Exploratory Research in Clinical and Social Pharmacy 16 (2024) 100502

Contents lists available at ScienceDirect

Exploratory Research in Clinical and Social Pharmacy

journal homepage: www.elsevier.com/locate/rcsop

Translation, transcultural adaptation, and validation of the Brazilian Portuguese version of the general medication adherence scale (GMAS) in patients with high blood pressure

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ARTICLE INFO

Keywords:
Medication adherence
Anti-hypertensives
Hypertension
Validation
Non-adherence
Arterial pressure
Psychometric properties
Behavior rating scale

ABSTRACT

Objective: To validate the General Medication Adherence Scale (GMAS) in Brazilian Portuguese for hypertensive patients.

Methods: The GMAS-English was translated into Brazilian Portuguese and adapted for cultural appropriateness by a translation process and expert panel. A cross-sectional study was conducted in northeast Brazilian cardiology divisions of public and private hospitals, interviewing hypertensive patients. Reliability was assessed using Cronbach's alpha, intraclass correlation, and Pearson's correlation. Convergent validity was tested against the BMQ using chi-square. Criterion validity was assessed by comparing GMAS with blood pressure control using chi-square.

Results: The GMAS was translated and adapted according to standard procedures. In a validation study with 167 hypertensive patients, Cronbach's alpha was 0.79, and Pearson's correlation showed significant test-retest reliability ($p < 0.001$). Convergent validity with BMQ was significant ($p < 0.001$), with 89.4 % sensitivity for behaviors considered adherent (High adherence and good adherence), but between the strata that measure low adherence (Partial adherence, low adherence and very low adherence), the specificity rate was 50 %. Criterion validity between GMAS and blood pressure control was not observed.

Conclusion: The Brazilian Portuguese version of the GMAS exhibited good consistency and reproducibility, modest agreement with BMQ scale and did not demonstrate acceptable criterion validity for hypertensive patients.

1. Introduction

Diseases of the cardiovascular system significantly contribute to global morbidity and mortality.[1] Changes in blood pressure represent a well-established cardiovascular risk factor, with hypertension being the most prevalent cardiovascular disease worldwide.[2] Although behavioral therapies aimed at adopting a healthy lifestyle serve as an initial therapeutic approach, drug therapy becomes essential in most cases.[3] The primary objective of drug therapy is to control blood pressure. In this context, adherence to treatment emerges as a crucial factor for treatment effectiveness.[4,5]

Adherence to hypertension treatment in clinical practice can be evaluated through both direct and indirect methods.[6–9] While various approaches exist, no single method is universally recognized as the gold standard.[10–13]

The most frequently employed method in clinical practice involves the use of structured self-reporting scales. This preference is mainly attributed to their advantages, including low cost, rapid completion, applicability in diverse environments, and the ability to identify factors contributing to non-adherence.[14,15] However, despite the widespread use of several scales in recent decades, they come with limitations such as a lack of precision, overestimation of adherence, licensing costs,

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https://doi.org/10.1016/j.rcsop.2024.100502
Received 19 June 2024; Received in revised form 22 August 2024; Accepted 4 September 2024
Available online 5 September 2024

complexity, and reliance on yes/no responses that do not distinguish between patients who are highly or partially adherent to a specific clinical condition.[16]

Recent scales, such as the General Medication Adherence Scale (GMAS), have been specifically designed to overcome these recognized limitations, offering practical advantages in both clinical and scientific settings.[7,17]

Naqvi et al.[17] developed the GMAS, which has undergone thorough testing and validation in several languages, including by Naqvi et al.,[18] Naqvi et al.,[19] Nguyen et al.,[20] Y. Wang et al.,[21] and Shrestha et al.[22]

This study aims to validate the GMAS for Brazilian Portuguese for hypertensive patients.

2. Methods

This is a two-stage validation study. The first stage involved the translation and transcultural adaptation of the English version of the GMAS developed by Naqvi et al.[18] following directives and regulations for the translation and transcultural adaptation of self-reporting scales.[23–25] In the second stage, a cross-sectional study was conducted in the cardiology divisions of public and private hospitals in northeast Brazil, to validate the instrument.

2.1. Translation process and specialist panel

2.1.1. Instrument: GMAS

The GMAS was initially developed by Naqvi et al. in the Urdu language to assess adherence to therapy in patients with chronic diseases; it was later translated and validated for English (Naqvi et al.[18]) by these same authors. The GMAS scale is composed of 11 questions divided into three constructs: non-adherence due to the patient's behavior, containing five questions; non-adherence due to additional disease and pill burden, with four questions; and cost-related non-adherence, with two questions. The responses are presented on a Likert scale ranging from "always" to "mostly," "sometimes," and "never."

2.1.2. Translation and transcultural adaptation of the GMAS

The GMAS was translated into Brazilian Portuguese according to the guidelines by Beaton et al.[23–25] First, the English version of the GMAS (Naqvi et al.[18]) was translated into Brazilian Portuguese in a blinded manner by two specialists in the area who are proficient in English. The two versions were analyzed and compared by a specialist panel to identify linguistic and conceptual variations and technical equivalency, inconsistencies, and disagreements. After this step, a consolidate version of the GMAS in Portuguese was created.

This Portuguese version was sent separately to two independent translators for backtranslation. Inconsistencies and disagreements in the two backtranslated versions were resolved by consensus of the specialist panel. A pre-final version of the instrument was then drafted by the panel and sent to the research team for validation.

The translated version was tested in a group of thirty patients with high blood pressure to verify that the questions were understood as originally intended. The questions were understood identically by all the participants, and no subsequent changes were considered necessary, with no complications in the backtranslation process. The stages in this process are depicted in (Fig. 1).

2.2. Psychometric validation of the GMAS

2.2.1. Study design and population

The cross-sectional study included hypertensive patients aged 18 and older who were receiving medication and were under the care of a cardiologist in an outpatient clinic. Exclusions comprised patients with cognitive impairment, those requiring a caregiver, individuals with secondary hypertension, individuals undergoing cancer treatment, and those with depression and other mental diseases.

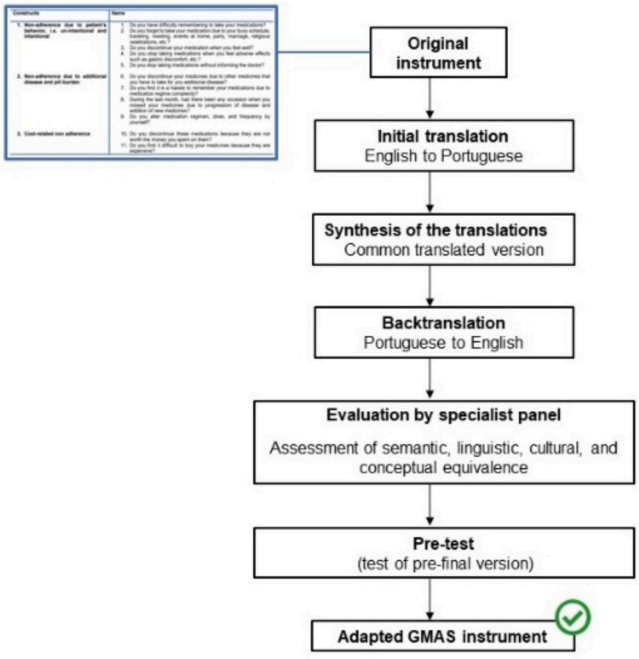

Fig. 1. Stages in translation and transcultural adaptation of the GMAS scale, Maceió, 2023.

2.2.2. Sample size and selection

Considering the original study by Naqvi et al., the sample size was calculated using item response theory. Dowrick et al.[26] and Osborne and Costello.[27] suggested an item-response ratio ranging from 1: 5 to 1:10. To ensure more robust results, we opted for the more conservative method and considered a 1:10 ratio, which required a minimum sample size of 110 participants since the GMAS contains 11 items.[17,26–28]

The selection of patients was conducted through a random draw from a list provided by the cardiology departments of the hospitals where the research was carried out. Patients were randomly selected from this list, referred by their cardiologists, and then forwarded to the research team.

2.3. Data collection

The interviews were conducted after the medical consultations in the same outpatient clinic, in a designated room to ensure privacy and confidentiality.

Initially, the patients were invited to participate in the study, and written informed consent was obtained. Data collection included: (i) semi-structured interviews guided by standardized forms, covering sociodemographic information, lifestyle, medication use, and medication adherence, assessed using the GMAS scale translated into Brazilian Portuguese and the Brief Medication Questionnaire (BMQ); (ii) blood pressure measurements taken by the research team in accordance with the International Society of Hypertension Global Hypertension Practice Guidelines (Unger et al.[29]); and (iii) anthropometric measurements, including weight, height, and waist circumference.

In addition to the interviews, information was extracted from current medical prescriptions and records to obtain data on comorbidities and blood pressure readings from the past three months.

At the conclusion of the initial phase, each patient was informed of the return date for ambulatory blood pressure monitoring (ABPM), which was scheduled within 15 days of the initial interview. During this follow-up visit, the GMAS scale was reapplied to gather test-retest reliability data.

2.4. Psychometric analysis

The GMAS was assessed for reliability and validity, with internal consistency demonstrated using Cronbach's alpha coefficient. Test-retest reliability was evaluated by correlating the adherence scores of participants at baseline and follow-up, using the same method employed by Naqvi et al.[17,18] during the validation of the original scale.

Content validity was established based on the specialist panel's assessment scores and their evaluation of the equivalence between the translated versions and the original GMAS.

Convergent validity was determined by comparing the results of the GMAS with those of the BMQ.[30] The Beliefs about Medicines Questionnaire (BMQ-Specific) was used for convergent validity because it has proven effective in assessing patients' beliefs and their association with non-adherence to treatment across various disease groups. A validated Portuguese version of this instrument, freely accessible, is available and has demonstrated good sensitivity and specificity for measuring adherence in patients with hypertension.[31,32]

Criterion validity was assessed by comparing GMAS adherence scores to blood pressure control rates. The Controlled blood pressure was defined as values below 140/90 mmHg, based on parameters established by both international[29] and national[33] guidelines. As a measure to reduce the white coat effect, we additionally used the 24-h mean arterial pressure (MAP) derived from the ambulatory blood pressure monitoring (ABPM) exam.

2.5. Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows (SPSS Inc.; Chicago, USA). Descriptive analyses, including mean, standard deviation, minimum and maximum values, confidence interval, and median, were employed for continuous variables, while frequency distribution was used for categorical variables. Reliability and reproducibility were assessed through corrected item/total correlation, Cronbach's alpha (α), and the Pearson correlation coefficient.

Convergent validity was evaluated using the chi-squared test to analyze the relationship between the GMAS and BMQ. Criterion validity was determined by comparing the frequency of controlled high blood pressure (HBP) among different levels of adherence to the GMAS scale via the chi-square test.

To assess the relationship between mean systolic and diastolic blood pressure values (SBP and DBP, respectively) and the GMAS, ANOVA were employed. Normality analysis, using the Shapiro-Wilk test, preceded these analyses. The significance level for statistical tests was set at ≤ 0.05.

2.6. Ethical aspects

This study followed the recommendations of Brazilian National Health Council Resolution 466 of 2012 on research involving humans and was approved by our institution's research ethics committee (CAAE process 47,130,221.3.0000.5013). Only individuals who gave their informed consent prior to data collection participated in the study.

3. Results

3.1. Characteristics of the sample

The sample included 167 hypertensive patients, the majority of whom were women (68.9 %), with a mean age of 59.1 ± 11.2 years. Most participants reported having completed high school (34.1 %) and had a mean income of US$ 230,00.[1] Regarding occupation, nearly half of the participants were retired (49.1 %).

Most patients were overweight or obese[2] (87.4 %) and had another chronic comorbidity (72.5 %). Notably, the female group showed a higher prevalence of an inappropriate waist–hip ratio (70.4 %). Regarding health access, 62.9 % of the patients received treatment from the Brazilian National Health System (SUS). The characteristics of the study population are presented in (Table 2).

For clinical characteristics related to HBP and its treatment, only 67 (40.1 %) patients had controlled blood pressure. The mean blood pressure values for the patients were SBP = 137.3, SD ± 18.6 mmHg and DBP = 80.9, SD ± 11.1 mmHg. The patients were taking an average of 2.1, SD ± 1.0 medications, and 60.5 % of patients were on a monotherapy or dual therapy regimen, while 39.5 % were taking three medications or more.

3.2. Translation and transcultural adaptation of the GMAS into Brazilian Portuguese

After translation and transcultural adaptation, a high level of equivalence was achieved between the pre-final and English versions. A specialist panel determined that the Brazilian version of the GMAS was highly equivalent to the English version based on four criteria: semantic, linguistic, experiential, and conceptual equivalence. The constructs and their items are presented in (Table 1).

3.3. Description of adherence according to GMAS in the sample

In this study, greater frequency of adherent behavior was obtained for both the overall classification as well as the domains (overall GMAS: 93.3 %; GMAS1: 85.8 %; GMAS2: 95.8 %; GMAS3: 76.5 % for patients with high or good adherence) (Table 2).

Table 1
Brazilian Portuguese Version of the *General Medication Adherence Scale (GMAS)*.

Construct	Items
1.Não-adesão devido ao comportamento do paciente	1.Você tem dificuldade de lembrar de tomar seus medicamentos? 2.Você esquece de tomar seu medicamento por causa de compromissos na sua agenda, viagens, reuniões, eventos, festas, casamento, celebrações religiosas etc.? 3. Você descontinua seu tratamento quando se sente bem? 4.Você para de tomar seus medicamentos quando sente efeitos adversos como desconforto gástrico etc.? 5.Você para de tomar seus medicamentos sem informar seu médico?
2.Não-adesão devido a doença adicional ou à sobrecarga do tratamento	6.Você descontinua seus medicamentos por causa de outros medicamentos que tem que tomar para outras doenças? 7.Para você, é um problema lembrar de tomar seus medicamentos por causa da complexidade da posologia? 8.Durante o último mês, houve alguma ocasião em que você deixou de tomar seus medicamentos devido à progressão da doença e inclusão de novos medicamentos? 9.Você altera a horários, dose ou frequência dos seus medicamentos por conta própria?
3.Não-adesão relacionada ao custo do tratamento	10.Você às vezes, descontinua esses medicamentos porque acha que não vale a pena gastar com eles? 11.Você acha difícil comprar seus medicamentos por causa do preço?

[1] This value represents 1 minimum wage equivalent for the year 2022.

[2] BMI greater than or equal to 30 kg/m2

Table 2
Sociodemographic and clinical profile of patients with high blood pressure, Maceió, Brazil, 2023.

Variable	Freq. (%)
Sociodemographic data	
Self-reported Gender	
- Male	52 (31.1 %)
- Female	115 (68.9 %)
Age range	
18–29	1 (0.6 %)
30–39	8 (4.8 %)
40–49	22 (13.2 %)
50–59	47 (28.1 %)
60+	89 (53.3 %)
Self-reported Race	
- White	31 (18.6 %)
- Black	38 (22.8 %)
- Asian	5 (3.0 %)
- Mixed race of African descent	90 (53.9 %)
- Indigenous	3 (1.8 %)
Education	
- Illiterate	31 (18.5 %)
- Elementary	33 (19.8 %)
- Middle School	9 (5.4 %)
- High school	57 (34.1 %)
- College	29 (17.3 %)
- No response	8 (4.9 %)
Occupation	
- Employed	43 (25.7 %)
- Unemployed	22 (13.2 %)
- Retired	82 (49.1 %)
- Self-employed	18 (10.7 %)
- No response	2 (1.3 %)
Type of access to healthcare	
- Public (SUS)	105 (68.9 %)
- Private	62 (37.1 %)
Clinical profile	
Nutritional status (BMI kg/m^2)	
- Eutrophy	21 (12.6 %)
- Overweight	66 (39.5 %)
- Obese Type 1	45 (26.9 %)
- Obese Type 2	18 (10.8 %)
- Obese Type 3	17 (10.2 %)
Waist-hip ratio (WHR): male	
- Low risk	30 (81.1 %)
- Moderate risk	6 (16.2 %)
- High risk	1 (2.7 %)
WHR: female	
- Low risk	14 (13.0 %)
- Moderate risk	18 (17.5 %)
- High risk	76 (70.4 %)
Other chronic disease	
- Yes	121 (72.5 %)
- No	46 (27.5 %)
Blood pressure*	
- Controlled	67 (40.1 %)
- Not controlled	100 (59.9 %)
Adherence	
GMAS	
High adherence	113 (67.7 %)

(*continued on next page*)

Table 2 (*continued*)

Variable	Freq. (%)
Good adherence	46 (25.6 %)
Partial adherence	5 (3 %)
Low adherence	2 (1.2 %)
Poor adherence	1 (0.6 %)
GMAS 1 (Behavior)	
High adherence	126 (75 %)
Good adherence	18 (10.8 %)
Partial adherence	16 (9.6 %)
Low adherence	4 (2.4 %)
Poor adherence	3 (1.8 %)
GMAS 2 (Pill burden)	
High adherence	140 (83.8 %)
Good adherence	20 (12.0 %)
Partial adherence	6 (3.6 %)
Low adherence	1 (0.6 %)
Poor adherence	–
GMAS 3 (Cost)	
High adherence	101 (60.8 %)
Good adherence	26 (15.6 %)
Partial adherence	36 (21.6 %)
Low adherence	2 (1.2 %)
Poor adherence	2 (1.2 %)

3.4. Psychometric validation of the GMAS

3.4.1. Internal consistency and reliability

Cronbach's alpha coefficient for internal consistency for the entire scale was 0.79. When each domain was considered separately, a value of 0.711 was obtained for non-adherence due to patient behavior, 0.365 for non-adherence due to additional disease and pill burden, and 0.207 for cost-related non-adherence. The corrected item/total correlation for each question was superior to 0.3 (Table 3).

Test-retest reliability was assessed using the same parameters as adopted by Naqvi et al.,[17,18] correlating the adherence scores of participants at baseline and, at follow-up. The Pearson's correlation coefficient for test-retest reliability was 0.761 ($p < 0.01$). For each individual question, this value did not exceed 0.540 ($p < 0.001$) (Table 4).

3.4.2. Convergent validity

Convergent validity between the GMAS and the BMQ was significant ($p < 0.001$), showed a sensitivity rate of 89.4 % regarding the strata that measure behaviors considered adherent (High adherence and good adherence), but between the strata that measure low adherence (Partial adherence, low adherence and very low adherence), the specificity rate was 50 % (Table 5).

The items cluster into factors based on intentionality or unintentional non-adherence, and the additional burden of illness and costs appear to have less impact than expected. This result is interesting because despite being a negative result, the first since the publication of the original scale, the research was conducted within the correct parameters for this study design.

3.4.3. Criterion validity

To assess criterion validity, we examined the relationship between GMAS adherence scores and blood pressure control rate, with mean SBP and DBP values as secondary outcomes. There were no significant differences in blood pressure control rate or mean SBP and DBP values between adherent and non-adherent patients (Table 6).

Even after analysis adjusted by the therapeutic regimen (considering the use of monotherapy and dual therapy or triple therapy or higher), and presence of comorbidities (patient with or without comorbidity), no significant relationship was observed between these clinical outcomes

Table 3
Internal consistency of the GMAS scale applied to patients with HBP, Maceió, Brazil, 2023.

Domain	Item	Item-total correlation	(α) if item is excluded	(α) of the scale	Intraclass correlation coefficient	CI (95 %)
GMAS 1	1	0.627	0.713			
(Behavior)	2	0.570	0.724			
	3	0.414	0.747		0.7111	0.63–0.77
	4	0.408	0.747			
	5	0.534	0.731			
GMAS 2	6	0.359	0.763			
(Pill burden)	7	0.396	0.748			
	8	0.378	0.754	0.797	0.365	0.19–0.50
	9	0.463	0.740			
GMAS 3	10	0.453	0.754			
(Cost)	11	0.331	0.779		0.207	0.03–0.26
GMAS Total	11					

Table 4
Reproducibility of the GMAS, considering two applications of the GMAS scale with a 15-day interval in patients with HBP, Maceió, Brazil.

Item	Correlation coefficient	p*
1	0.663	<0.001
2	0.547	<0.001
3	0.677	<0.001
4	0.523	<0.001
5	0.677	<0.001
6	1	<0.001
7	0.577	<0.001
8	0.710	<0.001
9	0.543	<0.001
10	0.713	<0.001
11	0.851	<0.001

* Pearson's correlation coefficient.

Table 5
Convergent validity between the overall GMAS and Brief Medication Questionnaire (BMQ) between patients with HBP, Maceió, Brazil, 2023.

		BMQ		
		Adherent N (%)	Non-adherent N (%)	p*
GMAS	High adherence	70 (76.9 %)	10 (31.3 %)	0.000
	Good adherence	13 (14.3 %)	14 (43.8 %)	
	Partial adherence	6 (6.6 %)	7 (21.9 %)	
	Low adherence	2 (2.2 %)	0 (0 %)	
	Very low adherence	0 (0 %)	1 (3.1 %)	

* Chi-square test.

and the degree of adherence measured by the GMAS.

4. Discussion

The English version of the GMAS was translated and transculturally adapted to create the Brazilian Portuguese version of this scale. Regarding the psychometric properties, the reliability, measured by Cronbach's alpha coefficient (0.79), is comparable to that reported in other studies on the translation and validation of adherence scales.[18–20,22,38] These studies reported Cronbach's alpha values ranging from 0.725 (Naqvi, Mahmoud, et al.[19]) to 0.879 (Nguyen et al.[20]).

A strong, significant positive correlation was found for test-retest reliability at the two times the scale was applied, demonstrating that the Brazilian version exhibits good reproducibility.[38,39]

The findings indicate an issue with the convergent validity between the GMAS and BMQ, particularly in their ability to identify non-adherent behavior. However, we note that the GMAS identified a higher proportion of patients with adherent behavior compared to validation studies conducted on similar populations,[35–37,40] which raises the hypothesis that this instrument exhibits false positive results about adherent behavior; this would hinder its ability to identify non-adherent behavior and would explain the gap in comparison to the BMQ for this aspect.

Regarding the cutoff points established by Naqvi et al.[17] for classifying adherent behavior, we attempted to test points that offered a better balance between sensitivity and specificity using an ROC curve, but we were unable to identify cutoffs that would significantly alter the observed outcomes.

This indicates that there is a tendency toward positive responses in terms of adherence, with a high concentration (over 95 %) of respondents whose adherence was classified as good or high. This trend of more frequent adherent behavior diverges from previous studies that used other instruments to measure adherence who were conducted on similar populations.[34–36] Besides questions about whether the instrument itself could be influencing the positive responses by patients, we also must consider that the sample was composed of patients with a greater frequency (81.3 %) of monotherapy or dual drug therapy, reducing the complexity of treatment for this group. Likewise, they used similar pharmaceutical therapies and faced a lower cost barrier due to free universal access to medication through the Brazilian public health system.

Health professionals in Pakistan, where other studies have been conducted, consider cost a potential barrier, since patients with lower socio-economic levels have difficulty paying for treatment. Within this context, cost-related non-adherence is an important determinant of overall medication adherence in Pakistani patients.[41–43]

In the Brazilian version of the scale, we opted to validate the instrument for patients with HBP; this required us to validate the criterion, and we decided to assess the relationship between adherence measured by the GMAS and blood pressure control measured by the ABPM test. However, we were unable to identify a significant relationship between the levels of adherence measured by the GMAS and the rate of blood pressure control, nor were significant variations seen in mean SBP and DBP values in the different strata of the GMAS and its domains (Table 6) Even with analysis adjusted for number of medications and presence of comorbidities, the result remains the same.

4.1. Study limitations

Reproducibility may be compromised, considering that adherence in the same individual can vary over time. We acknowledge this limitation and aim to mitigate it by adhering to the same criteria used in the validation of the original scale by Naqvi et al.[17,18] which involves respecting a 14-day period between the application of the two questionnaires.

5. Conclusion

The General Medication Adherence Scale (GMAS) was translated into Brazilian Portuguese and validated for patients with high blood pressure (HBP). The validation process for the GMAS-Brazilian

Table 6
Criterion validity: relationship between overall GMAS and its domains and control rate for blood pressure, and mean systolic and diastolic blood pressure values in patients with high blood pressure, Maceió, Brazil, 2023.

GMAS Scale	CONTROLLED HBP YES	NO	p[a]	SBP Med (SD)	p[b]	DBP Med (SD)	p[b]
GMAS							
High adherence	45 (40.2 %)	67 (59.8 %)		125.0 (14.4)		76.2 (10.2)	
Good adherence	13 (41.9 %)	18 (58.1 %)		123.7 (14.6)		74.6 (8.2)	
Partial adherence	9 (45.0 %)	11 (55.0 %)		126.0 (1.4)		79.0 (4.2)	
Low adherence	–	2 (100 %)	0.691	125.0 (0.0)	0.984	77.5 (3.5)	0.586
Poor adherence	–	1 (100 %)		130.0 (0.0)		89.0 (0.0)	
GMAS 1							
High adherence	49 (39.2 %)	76 (60.8 %)		125.2 (15.4)		76.0 (10.3)	
Good adherence	8 (44.4 %)	10 (55.6 %)		120.0 (8.0)		70.7 (5.8)	
Partial adherence	9 (56.3 %)	7 (43.8 %)		125.5 (12.1)		78.3 (6.1)	
Low adherence	1 (25 %)	3 (75 %)	0.368	126.0 (1.4)	0.779	79.0 (4.2)	0.178
Poor adherence	–	3 (100 %)		126.8 (2.8)		81.3 (7.0)	
GMAS 2							
High adherence	57 (41.0 %)	82 (59.0 %)		124.9 (14.6)		76.0 (9.7)	
Good adherence	7 (35 %)	13 (65.0 %)		122.6 (10.9)		73.6 (8.3)	
Partial adherence	3 (50 %)	3 (50 %)		127.5 (21.9)		79.5 (2.1)	0.364
Low adherence	–	1 (100 %)	0.760	130.0 (0.0)	0.897	89.0 (0.0)	
Poor adherence	–	–		–		–	
GMAS 3							
High adherence	40 (39.6 %)	61 (60.4 %)		125.9 (13.4)		76.4 (9.4)	
Good adherence	10 (38.5 %)	16 (61.5 %)		118.2 (12.7)		71.3 (9.0)	
Partial adherence	17 (48.6 %)	18 (51.4 %)		124.8 (17.5)		76.3 (10.0)	
Low adherence	–	2 (100 %)	0.441	130.0 (0.0)	0.403	89.0 (0.0)	0.201
Poor adherence	–	2 (100 %)		125.0 (0.0)		77.5 (35)	

[a] Chi-squared test.
[b] ANOVA. HBP: high blood pressure. SBP: systolic blood pressure. DBP: diastolic blood pressure.

Portuguese demonstrated good internal consistency, reproducibility, and modest agreement with BMQ scale. However, the scale did not exhibit satisfactory criterion validity when assessed against a clinical parameter for HBP. Thus, despite its strong psychometric properties, the GMAS does not appear to be well-suited for use with hypertensive patients. We nonetheless recommend exploring its application in other populations, particularly among patients with diseases requiring treatments that involve higher costs and greater therapeutic complexity, as the GMAS was originally designed to identify non-adherence related to cost and treatment comprehension.

Funding

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

CRediT authorship contribution statement

Rosileide Zeferino da Silva: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Francisco de Assis Costa:** Writing – original draft, Validation, Supervision, Methodology, Formal analysis. **Alfredo Dias de Oliveira-Filho:** Validation, Supervision, Resources, Methodology, Formal analysis, Conceptualization. **Sabrina Joany Felizardo Neves:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Acknowledgments

We wish to thank the hospital staff for their support during this study, as well as the patients for their participation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rcsop.2024.100502.

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