ASSESSING THE PSYCHOMETRIC PROPERTIES OF THE MALAYSIAN VERSION OF PERCEIVED DIABETES SELF-MANAGEMENT SCALE FOR DIABETES MELLITUS

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ABSTRACT

Objective: The self-management of the chronic illnesses including diabetes mellitus (DM) contributes directly to the optimum outcomes. The self-management of patients living with DM is essential to achieve optimal glycemic control and to avoid or forestall the myriad to manage the long-term negative consequences. This study aimed to assess psychometric properties of the Malaysian version of perceived diabetes self-management scale (PDSMS).

Methods: This cross-sectional study recruited 314 adult diabetes patients (≥18-years-old; DM Type 1 or 2) attending Endocrine Clinic at Kuala Lumpur Hospital, Malaysia from July 2014 to January 2015, for the period of 6-month. Permission was obtained from the corresponding author to translate the English version of PDSMS to Malay language (M-PDSMS). The final version of the questionnaire was self-administered among the patients living with DM after taking their consent before their participation in this study. Psychometric properties were evaluated using the classical test theory: Cronbach's alpha (α), intraclass correlation (ICC), and construct validity by principle component analysis and the modern test theory (MTT): Realtime item reliability, person reliability, and item construct validity.

Results: M-PDSMS proved to be internally consistent with good Cronbach α values for both pilot and real study (α=0.69, 0.77), respectively. ICC (0.75) for 1-month test-retest reliability proved the stability of the items. While in MTT, the realtime item reliability values also surpassed the good reliability index of 0.70 for both pilot (α=0.93) and real study (α=0.97).

Conclusion: M-PDSMS proved to be a valid and reliable questionnaire to assess the perceived diabetes self-management among the Malaysian DM patients. The findings of the study should be replicated in other states of Malaysia to ensure the retention of good reliability and validity profile.

Keywords: Self-management, Diabetes, Perceived diabetes self-management scale, Reliability, Validity, Modern test theory, Classical test theory, Rasch.

INTRODUCTION

Diabetes mellitus (DM) is one of major public health concerns because of increased morbidity, mortality, and economic burden. People living with DM are always at higher risk of developing life-threatening DM-related complications, which would negatively affect the quality of life and duration of life [1]. The complications associated with DM can be avoided by following the self-management practices which includes regular exercise, taking recommended diet, proper intake of prescribed medications, and blood glucose monitoring [2].

The desired goals for effective self-management of DM can only be accomplished by successful adaptation to DM in daily life [3]. Being knowledgeable of how self-management improve DM patients' life and may be a key factor for devising a treatment strategy and its successful implementation [4]. The failure to adapt to the DM on regular daily basis may lead to poor health outcomes and serious life-threatening DM associated complications of major organs. Therefore, to avoid all these serious health consequences, diabetes patients should be capable and responsible for performing diabetes self-management to achieve optimum glycemic control [5].

The degree of perceived self-management may impact glycemic control, and consequently, the desired health outcomes for the DM patients. As the assessment of perceived self-management level among DM patients is very subjective; therefore, over the last few decades, a handful of measurement scales have been developed in the English language to measure various aspects of self-management among diabetes patients.

To use these instruments for other populations where English is not the main language, the cross-cultural adaptation, and revalidation of the translated version is the preferred choice instead of developing a new instrument in local language [6]. To date, to the best of our knowledge, there is no valid and reliable instrument is available to assess perceived self-management in Malaysian patients living with DM. Therefore, the aim of this study was to translate and assess the psychometric properties perceived diabetes self-management scale to Malay language (M-PDSMS) in Malaysian patients living with DM.

METHODS

PDSMS

PDSMS was developed by Wallston *et al.* (2007) to assess the extent to which DM patients felt functional to achieve desired health outcomes. PDSMS is 8-item DM specific instrument [7]. The PDSMS is a valid measure to assess DM self-management. The responses for PDSMS items ranged from strongly disagree (score=1) to strongly agree (score=5). Four of the items (item number: 1, 2, 6, and 7) were negatively worded. These four items were reverse-scored. The total of PDSMS score ranged from 8 to 40, with higher score indicating more confidence in DM self-management.

Translation of questionnaire

Forward translation

The original questionnaire was translated from English to Bahasa Malaysia by two independent local professional bilingual persons; one of them was a clinician and another had a linguistics background.

Both translated versions were reviewed by the local project manager of translation committee and was agreed on a single reconciled version (reconciliation). The aim of this step was to produce a conceptually equivalent translated Malay version that is easy to understand (face validity). Since the questionnaire was disease-specific, the review of this intermediary version was also conducted by endocrinologist doctor and diabetes specialist nurse.

Backward translation

In this step, the reconciled translated questionnaire was back-translated from Bahasa Malaysia to the English language by other two local independent professional translators blind to the original version. The objective of this step was to check that the translated version reflected the same item content as the original without any misunderstandings, miss-translation, or inaccuracies to reduce any cultural and social biases.

Harmonization

Before pre-testing the translated questionnaire, translation committee that reviewed those forward and backward translations checked the format, modified, or rejected inappropriate items/words for final consensus. In this stage, any content value variances among the translation in this targeted language were identified and resolved for uniformity of translations. The local project manager of translation committee together with another independent endocrinologist reviewed and approved the second harmonized translation for cognitive debriefing interviews.

Testing for translated questionnaire

The translated questionnaire was distributed to respondents who were not a part of the targeted sample of this study. Each subject completed the questionnaire and interviewed about the meaning of each item, instructions, and response choices.

Proofreading and finalization

The final version was discussed, checked, amended, and proofread by a native Bahasa Malaysia speaking group to perform a final check of the spelling, grammar, and page layout. After this step, the final version of M-PDSMS was ready to be distributed to the real sample of the respondents.

Participants and setting

This study was conducted in July 2014 (pilot) and from August 2014 to January 2015 (real) to enroll adult diabetes patients attending diabetes (endocrine) clinic at Hospital Kuala Lumpur. The study recruited a total of 314 diabetes patients aged ≥18-year-old, diagnosed for either type 1 or type 2 diabetes and was able to understand and speak Malay. The M-PDSMS took approximately 15 minutes to complete by the majority of enrolled patients.

Data analysis

The statistical analyses were done using the Statistical Package for Social Science (SPSS®) version 20 and Bond and Fox software®. The demographic profiles of the participants had been described using mean (standard deviation), median (intraquartile range) for continuous variables, and frequency and percentage for categorical variables.

The content validity, face validity, and construct validity procedures were used to validate the study questionnaire. Construct validity was tested using an exploratory factor analysis. The factor analysis was conducted by a principal component analysis (PCA), followed by varimax rotation with Kaiser normalization. Kaiser's Eigen value >1 was used to determine the number of factors when the p value of Bartlett's test of sphericity was >0.001 and the value of Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was <0.5, factor loadings >0.3 on each item were considered to belong to the corresponding factors by classical test theory (CTT) [8].

The Rasch analysis (modern test theory [MTT]) has been increasingly used in the health field and explores the performance of each item [9]. The values should be ranged between 0.4 and 0.8 for point measure correlation (PTMEA Corr); 0.5 and 2 for infit/outfit mean square (MNSQ), and −2 and +2 for Z-standard (ZSTD) [10]. If the items meet these criteria considered as well fitted to the model, in other words valid.

Internal consistency reliability was determined using Cronbach's alpha value ranged from 0 to 1. By both CTT and MTT, the value <0.5 is considered as unacceptable, 0.5≤α<0.6 as poor, 0.6≤α<0.7 as acceptable, 0.7≤α<0.9 as good, and α≥0.9 as excellent for reliability. Cronbach's α was used to determine if the items on the translated questionnaire were internally consistent [11]. While intraclass correlation (ICC) was used to determine the test-retest reliability for M-PDSMS that was administered at 1-month time interval to about one-fifth of the total respondents from real study. ICC value was interpreted as poor if <0.4; fair or good if <0.75, and excellent if >0.75 [12].

RESULTS

Socio-demographic and medical data

The mean ages of the respondents were 47.01 (±4.68) and 45.97 (±14.90) for pilot and real study, respectively. The majority of the DM patients were Malay and were married in both pilot and real studies, The details of socio-demographic and medical data for respondents are shown in Table 1.

Self-management (PDSMS) score

The overall scores of PDSMS were 27.48 (±3.86) and 27.30 (±4.52) for pilot and real studies, respectively. The results for each type are illustrated in Table 2.

CTT

The Bartlett's test of sphericity and KMO test were performed. The overall Bartlett's test of sphericity was significant (χ^2 [28]=114.07, p<0.001). The value of KMO (0.64) of M-PDSMS was higher than 0.6 indicated sampling adequacy for factor analysis. For M-PDSMS, the items yielded two factors: "Positive worded factor" (item number 3, 4, 5, and 8) and "negative worded factor" (item number 1, 2, 6, and 7). The loaded items in both factors were above 0.6. Moreover, the single factor revealed factor loadings ranging from 0.39 to 0.66 as shown in Table 3.

Internal consistency

The Cronbach's α values, for pilot (α=0.69) and real (α=0.77) studies, were considered good. Moreover, the individual item to total correlation coefficient ranged from 0.318 to 0.48 and 0.35 to 0.57 (higher than 0.3) for pilot and real studies, respectively, except for item 3 where the loading value was <0.3 in pilot as shown in Table 4. The test-retest reliability of M-PDSMS (ICC=0.75) indicated good stability of items of the questionnaire over time.

MTT

The reliability analyses of real item and person reliability showed 496 and 2000 data points for pilot and real studies, respectively. The person reliability (α=0.64, 0.72) values were good, whereas the real item reliability values were (α=0.93, 0.97) excellent for both (pilot and real) studies.

According to Rasch measurement model, MNSQ for a valid item must be within the range of 0.5 and 2.0, MNSQ determines how well each item contributes to defining one common construct, whereas ZSTD value must be between −2 and +2, and PTMEA Corr score should be between 0.4 and 0.85 and should not be <0.32 [13]. Both pilot and real studies showed that all items measure for the questionnaire PDSMS are fitted to Rasch-Model as shown in Tables 5 and 6, respectively. Overall, the mean-square fit statistics indicated that the estimated measures were valid, and this provides empirical evidence that the items measure the construct of interest.

Table 1: Socio-demographic and clinical data for participants for pilot (n=62) and real (n=252) studies

S. No.	Items	Category	Pilot	Real	Pilot n (%)	Real n (%)
1	Age (years)	Mean±SD	47.01±4.68	45.97±14.90		
2	Gender	Male			29 (46.8)	127 (50.4)
		Female			33 (53.2)	125 (49.6)
3	Marital status	Single			11 (17.7)	63 (25)
		Married			45 (69.4)	169 (67.1)
		Widow			2 (3.2)	9 (3.6)
		Divorced			6 (9.7)	11 (4.4)
4	Ethnicity	Malay			47 (75.80)	158 (62.7)
		Chinese			0 (0)	28 (11.1)
		Indian			13 (21.00)	61 (24.2)
		Others			2 (3.2)	5 (2.0)
5	Education level	Primary school			5 (8.1)	11 (4.4)
		Secondary school			28 (45.2)	122 (48.4)
		College			14 (22.6)	51 (20.2)
		University			14 (22.6)	63 (25.0)
		Others			1 (1.6)	5 (2)
6	Monthly income	<1000 RM			16 (25.80)	50 (19.8)
		1001-2000 RM			11 (17.7)	61 (24.2)
		2001-3000 RM			16 (25.8)	63 (25.0)
		>3000 RM			18 (29.00)	78 (31.0)
7	Smoking status	Smoker			1 (1.6)	28 (11.1)
		Non-smoker			5 (8.10)	191 (75.8)
		Ex-smoker			51 (82.3)	33 (13.1)
8	Hospitalization	Never			42 (67.70)	185 (73.4)
		1 time			16 (25.80)	21 (8.3)
		2 times			2 (3.2)	7 (2.8)
		>3 times			2 (3.2)	39 (15.5)
9	DM duration (years)	Mean±SD	12.11±8.63	11.26±8.08		

DM: Diabetes mellitus, SD: Standard deviation

Table 2: Perceived diabetes self-management score for pilot (n=62) and real (n=252) studies

S. No.	Variables	Type I	Type II	Overall
Pilot	Self-management (PDSMS)	27.9 (3.94)	27.9 (3.94)	27.48 (3.86)
Real	Self-management (PDSMS)	27.44 (4.27)	27.24 (4.6)	27.30 (4.52)

PDSMS: Perceived diabetes self-management scale

DISCUSSION

The purpose of this study was to assess the psychometric properties of the M-PDSMS among Malaysian adults living with DM. The original English version of questionnaire was translated by adapting standard translation procedure for cross-cultural validation [7].

M-PDSMS proved to have good reliability for both pilot (α=0.69) and real (α=0.77) studies based on CTT. The Cronbach's α in the real study was higher than pilot study because of greater sample size. Moreover, the 1-month test-retest reliability showed the scale had good stability over the time (ICC=0.75). While in MTT, the person reliability values were 0.64 and 0.72 for pilot and real studies, respectively. Similarly, the real item reliability values were the excellent and small difference between pilot (0.93) and real (0.97) studies were observed. The item reliability in both pilot and real for MTT were higher than CTT.

The reliability findings of this study were consistent with the original English version that was used to assess self-management in adults living with DM (Cronbach's α=0.83) [7], translated Chinese version (Cronbach's α=0.92) [14], in parents of children with diabetes Type 1 (Cronbach's α=0.84), and in young patients living with Type 1 DM (Cronbach's α=0.80) [15]. All these findings from the previous studies and the present study supported the good reliability index of PDSMS in different study populations as well as in different languages.

Table 3: Factor loadings for the extracted factors (items, n=8) for pilot (n=62) and real (n=252) studies

S. No.	Items	Factors		
		Single	Positive	Negative
1	It is difficult for me to find effective solutions for problems that occur with managing my diabetes	0.655		0.635
2	I find efforts to change things (problems and bad health habits). I do not like about my diabetes are ineffective	0.619		0.795
3	I handle (manage) myself well with respect to my diabetes	0.388	0.639	
4	I am able to manage things (problems or regimens) related to my diabetes as well as most other people	0.645	0.856	
5	I succeed in the projects I undertake to manage my diabetes	0.595	0.704	
6	Typically, my plans for managing my diabetes do not work out well	0.448		0.713
7	No matter how hard I try, managing my diabetes does not turnout the way I would like	0.530		0.792
8	I am generally able to accomplish my goals with respect to managing my diabetes	0.605	0.709	
	Eigen value	2.58, 1.87	2.58	1.87
	Percentage proportion of variance explained	55.74	32.26	23.48
	Construct reliability (Cronbach's α)	0.69	0.71	0.72

Table 4: Reliability analysis of PDSMS for pilot (n=62) and real (n=252) studies

Item	Scale mean if item deleted		Scale variance if item deleted		Corrected item-total correlation		Cronbach's alpha if item deleted	
	Pilot	Real	Pilot	Real	Pilot	Real	Pilot	Real
1	24.44	24.56	10.61	14.61	0.479	0.472	0.634	0.734
2	24.24	24.34	10.87	15.56	0.468	0.420	0.638	0.743
3	23.44	23.39	13.20	17.34	0.207	0.354	0.695	0.752
4	23.74	23.71	11.90	16.22	0.418	0.478	0.652	0.733
5	24.11	24.13	12.52	16.45	0.371	0.393	0.663	0.746
6	24.27	24.19	12.07	14.72	0.318	0.573	0.676	0.713
7	24.40	24.36	11.75	14.32	0.410	0.532	0.653	0.721
8	23.74	23.82	12.85	16.06	0.387	0.460	0.663	0.735

PDSMS: Perceived diabetes self-management scale

Table 5: Items measure of PDSMS for pilot study by Rasch model (n=62)

Entry number	Total score	Total count	Measure	Model SE	Infit		Outfit		PT measure-A		Exact match	
					MNSQ	Zstd	MNSQ	Zstd	Correlation	Exp.	Obs. (%)	Exp. (%)
1	189	62	0.76	0.17	1.09	0.6	1.09	0.6	0.67	0.59	45.2	48.1
2	201	62	0.42	0.17	1.06	0.4	1.12	0.8	0.64	0.57	48.2	48.3
3	251	62	−1.37	0.22	1.44	1.9	1.35	1.6	0.41	0.49	61.3	64.0
4	232	62	−0.58	0.19	0.99	0.0	0.93	−0.3	0.56	0.52	62.9	57.5
5	209	62	0.18	0.17	0.75	−1.6	0.87	−0.8	0.54	0.56	66.1	47.4
6	199	62	0.47	0.17	1.11	0.7	1.36	2.0	0.50	0.58	51.6	48.4
7	191	62	0.71	0.17	0.87	−0.7	0.94	−0.3	0.60	0.59	54.8	48.1
8	232	62	−0.58	0.19	0.65	−2.1	0.74	−1.4	0.50	0.52	71.0	57
Mean±SD	213.0±21.2	62.0±0.0	0.00±0.71	0.18±0.02	1.00±0.23	−1.05±1.2	1.05±0.21	0.3±1.1	-		57.7±8.5	52.4±5.9

SD: Standard deviation, PT: Prothrombin time, MNSQ: Mean square, Zstd: Z-standard, PDSMS: Perceived diabetes self-management scale, SE: Standard error

Table 6: Items measure of PDSMS for real study by Rasch model (n=252)

Entry number	RAW score	Count	Measure	Model SE	Infit		Outfit		PT measure-A	Exact match	
					MNSQ	Zstd	MNSQ	Zstd	Correlation	Obs. (%)	Exp. (%)
1	739	250	0.69	0.08	1.15	1.8	1.16	1.8	0.58	42.8	43.7
2	796	250	0.37	0.08	1.08	1.0	1.13	1.4	0.52	46.4	43.5
3	997	250	−1.07	0.10	1.38	3.2	1.14	3.5	0.43	65.2	62.1
4	925	250	−0.47	0.09	0.89	−1.2	0.82	−1.9	0.57	59.6	54.9
5	830	250	0.16	0.08	0.84	−2.1	0.85	−1.7	0.54	49.2	45.7
6	822	250	0.21	0.08	0.75	−3.3	0.75	−3.0	0.64	55.2	45.6
7	788	250	0.41	0.08	1.07	0.90	1.09	1.1	0.60	43.6	43.4
8	903	250	−0.31	0.08	0.90	−1.1	0.85	−1.6	0.56	60.4	51.8
Mean±SD	850.0±79.3	250.0±0.0	0.00±0.54	0.08±0.01	1.01±0.19	−0.1±2.0	1.01±0.21	0.1±2.0	-	52.8±7.9	48.8±6.4

SD: Standard deviation, PT: Prothrombin time, MNSQ: Mean square, Zstd: Z-standard, PDSMS: Perceived diabetes self-management scale, SE: Standard error

In the current study, PCA yielded a two-factor solution (Eigen value >1) supported the design of the scale. After a varmix rotation, it was clear that the first factor consisted mainly of the four "positively worded" PDSMS items (3, 4, 5, and 8), while the second factor consisted of the four "negatively worded" items (1, 2, 6 and 7), factor loadings >0.7 proved the excellent loading. While in single factor structure values for loading factors were higher than 0.5, as suggested by the original English version where Walleston *et al.* also observed two factors structure with high loading value. But they argued that the high loading values were because of positive and negative worded items; therefore, it was preferred to retain these 8 items of the scale in a single factor. The items loaded were higher than 0.3 in pilot and real studies except item number 3 in pilot that has loaded factor <0.3. In MTT, the output tables showed that all items fit the model in both pilot and real studies.

CONCLUSION

The comprehensive analysis of psychometric properties of the M-PDSMS proved to be valid and highly reliable scale that is conceptually equivalent to the original English version, easy to understand for the Malaysian adult DM patients. For future studies and research, M-PDSMS can be used in clinical practice and research to address the issues of self-management of Malaysian patients living with DM.

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