ORIGINAL ARTICLE

Validity and reliability of the Patient Activation Measure® (PAM®)-13 Malay version among patients with Metabolic Syndrome in primary care

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Abstract

Introduction: The Patient Activation Measure (PAM) is one of the most extensively used, widely translated, and tested instruments worldwide in measuring patient activation levels in self-management. This study aimed to determine the validity and reliability of the PAM-13 Malay version among patients with Metabolic Syndrome (MetS) attending a primary care clinic.

Methods: This work is a cross-sectional validation study among patients with MetS attending a university primary care clinic in Selangor. The PAM-13 Malay version underwent a validation process and field testing. Psychometric properties were examined using principal component analysis (PCA) with varimax rotation, scree plot, Monte Carlo simulation, internal consistency, and test-retest reliability analyses.

Results: The content of the PAM-13 Malay version and the original version were conceptually equivalent. The questionnaire was refined after face validation by 10 patients with MetS. The refined version was then field-tested among 130 participants (response rate 89.7%). The Kaiser–Meyer–Olkin test was 0.767, and Bartlett's test of sphericity was ≤0.001, indicating sampling adequacy. Two factors were identified and labeled as (1) Passive and Building Knowledge, and (2) Taking Action and Maintaining Behavior. These labels were chosen as they were conceptually consistent with the items representing the levels of activation in PAM-13. The validated PAM-13 Malay version consisted of 13 items, framed into two domains. The overall Cronbach's α was 0.79, and the intraclass correlation coefficient was 0.45.

Conclusions: The PAM-13 Malay version is valid, reliable, and fairly stable over time. This questionnaire can be used to evaluate the levels of activation among patients with MetS in primary care in Malaysia.

Introduction

The World Health Organization defines patient empowerment as a "process through which people gain greater control over decisions and actions affecting their own health."[1] To be empowered, patients need to understand their role to be more active, responsible, and participative.[2] Patients also need to improve their knowledge and skills concerning their health and treatment options, be able to carry out self-care action in a competent manner, and improve their self-efficacy.[2]

The chronic care model seeks to empower patients to take an active role in their care and supports self-management.[3] The model promotes a health care system redesign that enables proactive healthcare teams to interact with informed, activated patients. Patient activation is therefore defined as "the state in which an individual possesses the knowledge, skills, and confidence to take independent actions to manage their health and care."[4,5] Being an activated patient in one's own self-care has been shown to be associated with better health outcomes and cost savings.[6] Patient activation has been shown to improve health-related behaviors including self-management, disease prevention, and health information-seeking.[6-8] Activated patients have also been shown to have a better quality of life, greater satisfaction with care, improved adherence, better knowledge, increased health status, and lower utilization of health care services.[6-9]

Patients with chronic conditions such as metabolic syndromes (MetS) often need to adhere to complicated treatment regimes, self-monitor their conditions, make changes to their lifestyle, and make decisions about when they need to seek advice from the healthcare team and when they can self-manage a

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problem on their own.[10] MetS patients need to be actively involved in self-managing their chronic conditions in order to improve clinical outcomes. Effectively, an individual with multiple chronic conditions such as MetS needs to be an activated patient. This would require a high level of knowledge, skills, and confidence, and these patients need to be empowered with such attributes and skills.[7,10]

Tools to measure patient activation and empowerment have been developed by various researchers in the form of questionnaires.[11] These include the Patient Activation Measure (PAM),[4,12,13] Patient Empowerment in Long-Term Conditions,[2] Patient Enablement Instrument[14] and Self-Efficacy in Long-Term Conditions.[15] PAM is one of the most extensively used, widely translated, and tested instruments worldwide for measuring patient activation level in self-management. It was originally developed as a 22-item questionnaire in the English language using the Rasch model.[4] This questionnaire identifies four domains of patient activation (knowledge, skills, confidence, and behaviors) and suggests four levels of activation patients reach in becoming fully engaged in managing their own health.[4,12] The PAM 13-item short version (PAM-13) was subsequently developed, and it was proven to have the same psychometric properties as the longer version.[12] PAM-13 has been validated among adults with various conditions,[16-18] and it has been translated into various languages,[19-25] including the Malay language.

To date, no study in Malaysia has specifically measured patient activation or empowerment. The PAM-13 questionnaire has been translated into the Malay language by Insignia Health, University of Oregon.[26] However, it has not yet been validated in the Malaysian primary care population. Hence, there is a need to validate this tool to measure the levels of patient activation in primary care, as studies concerning this area in Malaysia is severely lacking. Due to its robust development and extensive utilization worldwide, PAM-13 would be the best questionnaire to be validated in the Malay language. Therefore, the objective of this study is to determine the validity and reliability of the PAM-13 Malay version among patients with MetS attending a primary care clinic.

Methods

Study design and population

This cross-sectional validation study was conducted as part of a larger study, that is, the EMPOWER-SUSTAIN e-health pilot randomized controlled trial to improve patient activation and self-management behaviors among individuals with MetS in primary care.[27] The study population was patients with MetS attending the Universiti Teknologi MARA (UiTM) primary care clinic in Selangor, Malaysia. Conducted in two parts, the study is based on the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guideline.[28] Part 1 was the content and face validation of the PAM-13 Malay version, and Part 2 was the field testing and psychometric analysis of the questionnaire. The conduct of the study is outlined in the flow chart presented in Figure 1.

Stringent eligibility criteria were set as this validation study was part of a pilot randomized controlled trial where the PAM-13 Malay version will be used as a tool to measure the primary outcome. The inclusion criteria were as follows: (a) aged 18–80 years old; (b) attended the university primary care clinic for at least one year; (c) had blood investigations [Fasting Plasma Glucose (FPG), Fasting Serum Lipid (FSL) and HbA1c] done in the last 3 months; (d) were able to read and understand the Malay language; (e) fulfilled at least 3 out of 5 diagnostic criteria for MetS based on the 2008 Joint Interim Statement definition[29] [i.e., waist circumference South Asian cut-points: male ≥90 cm, female ≥80 cm; systolic blood pressure (BP) ≥130 and/or diastolic BP ≥85 mmHg or on treatment for hypertension (HPT); FPG ≥5.6 mmol/L or on treatment for elevated glucose; triglycerides (TG) ≥1.7 mmol/L or on treatment for dyslipidemia; high-density lipoprotein-cholesterol (HDL-C): male <1.0 mmol/L, female <1.3 mmol/L or on treatment for dyslipidemia]; and (f) willingness to participate in the study.

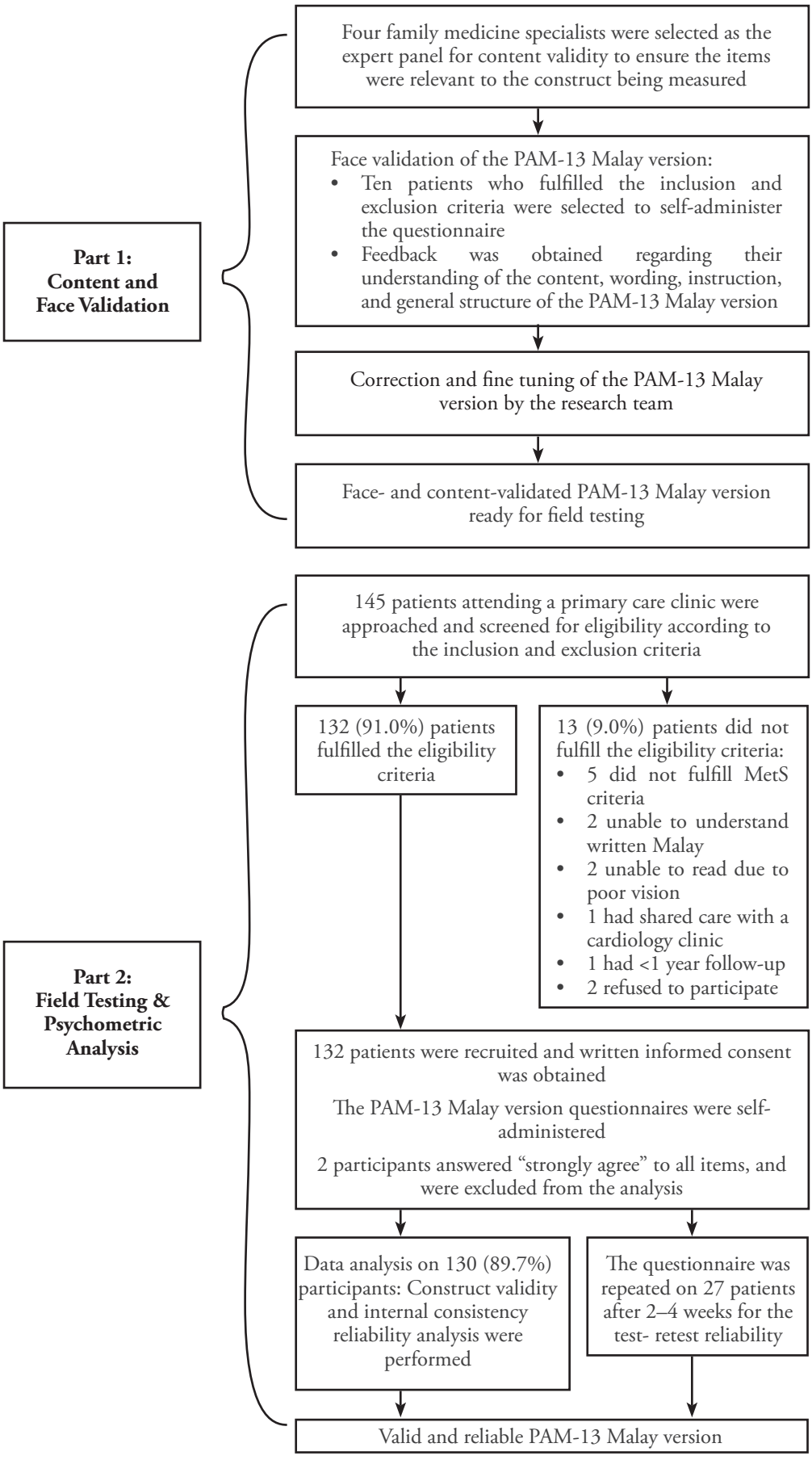

Figure 1. Validation and Psychometric Analysis of PAM-13 Malay Version.

The following patients were excluded from the study: (a) on renal dialysis, (b) presented with severe HPT (systolic BP >180 mmHg and/or diastolic BP >110 mmHg), (c) had secondary HPT, (d) diagnosed with circulatory disorders requiring secondary care over the past year (e.g., unstable angina, heart attack, stroke, transient ischemic attacks, peripheral vascular disease), (e) received shared care at primary and secondary care centers for complications of type 2 diabetes mellitus (T2DM) and/or cardiovascular diseases, (f) pregnant, (g) enrolled in another intervention study, (h) diagnosed with malignancy, (i) had any form of mental disorder or cognitive impairment that would affect the ability to answer the questionnaire, for example, dementia or mental retardation, and (j) unable to give informed consent.

** MARA stands for Majlis Amanah Rakyat.*

Study tool

The PAM-13 questionnaire consists of 13-items that form a Guttman-like scale with strong psychometric properties.[12] The PAM items are framed within 4 domains, that is, knowledge, beliefs, confidence, and skills about managing one's health.[4,12,13] Each item is answered based on a 4-point Likert scale, ranging from "strongly disagree" to "strongly agree" and "non-applicable." The scale reflects the four stages of activation in a progressing difficulty.[4,12,13] **Table 1** shows the categorization of the PAM-13 activation levels, scores, definitions, and items.

Table 1: PAM-13 activation levels, scores, definition and items.

Activation Level	Activation Score	Definition	Item
Level 1	0–47	A belief that their role is important	Items 1 and 2
Level 2	47.1–55.1	Have confidence and knowledge to act	Items 3–8
Level 3	55.2–72.4	Taking action	Items 9–11
Level 4	72.5–100	Staying on course under stress	Items 12 and 13

The score was then transformed to a scale with a theoretical range of 0–100, based on calibration tables, with higher PAM scores indicating higher patient activation. Written permission from the questionnaire developer and license to validate the PAM-13 Malay version was granted and approved by the Insignia Health prior to the conduct of the study.[4, 12, 13]

Content validation

Content validation was conducted by four family medicine specialists who are experts in questionnaire validation methods. All of them are also clinical experts with a special interest in patient empowerment and chronic disease management. Definition of the domains and the items representing the domains were provided to the experts. They were requested to critically review the domains and items, and rate the relevance of each item to the conceptual framework on a scale from 1 to 4 (1 = not relevant, 2 = not important, 3 = relevant, 4 = very important) for each item. Prior to the calculation of the content validation index (CVI), scores of 1 and 2 were categorized as 0, whereas scores of 3 and 4 were categorized as 1. CVI was calculated by adding up these values (0 or 1) for each item, and then the total value was divided by the total number of experts. A CVI value of >0.8 determined that the items were relevant and to be retained in the questionnaire.[30]

Face validation

The PAM-13 Malay version was tested on a sample of 10 patients who fulfilled the inclusion and exclusion criteria. The questionnaire was self-administered. The time taken to answer the questionnaire was noted. Their opinions on understanding the instructions, contents, wording, and general structure of the questionnaire were assessed. The result was reviewed by the research team to ensure that all the items were comprehensible. Correction and fine-tuning of the PAM-13 questionnaire items by the research team were conducted based on the feedback from the patients. This process produced the refined PAM-13 Malay version, which was ready to undergo the psychometric evaluation.

Field testing and psychometric evaluation

The refined PAM-13 Malay version was field-tested among patients who fulfilled the same inclusion and exclusion criteria as previously described.

Sample size determination

The sample size was calculated using the sample to variable ratio of 10:1, giving a minimum required sample size of 130 patients.[31] After taking into consideration a 10% non-responder and non-eligibility rate, this study aimed to approach 143 patients.

Sampling method

This study was conducted using a convenience sampling method until the target sample size was achieved. This sampling method was chosen as there was difficulty in conducting probability sampling due to the absence of an electronic registry for patients with MetS. To minimize sampling bias, consecutive patients were approached and screened for eligibility according to the inclusion and exclusion criteria on the designated day of data collection.

Patient recruitment and data collection

Patients were recruited over four weeks at UiTM primary care clinic in June–July 2019. Data were collected by a trained research assistant to ensure a standardized data collection method was followed. Patients were approached in the nurse's assessment room and invited to participate. Those who were interested were given the study information sheet containing valuable information pertaining to the study, which included the background, purpose, benefit, information regarding participation, the study procedure, confidentiality status, and contact information. Patients were screened for eligibility according to the inclusion and exclusion criteria. Screening for the eligibility criteria was made through a self-administered questionnaire and a review of the medical records. Patients' medical history and blood investigations were required to make the diagnosis of MetS. FPG and FSL, as well as HbA1c (for those with diabetes), were retrieved from the electronic medical record. Those who fulfilled the eligibility criteria and agreed to participate were recruited. Written informed consent was obtained.

The PAM-13 Malay version was given to the participants to be self-administered. Participants were reminded to complete the questionnaire in approximately 15 minutes without referring to notes or family members. Clear verbal instructions were given on how to fill up the questionnaire. The participants were free to ask for clarification from the researcher at any time should any query arise. Once completed, participants were requested to return it to the researcher, and the questionnaire was checked for completeness.

Data collection for test-retest

Thirty patients were recruited to participate in the test-retest of the PAM-13 Malay version. Patient selection was based on logistic reasons. Those with an appointment, either for a routine clinic follow-up or blood draw within 2–4 weeks, were offered to participate. They were given a date to return to the clinic if they agreed to participate. Twenty-seven patients returned to the clinic after 2 to 4 weeks, and they were given the same questionnaire to complete for the test-retest reliability analysis.

Statistical analysis

Data entry and statistical analysis were performed using IBM SPSS Statistics Version 24. Continuous variables were expressed as means and standard deviations (SD). Categorical variables were expressed as frequencies and percentages. Data were entered into the PAM-13 online score sheet to obtain the activation score (1–100) and activation level (1–4) for each patient.[26] Higher PAM scores indicate higher patient activation levels.[4,12] Data quality was examined using the mean (±SD), percentage of missing data, and percentage of "non-applicable" answers for each item. Those who answered "strongly agree" or "strongly disagree" to all the items and those who answered ≥3 "non-applicable" answers were excluded from the analysis as these are the requirements to be able to compute a valid PAM-score as stipulated by Insignia Health.[26]

Psychometric analysis of the PAM-13 Malay version was performed in three stages. First, to ensure that the items were suitable for principal component analysis (PCA), sampling adequacy using the Kaiser–Meyer–Olkin (KMO) criterion was performed before factor extraction. A KMO criterion of >0.5 was set as the minimum value for factor analysis, and >0.8 was considered optimal.[32] The appropriateness of the data was assessed using Bartlett's test of sphericity. A p-value of <0.05 was considered appropriate to proceed with factor analysis.[32]

Second, PCA for factor extraction with subsequent varimax rotation was chosen to examine the PAM-13 Malay version's dimensionality and construct validity.[33] Factor loadings of >0.30 were set as the lower cutoff point in the formation of the factor structure.[30] The eigenvalues, scree plot, and Monte Carlo PCA simulation were used to determine how many factors to retain.[33] The Kaiser's criterion suggests retaining factors with an eigenvalue of ≥1.34 Factors with a low eigenvalue of <1 were considered redundant as it would not explain much of the variance in the data. According to the scree plot, the number of factors to be retained are the data points above the point of inflection (i.e., the elbow).[33] Next, the Monte Carlo PCA for parallel analysis was also performed to further confirm the number of factors to retain.[35]

Third, the internal reliability of the PAM-13 Malay version was measured using Cronbach's α coefficient and corrected item-total correlations. A Cronbach's α value of >0.70 is considered reliable.[36] The corrected item-total correlations are the correlations between individual items to the sum scale of the questionnaire. Correlations of r ≥ 0.10 are considered as weak, r ≥ 0.30 as moderate, and r ≥ 0.50 as strong.[37] Intraclass correlation coefficients (ICC) were used to assess the test-retest reliability of the questionnaire. The closer the values are to 1.00, the more stable the items are over time.[38]

Ethical consideration

Ethical approval was obtained from the Research Ethics Committee of Universiti Teknologi MARA [600-IRMI (5/1/6)/ REC/61/19] prior to the conduct of the study. A research license was obtained from Insignia Health, University of Oregon[26] to validate and utilize the PAM-13 Malay version for research and educational purposes (License Number 1539265175-1570801175).

Results

The content and face validation of the PAM-13 Malay version

Regarding content validity, the expert panel found that the items were relevant to the construct being measured. CVI was found to be 1 for each item, and therefore, all 13 items were retained. For face validation, all 10 participants thought that the questionnaire was generally clear, easy to read, and understand. Several participants gave feedback on item numbers 1, 5, 6, 7, 8, and 13 regarding the wording for better clarity. These items were then refined for simpler and better understanding. These did not change the purpose and meaning of the items. The scale was straightforward, and participants managed to complete the questionnaire within 10–15 minutes.

Recruitment for field testing

Out of 145 patients who were approached and invited into the study, 132 (91.0%) fulfilled the eligibility criteria and were recruited into the study. Informed written consent was obtained, and these patients completed the self-administered PAM-13 Malay version. However, two participants were excluded from the analysis as they answered "totally agree" to all items. Therefore, the total number of participants included in the final analysis was 130 (89.7%).

Demographic characteristics

The demographic characteristics of the participants are shown in **Table 2**. The mean age was 60.4 years (SD ± 9.56). More than half of the participants were female (53.8%), and the majority of them were Malays (82.3%).

Psychometric properties

Regarding the data quality, there were no missing responses to the questionnaire items. None of the participants answered "non-applicable" in ≥3 of the questionnaire items or "strongly disagree" in all items. Two participants answered "strongly agree" to all items, and they were excluded from the final analysis as this is a requirement to be able to compute a valid PAM-score.[26] The mean score was 58.9 (SD ± 9.9). Overall, these findings confirmed that the dataset was of good quality.

The KMO value for the PAM-13 Malay version was 0.767, and Bartlett's test of sphericity was significant with a p-value of <0.001, indicating that the sample was adequate for factor analysis. The highest value for communalities was 0.737 (item 2), and the lowest value was 0.243 (item 6). This indicates that 73.7% of its variability was explained by item 2.

Table 2. Socio-demographic characteristics of the participants (n = 130).

Variables	Frequency, n (%)	Mean (±SD)
All subjects	130 (100)	
Age		
		60.4 (±9.56)
18–39	6 (4.6)	
40–59	42 (32.3)	
60–80	82 (63.1)	
Gender		
Male	60 (46.2)	
Female	70 (53.8)	
Ethnicity		
Malay	107 (82.3)	
Chinese	13 (10.0)	
Indian	8 (6.2)	
Other	2 (1.5)	
Martial Status		
Single	4 (3.1)	
Married	115 (88.5)	
Divorced	3 (2.3)	
Widow / Widower	8 (6.2)	
Educational Level		
No formal education	2 (1.5)	
Primary	19 (14.6)	
Secondary	51 (39.1)	
Tertiary	58 (44.6)	
Occupation		
Unemployed	21 (16.2)	
Employed	38 (29.2)	
Pensioner	71 (54.6)	
Household Income		
B 40 ≤ RM 3,000	54 (41.5)	
M 40: RM 3,001–RM 13,147	71 (54.5)	
T 20: ≥ RM 13,148	5 (3.8)	

The PCA using varimax rotation yielded a three-factor solution, with eigenvalues of more than one. This three-factor solution explained a cumulative 53.7% of the variance in the data. Further analysis using the scree plot was conducted to aid in the decision of the number of factors to retain. The elbow of the scree plot occurred at factor three, suggesting that two factors should be retained. Since the PCA yielded a three-factor solution, and the scree plot suggested a two-factor solution, Monte Carlo PCA for parallel analysis was conducted. The Monte Carlo PCA supported the retention of a two-factor solution.[35] Therefore, a two-factor solution with varimax rotation was deemed to be the most conceptually appropriate for the PAM-13 Malay version. The data were reanalyzed by fixing the number of factors at two. The eigenvalue for Factor 1 was 2.04, with a variance of 15.7%, while the eigenvalue value for Factor 2 was 3.87, which explained 29.7% of the variance in the data. The total variance for both factors was 45.4%.

Table 3 shows the results of the factor loadings of the PAM-13 Malay version on the final two-factor solution. All the items have factor loadings of >0.3. Item 6 cross-loaded into both factors with the values of 0.356 and 0.334, and item 10 cross-loaded into both factors with the values of 0.490 and 0.399. Both items were retained in Factor 2 as they fit better conceptually in this factor. As previously shown in Table 1, PAM-13 consisted of 4 levels of activation. Our factor analysis supported a two-factor solution; therefore, Factor 1, which consisted of items 1–4, was labeled as "Passive and Building Knowledge," in keeping with PAM-13 activation Levels 1 and 2. Factor 2, which consisted of items 5–13, was labeled as "Taking Action and Maintaining Behavior," in keeping with PAM-13 activation Levels 3 and 4.

Table 3. Factor loadings on the final two-factor solution.

Item	Activation Level	Factor 1	Factor 2
PAM 1: I am the person who is responsible for taking care of my health	1	**0.781**	
PAM 2: Taking an active role in my own health care is the most important thing that affects my health	1	**0.840**	
PAM 3: I am confident I can help prevent or reduce problems associated with my health	2	**0.768**	
PAM 4: I know what each of my prescribed medications does	2	**0.549**	
PAM 5: I am confident that I can tell whether I need to go to the doctor or whether I can take care of a health problem myself	2		**0.585**
PAM 6: I am confident that I can tell a doctor or nurse concerns I have even when he or she does not ask	2	**0.356**	**0.334**
PAM 7: I am confident that I can carry out medical treatments I may need to do at home	2		**0.614**
PAM 8: I understand my health problems and what causes them	2		**0.477**
PAM 9: I know what treatments are available for my health problem	3		**0.633**
PAM 10: I have been able to maintain lifestyle changes, like healthy eating or exercising	3	**0.490**	**0.399**
PAM 11: I know how to prevent problems with my health	3		**0.668**
PAM 12: I am confident I can work out solutions when new problems arise with my health	4		**0.667**
PAM 13: I am confident that I can maintain lifestyle changes, like healthy eating and exercising, even during times of stress	4		**0.656**

Extraction method: PCA with varimax rotation and Kaiser normalization.

Table 4 shows the item-total reliability analysis for the PAM-13 Malay version. The corrected item-total correlations ranged from 0.31 to 0.52, indicating moderate to strong correlations of the individual items to the sum scale of the questionnaire. The overall Cronbach's α value was 0.79. This value did not increase if any of the items were deleted.

Table 4. Item-total statistics for the PAM-13 Malay version.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's α if Item Deleted
PAM 1	24.71	13.67	0.36	0.44	0.77
PAM 2	24.72	13.83	0.33	0.54	0.78
PAM 3	24.93	13.38	0.48	0.49	0.76
PAM 4	24.95	13.48	0.44	0.29	0.77
PAM 5	25.26	12.66	0.46	0.34	0.76
PAM 6	25.07	13.68	0.31	0.19	0.78
PAM 7	25.68	13.34	0.31	0.25	0.78
PAM 8	25.06	13.25	0.44	0.29	0.77
PAM 9	25.23	13.03	0.44	0.29	0.77
PAM 10	25.09	13.59	0.45	0.37	0.77
PAM 11	25.28	13.13	0.52	0.40	0.76
PAM 12	25.71	13.23	0.39	0.42	0.77
PAM 13	25.28	13.18	0.47	0.40	0.76
Overall Cronbach's α value					**0.79**

Table 5 shows the Cronbach's α value for each domain of the questionnaire. For Factor 1, the Cronbach's α value was 0.76, whereas for Factor 2 was 0.77. This indicates the questionnaire items within these two domains were reliable.

Table 5. Cronbach's α values of the PAM-13 Malay version.

Domain	Item	Cronbach's α
Passive and Building Knowledge	PAM 1–PAM 4	0.76
Taking Action and Maintaining Behavior	PAM 5–PAM 13	0.77

Table 6 shows the ICC value for each item in the PAM-13 and the overall value. Most of the items have fair to good reproducibility. The overall ICC value was 0.45, which indicates that the PAM-13 Malay version was fairly stable over time.

Table 6. Intraclass correlation coefficient values of the PAM-13 Malay version.

Item ICC	ICC (95% CI)
PAM 1: I am the person who is responsible for taking care of my health	0.30 (0.01–0.61)
PAM 2: Taking an active role in my own health care is the most important thing that affects my health	0.55 (0.23–0.77)
PAM 3: I am confident I can help prevent or reduce problems associated with my health	0.41 (0.05–0.68)
PAM 4: I know what each of my prescribed medications does	0.59 (0.28–0.79)
PAM 5: I am confident that I can tell whether I need to go to the doctor or whether I can take care of a health problem myself	0.47 (0.12–0.72)
PAM 6: I am confident that I can tell a doctor or nurse concerns I have even when he or she does not ask	0.46 (0.10–0.71)
PAM 7: I am confident that I can carry out medical treatments I may need to do at home	0.41 (0.05–0.68)
PAM 8: I understand my health problems and what causes them	0.59 (0.28–0.79)
PAM 9: I know what treatments are available for my health problem	0.26 (0.12–0.58)
PAM 10: I have been able to maintain lifestyle changes, like healthy eating or exercising	0.41 (0.05–0.68)
PAM 11: I know how to prevent problems with my health	0.44 (0.08–0.70)
PAM 12: I am confident I can work out solutions when new problems arise with my health	0.55 (0.22–0.77)
PAM 13: I am confident that I can maintain lifestyle changes, like healthy eating and exercising, even during times of stress	0.45 (0.09–0.71)
Overall	**0.45**

Discussion

PAM-13 has consistently been shown to have strong psychometric properties in numerous validation studies involving heterogeneous groups of patients with various chronic conditions worldwide.[17-25,39] This tool has been proven to be valid and reliable for assessing patients' knowledge, skills, and confidence in self-management of chronic conditions. Our study was the first validation study of the PAM-13 Malay version carried out in a primary care clinic among patients with MetS in Malaysia.

The data quality of our study was good, as there were no missing values. The mean score of the PAM-13 Malay version among patients with MetS was 58.9 (SD ± 9.9). This is comparable to the mean activation score of 58.6 (SD ± 10.8) among patients seen in a heart clinic in Singapore.[40] Comparatively, the mean activation scores were lower at 50.0 (SD ± 13.5) among patients with osteoarthritis in Korea[25] and also among patients with mental health in Norway, where the mean activation score was 51.9 (SD ± 14.2).[24] However, the mean activation score was found to be higher at 68.3 (SD ± 14.8) among primary care populations in Germany.[20]

In the original American version, the PAM-13 items were conceptually developed to represent four domains, that is, knowledge, beliefs,

confidence, and skills about managing one's health. These domains reflect four levels of activation,[4,12,13] as shown above in Table 1. The PCA in our study identified a two-factor solution, explaining 45.4% of the variance. Conceptually, these factors were thought to represent a combination of two domains from the original four levels of activation. Factor 1 was labeled as "Passive and Building Knowledge" as it consisted of items 1-4, in keeping with PAM-13 activation Levels 1 and 2. Factor 2 was labeled as "Taking Action and Maintaining Behavior" as it consisted of items 5-13, in keeping with PAM-13 activation Levels 3 and 4. These labels were chosen as they were conceptually consistent with the items representing the levels of activation in PAM-13.

The finding of our study is comparable to the validation study of PAM-13 among patients with mental health in Norway, where the PCA revealed a fit for a two-factor model, explaining 48.07% of the variance.[24] Apart from our study and the Norwegian study, this bi-factorial solution has not been identified in previous research. In contrast to our findings, a study conducted among primary care patients in Germany showed that PCA with a subsequent varimax rotation revealed only one major underlying factor, explaining 34.5% of the variance.[20] In a study among patients with diabetes, hypertension, or rheumatoid arthritis in Turkey, confirmatory factor analysis (CFA) also confirmed the one-factor structure.[41] When Rasch analysis was used, the majority of the studies also revealed the unidimensionality of PAM 13. These include the original 22-item American version of PAM,[4] the PAM-13 Danish version among patients with dysglycemia,[19] the Italian version among patients with chronic conditions,[23] and the Korean version among patients with osteoarthritis.[25] Other previous studies that used the Rasch model have also supported the unidimensionality of the scale.[18,39] However, a more recent study using the Rasch model in Sweden found that the evidence for unidimensionality was ambiguous.[42] Differences in the sample population of our study, for instance, comorbidities, multi-ethnicity, and cultural backgrounds, may have resulted in the different factor structure. However, a definitive conclusion about the factor structure can only be made using CFA. Therefore, future studies using CFA among patients with MetS in Malaysia should be conducted to clarify this issue.

Regarding internal consistency, our study has proven that the PAM-13 Malay version is reliable, with a Cronbach's α value of 0.79. This is comparable to the Hebrew translation with a Cronbach's α of 0.77,[22] the German version with a Cronbach's α of 0.84,[20] the Korean version with a Cronbach's α of 0.88,[25] and the Dutch version with a Cronbach's α of 0.88.[21]

Regarding the test-retest reliability analysis, our study revealed an overall ICC value of 0.45 and ranged from 0.26 to 0.59, indicating that the PAM-13 Malay version was fairly stable over time. This finding is comparable to the Dutch version, where the value was 0.47 with a range of 0.25 to 0.49,[21] and the Brazilian version, which found a range of 0.26 to 0.59.[43]

Strengths and limitations

The strengths of this study include a high response rate of 91%. The data quality is good, as there were no missing values. Only two participants had to be excluded from the final analysis as they answered "strongly agree" to all items. This study, however, has several limitations. First, although the sample to variable ratio of 10:1 was adequate for factor analysis in this study, a larger sample size of at least 300 participants would diminish the error in the data.[33]

Second, this study was conducted in a single primary care clinic where the majority of the participants were Malays (82.3%). Therefore, the findings may not be generalizable to other primary care clinics in Malaysia with a multiethnic population, as the Chinese and Indian ethnic groups were underrepresented in our study. Third, a convenience sampling method used in this study may contribute to sampling bias. However, a systematic random sampling method was not feasible for this study due to the absence of an electronic registry for patients with MetS in our primary care clinic. In the absence of a registry, it would be difficult to conduct systematic random sampling to ensure that all eligible patients within the sampling frame were given an equal chance to be selected for the study. However, measures were taken to reduce the sampling bias by ensuring that all patients who attended the clinics on the data collection days were approached and invited to participate. Lastly, CFA and Rasch Model analysis to assess the scale properties

could not be conducted due to the need for a larger sample size and the limited time frame given to complete the study. Concurrent or convergent and divergent validities were also beyond the scope of this study as the terms and conditions of the research license agreement provided by Insignia Health[26] do not include validating the PAM-13 Malay version against a new or existing patient health engagement, motivation, activation, self-management, or similar assessment or predictive modeling tool.

Implications for further research and clinical practice

Our study has produced a valid and reliable PAM-13 Malay version, which can be used to measure knowledge, skills, and confidence in self-management among patients with MetS in primary care in Malaysia. However, the questionnaire is only useful to those who can read and understand the Malay language. Translations of this questionnaire into Mandarin and Tamil are recommended to cater to the needs of other major ethnic groups in Malaysia, that is, Chinese and Indians. Further research involving a larger sample size and systematic random sampling to represent major ethnic groups in Malaysia is also recommended to further validate this questionnaire. CFA and Rasch Model analysis should also be conducted to further evaluate the PAM-13 Malay version's scale properties. Additional studies are also needed to validate the PAM-13 Malay version in other settings, for example, secondary care, or in patients with other chronic conditions such as mental health concerns.

Conclusion

The PAM-13 Malay version has been shown to be valid, reliable, and fairly stable over time. This tool can be used to measure activation levels among patients with MetS in the primary care setting in Malaysia. However, a further validation study, which includes CFA, is recommended to strengthen the validity of the PAM-13 Malay version. Further research to measure patient activation levels is also needed. Intervention strategies can then be developed and targeted, particularly toward those with low activation levels. These patients need to be empowered to improve their knowledge, skills, and confidence to self-manage their chronic conditions and eventually improve outcomes.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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How does this paper make a difference to general practice?

- This is the first validation study of the PAM-13 Malay version carried out in a primary care clinic among patients with metabolic syndrome in Malaysia.
- The PAM-13 Malay version has been shown to be valid, reliable, and fairly stable over time.
- This questionnaire can be used to evaluate the levels of activation among patients with metabolic syndrome in primary care in Malaysia.
- Intervention strategies can then be developed and targeted, particularly toward those with low activation levels.
- These patients need to be empowered to improve their knowledge, skills, and confidence to self-manage their chronic conditions and eventually improve outcomes.

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