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Assessing Diabetes Distress Among Type 2 Diabetes Mellitus in Malaysia Using the Problem Areas in Diabetes Scale

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ABSTRACT

Objectives: To validate, from a psychometric perspective, the Problem Areas in Diabetes (PAID) questionnaire in patients with type 2 diabetes mellitus from Malaysia. **Methods:** A total of 497 patients with type 2 diabetes mellitus were recruited from public hospitals in the state of Selangor through convenience sampling. Construct validity was evaluated through confirmatory factor analysis. Internal consistency of the instrument was tested by Cronbach α. Criterion validity and discriminant validity were also used. **Results:** The PAID instrument consisted of 3 factors: social support problem, food-related problem, and emotional distress problem. The Cronbach α values of the 3 factors showed adequate internal consistency with α values greater than 0.90. The present confirmatory factor analysis model achieved a good fit with a comparative fit index value of 0.923. Satisfactory criterion validity was also demonstrated because there existed positive significant association between glycated hemoglobin A_{1c} and diabetes duration. **Conclusions:** The PAID questionnaire in Malaysia was found to be a reliable and valid instrument exhibiting good psychometric properties.

Keywords: confirmatory factor analysis, Problem Areas in Diabetes (PAID) Scale, reliability, type 2 diabetes mellitus, validity.

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Introduction

Type 2 diabetes mellitus (T2DM) has become a common and burdensome disease requiring a careful and complex management, with oftentimes a daily treatment regimen.[1] For patients living with T2DM, daily treatment can lead to a considerable impact on many domains of quality of life.[2–4] Psychological factors affecting a patient's attitude toward life are strongly related to emotional distress.[5] Diabetes treatment can have a significant impact on work, social functioning, and the physical and emotional well-being of the patient.[1] The burden of care also might lead to distress among close relatives of patients with T2DM.[6,7] It has been long known that the daily management of diabetes can cause long-term stress.[8] Psychosocial determinants in patients with T2DM have often led to obstruction in self-care and diabetes management.[9] Poor self-care behaviors may lead to psychological distress,[10,11] thereby increasing the risk of developing diabetes-specific distress. Because of the impact of prospective long-term complications and its severe influence on the actual state of DM, many patients are worried and preoccupied with the fear of the accompanying serious complications.[6,12] This explains the recent findings that depression in patients with T2DM is fourfold than that in the general population[11] and that patients with T2DM who are depressed duly suffer from an increased level of diabetes-specific emotional distress,[13,14] where diabetes-specific emotional distress in turn affects the quality of life of patients.[15,16]

A well-known instrument for evaluation of distress is the Problem Areas in Diabetes (PAID) questionnaire, but the factor structure of PAID has been debated in nearly all validation studies. Initially, it was regarded as a 3-factor latent-dimensional instrument.[1] Nevertheless, validation of PAID among Dutch and US researchers[17] led to a 4-factor solution. The 4 factors were labeled as "emotional problems," "treatment problems," "food problems," and "lack of support." Other studies argued for a 2-factor solution after using oblimin rotation,[18] orthogonal rotation,[19] and

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varimax rotation.[20] Different studies extracted different factor structures of PAID. In Asian countries, it was observed that PAID consisted of a 2-factor solution[18] in certain cases, whereas a 3-factor structure was obtained in other cases.[21,22] One study[23] validated PAID as a 1-factor instrument as per the original study by Welch et al.[1] In European countries, 3 factors were obtained for PAID in one case[8] and 2 factors in another.[20] In the United States, PAID was reported to have a 4-factor structure,[5,17] which was surprisingly not described in European or Asian countries. Two factors were observed for an African-American population.[19] In brief, the PAID Scale might not be measurement-invariant and validation might be context- and language-specific. This prompts toward the need of context-specific studies. In this study, we will provide validation of the PAID instrument with patients with T2DM from Malaysia. Validation of the PAID instrument for the population of Malaysia has not been tackled so far, and might be useful for disseminating the use of PAID in Malaysia, thus improving the standards of care in this country. Besides validating the instrument and obtaining a 3-factor structure, we will also contribute to the ongoing debate about the psychometric characteristics of the PAID instrument in Asian countries.

Methods

Study Design

This study is based on a cross-sectional design. A total of 497 patients were recruited from 3 hospitals in the state of Selangor, Malaysia (Hospital Tuanku Ampuan Rahimah, Hospital Sungai Buloh, and Hospital Serdang), and a government public health clinic (Klinik Kesihatan Botanic). Patients were included if they were older than 18 years, diagnosed with T2DM since at least 1 year, used T2DM medications, and were able to speak, read, and write in either English or Malay. Patients were excluded if they had gestational diabetes or mental disorders. The sample size was calculated using a rule of thumb for structural equation modeling according to which a minimum of 200 subjects are necessary for adequate model specification. The Medical Research Ethics Committee in Kuala Lumpur, Malaysia, through the National Medical Research Register (NMRR-13-640-15679), granted permission for this research.

Overall, the sample comprised 53.7% men and 46.3% women. The mean age was 55.5 ± 10.9 years and ranged from 25 to 85 years. The mean duration of diabetes was 9.97 ± 7.74 years, ranging from 1 to 37 years. The mean body mass index was 28.56 ± 6.51, ranging from 14.84 to 72.62 kg/m^2. The mean duration of oral medication intake was 9.25 ± 7.75 to control their diabetes. In addition, the mean duration of insulin injection was 4.09 ± 4.53 years. In this sample, 47.7% were Malays (n = 237), 34.8% were Indians (Punjabis) (n = 173), and 17.5% (n = 87) were Chinese. Most of the respondents were married (83.9%) and attended secondary school (54.3%). For those who were working, the most frequently reported income was less than RM1000 (42.9%). Most participants were living with their spouse and children (59.6%) or only spouse (16.3%) and only 2.8% were living alone.

Instrumentation

The PAID Scale,[6] developed at the Joslin Diabetes Clinic, is a brief self-report measure of diabetes-specific emotional distress. This

Table 1 – Exploratory factor analysis for PAID.

Item	Factor 1	Factor 2	Factor 3
Factor 1: Social support problem			
Not "accepting" your diabetes	0.433		
Feeling unsatisfied with your diabetes physician	0.603		
Feeling that diabetes is taking up too much of your mental and physical energy every day	0.572		
Feeling alone with your diabetes	0.852		
Feeling that your friends and family are not supportive of your diabetes management efforts	0.690		
Coping with complications of diabetes	0.662		
Feeling "burned out" by the constant effort needed to manage diabetes	0.816		
Factor 2: Food-related problem			
Feelings of deprivation regarding food and meals		0.814	
Worrying about low blood sugar reactions		0.940	
Feeling constantly concerned about food and eating		0.632	
Worrying about the future and the possibility of serious complications		0.792	
Feelings of guilt or anxiety when you get off track with your diabetes management		0.582	
Factor 3: Emotional distress problem			
Not having clear and concrete goals for your diabetes care			0.973
Feeling discouraged with your diabetes treatment plan			0.787
Feeling scared when you think about living with diabetes			0.466
Uncomfortable social situations related to your diabetes care			0.466
Feeling depressed when you think about living with diabetes			0.547
Not knowing if your mood or feelings are related to your diabetes			0.712
Feeling overwhelmed by your diabetes			0.486
Feeling angry when you think about living with diabetes			0.594
Cronbach α	0.906	0.813	0.912
Eigenvalue	10.4	1.52	1.00
Percentage variance	52.0	7.58	5.04

PAID indicates Problem Areas in Diabetes Scale.

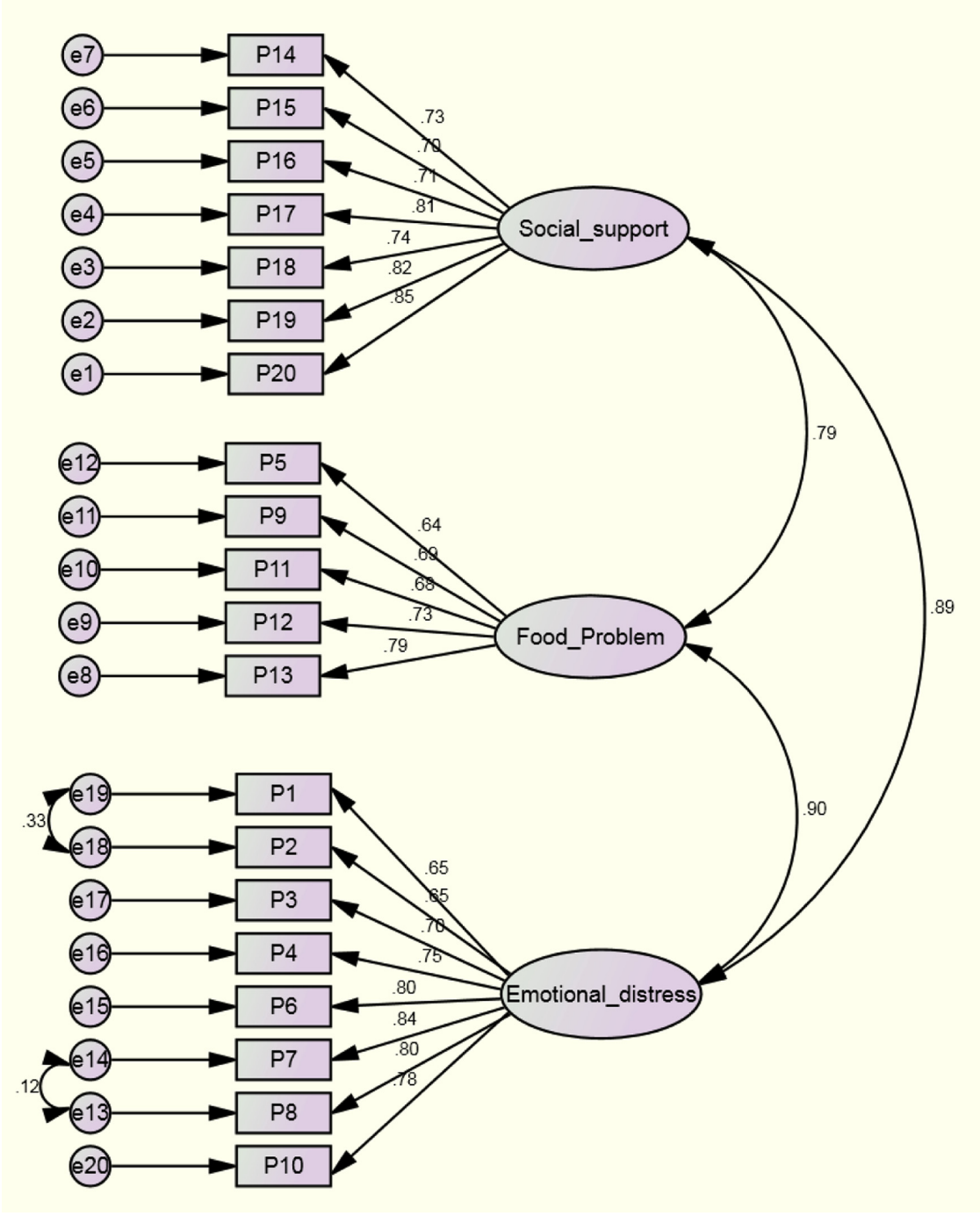

Fig. 1 – First-order model of PAID. PAID indicates Problem Areas in Diabetes Scale.

Table 2 – Fit indices for the PAID model.

Model	χ^2/df	GFI	AGFI	NFI	TLI	CFI	RMSEA (95% CI)
Model 1	4.052	0.881	0.849	0.900	0.911	0.923	0.078 (0.072-0.085)

AGFI indicates adjusted goodness-of-fit index; CFI, comparative fit index; CI, confidence interval; GFI, goodness-of-fit index; NFI, normed fit index; PAID, Problem Areas in Diabetes Scale; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index.

Table 3 – Path coefficients for the PAID model.

Item	Factor	Standardized regression weights	Unstandardized regression weights	SE
14	Social support	0.730	0.902	0.047
15	problem	0.703	0.802	0.044
16		0.712	0.870	0.047
17		0.809	0.894	0.040
18		0.736	0.815	0.042
19		0.820	0.956	0.042
20		0.854	1.000	–
5	Food problem	0.638	0.774	0.054
9		0.688	0.851	0.054
11		0.680	0.836	0.054
12		0.725	0.922	0.055
13		0.792	1.000	–
1	Emotional	0.646	0.827	0.054
2	distress	0.652	0.766	0.049
3	problem	0.696	0.915	0.054
4		0.751	0.878	0.047
6		0.802	1.002	0.050
7		0.837	0.970	0.042
8		0.803	1.000	–
10		0.782	0.959	0.049

PAID indicates Problem Areas in Diabetes Scale; SE, standard error.

instrument consists of 20 items, which capture a range of emotional problems relating to diabetes. The questionnaire is useful in clinical studies as an outcome measure to assess diabetes-related distress and to examine its impact on psychological adjustment of the patients.[1] The items were pooled from patients' feedback from 10 healthcare providers, which finally resulted in a 20-item measure.[6] Previous studies have revealed that PAID was a psychometrically sound measure to map emotional distress in diabetes,[17,24] but, as discussed in the Introduction section, its psychometric characteristics are context- and language-dependent and hence an assessment for the Malaysian region is needed.

Statistical Analyses

Data were analyzed using IBM SPSS Statistics 22.0 and IBM SPSS AMOS 18.0 (IBM Corporation, Armonk, NY). Construct validity was used to test the degree to which a test measures what it is designed to measure. Before that, a factor analysis was used to determine the factor structure in Malaysia. Confirmatory factor analysis (CFA) was used on the basis of previous studies mentioned in the Introduction section. A comparative fit index (CFI), Tucker-Lewis index (TLI), and normed fit index (NFI) of more than 0.9 were taken as indicative of a good fit. Interestingly, none of the models based on previously published factors achieved a good model fit. Internal consistency of the scale was assessed by Cronbach α coefficient with a cutoff of 0.70. Before testing the construct validity, the data were checked for normality, outliers, and multicollinearity.

After the CFA, convergent validity of the factors was tested. Convergent validity is the extent to which indicators of a specific construct share a high proportion of variance in common. The rules of thumb for determining the convergent validity are (1) standardized factor loadings of 0.5 or higher, and ideally 0.7 or higher; (2) an average variance extracted (AVE) greater than 0.50; and (3) construct reliability greater than 0.7 to indicate adequate convergence.[25]

Table 4 – Correlations of PAID for criterion validity.

Variable	1	2	3
PAID	1		
HbA_{1c}	0.199*	1	
Diabetes duration	−0.081	0.138†	1

HbA_{1c} indicates glycated hemoglobin A_{1c}; PAID, Problem Areas in Diabetes Scale.
* Correlation significant at .010 level.
† Correlation significant at .050 level.

Results

In the exploratory factor analysis, the first factor was based on 7 items, where an eigenvalue of 10.4 accounted for 52.0% of the total variance. Factor loadings of factor 1 were higher than 0.30, ranging from 0.433 to 0.852. Factor 2 had an eigenvalue of 1.52, accounting for 7.58% of the total variance extracted. Factor 3 had an eigenvalue of 1.00 and accounted for 5.04% of the total variance. Factors 2 and 3 had 5 and 8 items, respectively. The factor loadings of factors 2 and 3 ranged from 0.486 to 0.973. The Cronbach α for all these factors were higher than the 0.70 threshold for good internal reliability (see Table 1).

A first-order CFA model was then specified. PAID consisted of 3 factors, namely, social support problem, food problem, and emotional distress problem from the factor analysis results. The social support construct had 7 items, the food problem construct was composed of 5 items, and finally the emotional distress construct had 8 items. Two errors were allowed to correlate: P1 ↔ P2 and P7 ↔ P8 due to high modification indices. Figure 1

Table 5 – AVE and CR values for the 3 constructs.

Construct	Item	Factor loading	AVE	CR	CA
Social support problem	14	0.738			
	15	0.691			
	16	0.707			
	17	0.789			
	18	0.775			
	19	0.812			
	20	0.853	0.590	0.909	0.906
Food problem	5	0.600			
	9	0.743			
	11	0.639			
	12	0.773			
	13	0.762	0.500	0.832	0.813
Emotional distress problem	1	0.655			
	2	0.653			
	3	0.701			
	4	0.751			
	6	0.795			
	7	0.829			
	8	0.809			
	10	0.780	0.562	0.911	0.912

AVE indicates average variance extracted; CA, Cronbach α; CR, construct reliability.

Table 6 – Squared correlations among the 3 constructs.

Construct	1	2	3
Social support problem	**0.590**	0.738*	0.856*
Food problem	0.545	**0.500**	0.856*
Emotional distress problem	0.732	0.732	**0.562**

Note. Boldfaced diagonal values represent AVE values; upper diagonal values are the correlations, and lower diagonal values are squared interconstruct correlations.
AVE indicates average variance extracted.
* P<.001.

shows the PAID first-order CFA model. The results indicated that this model (first-order CFA) was a good fitting model (see Table 2). The $\chi 2$ ($df = 165$) was 668.6 and the χ^2/df was 4.052, which was below the threshold value of 5. The NFI was 0.900, TLI was 0.911, and CFI was 0.923, which were above the 0.90 cutoff value. Table 2 presents the fit indices of the PAID model. Table 3 presents the standardized estimates of the PAID items.

To assess the criterion validity of PAID, the assumption of this study was that diabetes-related distress is an important predictor of blood glucose control and duration of diabetes. Emotional distress can have a significant impact on physical outcomes such as the glycemic level (HbA_{1c}). Furthermore, duration of diabetes is thought to have also a consequent effect of emotional distress. Therefore, the existence of an association between HbA_{1c} indicator and duration of diabetes with PAID total score was investigated. The assumption of normality was first met before evaluating the criterion validity of the PAID score. The PAID score ranged from 0 to 100 with a mean of 35.72 ± 22.8. The descriptive statistics results showed that the total PAID score was approximately normal, with a skewness of 0.357 and a kurtosis of −0.686. Nearly all the points fell on the straight line in the Q-Q plot, indicating a normal distribution, and the box plot showed no outliers.

Table 4 presents the correlation analysis results. The PAID score was positively associated with HbA_{1c} ($r = 0.199$; $P<.050$). Nevertheless, there was no significant association between the PAID total score and diabetes duration ($P>.050$). The results suggested that higher levels of diabetes-related distress are related with higher HbA_{1c} values. Furthermore, the findings showed a positive significant association between HbA_{1c} and diabetes duration ($r = 0.138$; $P<.050$). Hence, satisfactory criterion validity was demonstrated for PAID.

The results indicated that all the item factor loadings were higher than 0.60. The AVE values for the social support problem, food problem, and emotional distress problem were 0.59, 0.50, and 0.562, respectively. In addition, the construct reliabilities for all 3 constructs were greater than 0.70, indicating adequate convergence or internal consistency. These results show that the 3 constructs had adequate convergent validity (see Table 5).

The AVE for social support problem (0.590) and food problem (0.500) was not greater than the squared interconstruct correlation (SIC; 0.545). The AVE for social support problem (0.590) and emotional distress problem (0.562) was not greater than the SIC (0.732). In addition, the AVE for food problem (0.500) and emotional distress problem (0.562) was not greater than the SIC (0.732). These results suggested that discriminant validity is not established. When high correlations exist, the 2 constructs can be combined or can be represented by a second-order factor model. In this study, the constructs were represented by a second-order factor model (see Table 6).

Discussion

Findings from the present study did support a 3-factor structure for the Malay version of PAID, with a good reliability. The 3 factors extracted were labeled as social support problems, food-related problems, and emotional distress problems. The CFA results of the PAID Scale showed satisfactory fit indices (CFI = 0.90; root mean square error of approximation = 0.090), suggesting adequate construct validity. The 3-factor solution was similar to the one obtained in validation studies for Sweden,[8] Greece,[21] and Iran.[22] It shall be noted that only few studies reported formal CFA results of the factor structure of PAID. The correlated error terms we obtain indicate that some items may be redundant, and the PAID questionnaire could be shortened, thus increasing its internal validity. For example, items 1 ("Feeling discouraged with your diabetes treatment plan") and 2 ("Not having clear and concrete goals for your diabetes care") are both strongly and equally associated with discouragement.

In their struggle with T2DM, many people have difficulties in complying with the treatment regimen. This is also clearly associated with a myriad of feelings such as emotional distress, anger, guilt, frustration, loneliness, and denial.[6,7] Diabetes-specific stressors lead to poor glycemic control and self-care.[26,27] In this respect, a scale whose psychometric properties are known is helpful for identification of diabetes distress and consequently patients at risk of lack of compliance and low quality of life. In further work we will explore more general[28,29] and robust[30] approaches for validation of the Malaysian questionnaire.

Conclusion

The psychometric properties of PAID demonstrated satisfactory validity and reliability. The results of this study were also consistent with previous psychometric studies of PAID from the originators and other researchers. Therefore, the MY-PAID-20 is a reliable and valid scale to assess the diabetes distress among the Malay-speaking patients with T2DM. However, the limitation of this study is that the study sample consists of only patients with type 2 diabetes, whereas some other studies include patients with both type 1 and type 2.

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