of responses to the Hausa MMAS-8 was interviewer administered at baseline and at the end of the intervention. Patients' socio-demographic characteristics, medications and blood pressure values were extracted from the patients' records.

Data analysis

SPSS software v. 20 was used for the data analysis. Descriptive statistics was used to analyse categorical variables, which are presented in frequencies and percentages. Means and standard deviations were used to describe continuous variables. The *t*- test or Mann Whitney U and ANOVA or Kruskal Wallis H were used for hypotheses testing for two or more groups of parametric and non-parametric data respectively. For the categorical variables chi square tests were used to test the null hypothesis. For the null hypothesis a *P* value ≤ .05 was considered statistically significant. Internal consistency and test–retest reliability were assessed using Cronbach's alpha and intraclass correlation coefficients (ICCs), respectively. The criteria for accepting Cronbach's alpha (≥ 0.70) was based on Nunally and Bernstein criteria (Korb-Savoldell *et al.,* 2012). The criteria for interpretation of ICCs were based on Rosner's criteria (suggesting that ICC < 0.40 = poor agreement, ICC < 0.75 = fair to good agreement, ICC ≥ 0.75 = excellent agreement (Sakthong *et al.,* 2009). Principal component analysis with oblique rotation was used to determine the factorial validity. Scree plot test and parallel analysis were used to determine the number of factors to retain. Items with a loading >.40 on a factor were considered significant for a factor (Field, 2009).

RESULTS

Participant socio-demographic and adherence characteristics

The socio-demographic and adherence characteristics of the participants are presented in Table 1. Of 130 participants, 61% (79) were females. The age range was (20 – 86 years, mean age 53.72±13). The mean, median and mode adherence scores were 6.1±2.1, 7.0 and 8.0 respectively. For the adherence levels, 30.0% (39), 32.3% (42) and 37.7% (49) were low, moderate and high adherence respectively. There was no statistically significant difference in adherence between the socio-demographic categories (*P* >.05). Statistically significant difference in adherence between the categories of hypertension duration and diastolic blood pressure control was found (Table 2).

Reliability of scale score

The internal-consistency reliability coefficient (Cronbach's alpha) for the MMAS was 0.79, which is above the acceptable value of 0.70 (Nunally and Bernstein, 2003); the test-retest reliability over a six weeks interval showed a fair intraclass correlation coefficient (ICC of 0.52 ($p < .001$).

Known-group validity

As shown in Table 2, a significant relationship between the MMAS and diastolic blood pressure control was obtained (t = 2.2; p = .030), (x^2 = 6.6; p = .036). As demonstrated in Table 3, for the SBP control, 0.31, 0.72, 0.56 and 0.47 were the sensitivity, specificity, positive and negative predictive values respectively. This sensitivity means that at baseline 31% of patients who had uncontrolled SBP reported low adherence, while the specificity indicates that 72% of patient who reported low-moderate adherence had controlled SBP. The positive predictive value means that 56% of patients with low adherence were poorly controlled whereas, the negative predictive value means that 47% of patients who were adherent had good control. However, for the DPB, the sensitivity, specificity, positive and negative predictive values were 0.36, 0.77, 0.64, and 0.52 respectively. Thus, the MMAS has shown slightly more sensitivity and specificity for the DBP

Construct validity

A principal component analysis (PCA) was conducted with oblique rotation (Direct Oblimin). The Kaiser-Meyer-Olkin measure of sampling adequacy for the factor analysis was significantly adequate KMO = .75 ('good' according to Field, 2009). Bartlett's test of sphericity x^2 (130) = 402.38, p < .001, indicated that correlations between items were significantly adequate for PCA. Two components had eigenvalues greater than 1 on Kaiser's criterion and in combination explained 58.8% of the total variance. The scree plot was unambiguous and showed inflexion that would justify retaining both components. Factor loadings on the 2 components after rotation are presented in Table 4. The items that cluster on component 1 suggest that it represent patients stopping their medication because of financial constraint and those items that cluster on component 2 suggest that it represent forgetfulness.

Table 1: Patients' Socio-demographic Characteristics and Scores on Adherence

Variable	n (%)	Score			Level				
		Mean ±SD	F/*t*/*U*/$x^2_{(2)}$	*P*	Low	Moderate	High	x^2	*P*
Gender									
Male	51 (39)	6.35 ±1.9	1758.0	.207	12	16	23	2.42	.299
Female	79 (61)	5.90 ±2.2			27	26	26		
Age categories									
≤40	19 (14)	6.00 ±2.5	6.06	.109	6	5	8	11.49	.074
41-60	76 (60)	5.78 ±2.5			28	25	23		
61-80	31 (23)	6.71 ±1.8			4	12	15		
>80	4 (3)	7.25 ±1.5			1	0	3		
Religion									
Muslim	107 (82)	6.13 ±2.2	1069.5	.311	31	33	43	1.61	.446
Christian	23 (18)	5.83 ±1.9			8	9	6		
Marital status									
Married	118 (91)	6.05 ±2.1	1.57	.665	36	39	43	4.66	.588
Single	1 (1)	8.00			0	0	1		
Divorced	3 (2)	6.00 ±3.5			1	0	2		
Widowed	8 (6)	6.25 ± 2.4			2	3	3		
Educational level									
No formal education	57 (44)	6.07 ±2.1	1.36	.715	18	18	21	2.89	.821
Primary	27 (21)	6.48 ±2.0			5	11	11		
Secondary	13 (10)	5.85 ±2.4			5	3	5		
Tertiary	33 (25)	5.85 ±2.2			11	10	12		

F = ANOVA, *t* = Students't, *U* = Mann Whitney U, $x^2_{(2)}$ = Kruskal Wallis H, x^2 = Chi square, p = significance level ≤ .05, SD = Standard Deviation, Low = < 6, Moderate = 6 – 7, High = 8

Table 2: Patients' Scores on Adherence, Hypertension Duration, and Blood Pressure Control

Variable	n (%)	Score			Level				
		Mean ±SD	F/*t*/*U*/$x^2_{(2)}$	*P*	Low	Moderate	High	x^2	*P*
Hypertension duration (year)									
< 5	39 (30)	6.82 ±1.6	13.54	.095	5	16	18	30.77	.014*
5 – 9	14 (11)	5.57 ±2.7			6	1	7		
10 – 14	48 (37)	5.77 ±2.4			17	13	18		
15 – 19	11 (8)	5.45 ±2.0			5	4	2		
20 – 24	4 (3)	4.75 ±1.3			3	1	0		
25 – 29	6 (5)	6.33 ±2.2			1	4	1		
30 – 34	4 (3)	5.25 ±1.7			2	2	0		
35 – 39	1 (1)	8.00			0	0	1		
> 39	3 (2)	7.67 ±0.6			0	1	2		
SBP (mmHg)									
Controlled	60 (45)	6.37 ±2.0	1735.5	.083	17	15	27	3.50	.174
Uncontrolled	70 (55)	5.83 ±2.2			22	27	22		
DBP (mmHg)									
Controlled	61 (47)	6.51 ±2.0	2.19	.030*	14	17	30	6.63	.036*
Uncontrolled	69 (53)	5.70 ±2.1			25	25	19		

SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure, F = ANOVA, *t* = Students't,*U* = Mann Whiteney U, $x^2_{(2)}$ = Kruskall Wallis H, x^2 = Chi square, *p* = significance level ≤ .05, * = Statistically Significant, SD = Standard Deviation, Low = < 6, Moderate = 6 – 7, High = 8

Table 3: Difference in Adherence and Associations with Blood Pressure Control

Adherence	SBP (mmHg)				DBP (mmHg)			
	Controlled (%)		Uncontrolled (%)		Controlled (%)		Uncontrolled (%)	
	Baseline	Post-intv.	Baseline	Post-intv.	Baseline	Post-intv.	Baseline	Post-intv.
Low	17 (28)	13 (13)	22 (31)	3 (10)	14 (23)	9 (11)	25 (36)	7 (15)
Moderate	16 (27)	20 (20)	26 (38)	8 (26)	17 (28)	16 (19)	25 (36)	12 (26)
High	27 (45)	66 (67)	22 (31)	20 (65)	30 (49)	58 (70)	19 (28)	28 (60)
Total (%)	60 (46)	99 (76)	70 (54)	31 (24)	61 (47)	83 (64)	69 (53)	47 (36)

Low = score < 6; moderate = score 6 to < 8; high = 8; SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure; (Notes; DBP pretest: x^2 = 6.6, df = 2, *p* = .036)

Table 4: Summary of Exploratory Factor Analysis Results

Item	Rotated factor loadings			
	Intentional		Unintentional	
	Pattern	Structure	Pattern	Structure
Do you sometimes forget to take your high blood pressure pills?	.26	**.48**	**.69**	**.73**
Over the past 2 weeks, were there any days when you did not take your high blood pressure pills?	**.42**	**.54**	.38	**.51**
Have you ever cut back or stopped taking your medication without telling your doctor?	**.75**	**.72**	-.08	.15
When you travel or leave home, do you sometimes forget to bring along your high blood pressure medication?	-.14	.13	**.87**	**.83**
Did you take your high blood pressure medication yesterday?	**.67**	**.61**	-.21	.01
When you feel your blood pressure is under control, do you sometimes stop taking your medication?	**.63**	**.69**	.16	.36
Taking medication every day is real inconvenience for some people, do you ever feel hassled about sticking to your high blood pressure treatment plan	**.73**	**.76**	.10	.33
How often do you have difficulty remembering to take all your blood pressure medication?	**.75**	**.88**	.39	**.63**
Eigenvalues	3.65		1.05	
% of variance	45.58		13.17	

Factor loading >.40 appear in bold.

DISCUSSION

The main objective of this study was to examine the reliability and validity of the adapted translated Hausa version of the MMAS-8 in hypertensive Hausa natives of north-western Nigeria. This study showed that the translated Hausa MMAS-8 was two-dimensional, with good internal consistency reliability (Cronbach's alpha = 0.79, which is > 0.70), fairly reproducible (ICC = 0.52) and significantly associated with blood pressure control. The original MMAS-8 scale was tested by Morisky *et al.,* (2008) on a sample of hypertensive patients, and was found to be one-dimensional with good reliability, predictive validity and sensitivity (Cronbach's alpha = 0.83), and was significantly associated with blood pressure control (P < .05) (Jankowska-Polanska *et al.,* 2016). Similarly, the Polish version of the MMAS-8 that was validated among hypertensive subjects was reported to have good reliability coefficient (0.81), and was two-dimensional, with the two components explaining 59.9% of the total variance. These values were slightly above values obtained in this study, but consistently, the Polish version and the Hausa version had similar important components. Also, Ibrahim *et al.,* (2015) has reported that the Hausa version of the MMAS-8 showed good reliability coefficient (0.71) among patients with schizophrenia and bipolar disorder. However, the construct validity of the original Hausa version of the MMAS-8 scale was not reported. Other foreign versions of the MMAS-8 have been reported to have lower reliability coefficient compared to the Hausa version. Reliability coefficient of 0.68, 0.54, 0.68, 0.69, 0.61 and 0.70 have been reported for the Brazilian-Portuguese, French, Malasian, Persian, Thai and Urdu versions respectively.

For the known group validity, there was significant association between MMAS-8 and diastolic blood pressure control (x^2 = 6.6; p = .036). The sensitivity and specificity of the scale for both systolic and diastolic BP was comparable, however, the scale showed a poor sensitivity (SBP = 31%; DBP = 36%), a specificity (SBP = 72%; DBP = 77%), meaning that the scale was weak in detecting non-adherence. Morisky *et al.*, (2008) showed that the original MMAS-8 had a sensitivity of 93% and a specificity of 53%, meaning that the translated Hausa version had higher specificity but lower sensitivity than the original MMAS-8. The decreased sensitivity of the Hausa MMAS-8 may have been due to self-presentational and recall biases, and the study participants may have answered untruthfully that they adhered to their antihypertensive medications, although they did not. Although patients' self-reported adherence is the most common method of assessment used in psychological research, it is subject to self-presentational and recall biases. Patients may overestimate the extent of their adherence in an attempt to please the assessor or if they believe that admitting to non-adherence may result in adverse judgments or penalties. Moreover, patients' recall may be inaccurate.

Thus, because reports of non-adherence may be more accurate than reports of adherence, self-report tends to underestimate the true extent of non-adherence by approximately 20%. In contrast, self-report offers a convenient, "spot check" estimate of adherence behavior (Sakthong *et al.,* 2009; Horne and Weinman, 1999). When the cut-off score for non-adherence was raised (non-adherence = MMAS scores ≤ 7), the sensitivity was increased to 69% and 72% for SBP and DBP respectively but the specificity decreased to 45% and 49% respectively. This indicated that the higher the sensitivity the lower the specificity and that the higher sensitivity had to be trade off against lower specificity. In clinical practice, healthcare providers are more interested in identifying patients who are uncontrolled and non-adherent than controlled and adherent patients; therefore, increasing the cut-off score of the scale can be a good option for solving its low sensitivity problem (Sakthong *et al.,* 2009).

The results of the principal component analyses showed that the adapted Hausa MMAS-8 has two latent traits; the intentional and unintentional non-adherence. Non-adherence has been described to be either intentional or unintentional and the scale could be measuring those two components (Horne *et al.*, 2005). Thus, all of the items that load on the first factor's pattern and structure can be classified as causes of intentional non-adherence while the remaining two items that load on the second factor (pattern and structure) are all related to forgetfulness, which is a cause of unintentional non-adherence. This finding is consistent with that of Zongo *et al.,* (2016), who reported that an adapted French MMAS-8 was a two component scale, although the adapted French version was used among type 2 diabetic patients. The loading of six items (except cross-loadings) on the intentional non-adherence component of the Hausa MMAS-8 may be a clear indication of presence of practical barriers especially cost of medication to the participants' adherence. The result of our principal component analysis is inconsistent with that of the original MMAS-8 which has only one underlying component. The difference could be due to differences in the factor extraction methods used and/or in the methods used to retain the number of factors. However, in the original validity study, those methods were not reported (Zongo *et al.,* 2016).

CONCLUSION

Reliability coefficient of the adapted Hausa MMAS-8 was higher than the acceptable value of 0.70. The Hausa MMAS-8 comprised two dimensions. One dimension was composed is of items related to intentional non-adherence, and the other dimension comprised items that measure unintentional non-adherence. Consequently, this study suggest that the Hausa MMAS-8 can help identify both intentional and unintentional non-adherence to antihypertensive drug therapy, and may therefore be beneficial for directing appropriate interventional strategies to improve adherence. Given the importance of accurately detecting medication non-adherence in clinical practice, future research should look at ways to improve this process. For example, studying the psychometric properties of other translated scales like the medication adherence rating scale (MARS) in order to identify the most reliable scale for our hypertensive patient population would be valuable.

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