Developing and Psychometric Testing of a Short-Form Problem Areas in Diabetes Scale in Chinese Patients

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ABSTRACT

Background: The 20-item Problem Areas in Diabetes (PAID) scale is widely used to measure diabetes-related emotional distress. The short-form PAID scale is helpful for the rapid screening of diabetes-related emotional distress in clinical settings.

Purpose: This study developed and examined the psychometric properties of a short-form Chinese-version PAID (SF-PAID-C) scale.

Methods: The Chinese-version 20-item PAID (PAID-C) scale was administered to 855 patients with type 2 diabetes mellitus. Item analysis, exploratory factor analysis, and confirmatory factor analysis were then applied to develop the SF-PAID-C and evaluate its construct validity. The correlations between SF-PAID-C and the latest HbA1c close to the measurement of PAID-C (baseline HbA1c) 3 months and 12 months later were used to examine the concurrent and predictive validity of the SF-PAID-C. Receiver operating characteristic curve analysis was used to examine the sensitivity and specificity of the SF-PAID-C.

Results: An 8-item SF-PAID-C was developed. The SF-PAID-C significantly correlated with the PAID-C (r = .941, p < .001), baseline HbA1c (r = .148, p < .001), 3-month HbA1c (r = .147, p < .001), and 12-month HbA1c (r = .142, p < .001). The sensitivity and specificity of the SF-PAID-C were 93.2% and 94.2%, respectively. The Cronbach’s α and test–retest reliability of the SF-PAID-C were .95 and .93, respectively.

Conclusions/Implications for Practice: The SF-PAID-C is a reliable and valid scale that can be used to screen for diabetes-related emotional problem in Chinese patients with type 2 diabetes mellitus in clinical settings.

Key Words: diabetes, Problem Areas in Diabetes, emotional distress.

Introduction

In Taiwan, diabetes mellitus (DM) affects 9.2% of the population and is currently the fourth leading cause of death (Department of Health, Executive Yuan, Taiwan, ROC, 2012). To prevent the progression of complications, patients with diabetes are often required to adhere to a complex and demanding regimen. Hence, living with diabetes can become a burden and cause significant psychological distress in patients with type 2 DM (Karlsen, Oftedal, & Bru, 2012).

Increasing psychosocial distress can stimulate the release of hormones that directly influence glycemic control (Ely, Zavaskis, & Wilson, 2011). Emotional distress is an important problem for patients with diabetes, and previous studies have correlated emotional distress negatively with diabetes self-care behaviors and glycemic control (Ogbera & Adeyemi-Doro, 2011; Wang, Wu, & Hsu, 2011). Emotional distress not only impacts the mental health of patients with diabetes but also affects their diabetes control.

The Problem Areas in Diabetes (PAID) scale is valuable for assessing diabetes-specific emotional distress (Polonsky et al., 1995). PAID is a 20-item one-factor self-reported instrument. It measures patient perceptions about the emotional burden of diabetes control, including diabetes-related emotional problems, treatment-related problems, food-related problems, and social support-related problems. After transforming the PAID score to a 0–100 scale, a cutoff score of ≥33 has been shown to be appropriate for identifying subclinical and clinical depression in patients with diabetes (Hermanns, Kulzer, Kirchbaum, Kubiak, & Haak, 2006). Sensitivity and specificity for PAID have been measured as 79% and 76%, respectively.

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PAID is widely used in different cultures, including Chinese populations, to assess diabetes-related emotional distress. These studies have indicated positive relationships between diabetes-related emotional distress and self-care behaviors and glycemic control (Chawla, Saha, & Marrero, 2010; Eom et al., 2011; Huang, Courtney, Edwards, & McDowell, 2010; Nozaki et al., 2009; Ogbera & Adeyemi-Doro, 2011). PAID can facilitate dialogue between patient and physician, which in turn, can improve glycemic control and satisfaction in patients with type 2 diabetes (Chawla et al., 2010). Furthermore, PAID has been appraised to be one of the most useful scales for measuring diabetic education outcomes (Eigenmann, Colagiuri, Skinner, & Trevena, 2009).

Different factor structures of PAID have been identified in different populations. In a Dutch study, a four-factor structure including diabetes-related emotional problems, treatment-related problems, food-related problems, and social support-related problems was identified (Dutch-PAID; Snoek, Pouwer, Welch, & Polonsky, 2000). In Swedish-speaking patients, a three-factor structure including diabetes-related emotional problems, treatment-related problems, and support-related problems was identified for type 1 DM patients (Amsberg, Wredling, Lins, Adamson, & Johansson, 2008). In an Icelandic study, a two-factor structure including distress in relation to life with diabetes and management of diabetes was identified in insulin-requiring patients (Siguurdardottir & Benediktsson, 2008). In Taiwan, a 20-item single-factor Chinese version of PAID (PAID-C) was identified in people with type 2 DM (Huang et al., 2010). The attribute or conceptual structure of emotional distress may be different because of different diabetes types or cultural backgrounds.

Diabetes-related emotional distress can be effectively managed (Lustman, Clouse, & Freedland, 1998). Assessing diabetes-related emotional distress and providing adequate care have been emphasized for patients with diabetes in clinical practice (American Diabetes Association, 2013). However, wider clinical utilization of PAID may be limited because of its length (McGuire et al., 2010). In clinical settings, a short-form PAID is a helpful tool to rapidly screen for diabetes-related emotional distress. Recently, a five-item short form of the PAID (PAID5) was developed for Western populations (McGuire et al., 2010). PAID5 showed good sensitivity (94%) and specificity (89%). The PAID5 included three items related to diabetes-related emotional problems, one item related to food-related problems, and one item related to social support-related problems. However, PAID5 might not be appropriate for Chinese patients because of cultural difference. The aim of this study was to develop a short-form PAID-C (SF-PAID-C) and test its psychometric properties in a Chinese population with type 2 DM.

**Methods**

**Sample**

Convenience sampling was used to recruit participants from an outpatient diabetes clinic in southern Taiwan. Patients having type 2 DM for at least 6 months were invited to participate. Exclusion criteria were age of ≤18 years, being pregnant, having cognitive disabilities (dementia, mental retardation), or having a history of cerebrovascular disease. A well-trained certified diabetes educator applied standardized procedure to interview the participants when patients visited clinics. Eight hundred fifty-five patients with type 2 DM were recruited. This study was conducted from September 2010 to March 2011.

**Statistical Methods**

To develop SF-PAID-C from PAID-C, items of PAID-C that did not sufficiently contribute to emotional distress were examined using the following procedures. First, item analysis was conducted. Items of the PAID-C that did not sufficiently contribute to emotional distress were excluded.

**Ethical Considerations**

The institutional review board of Tri-Service General Hospital approved the study protocol. Participants were informed that they could refuse or withdraw from the study at any time. Participants signed a consent form before questionnaires were administered.
correlation of <0.4 or an absolute value of skewness or kurtosis of ≥2 were deleted (Ferketich, 1991).

Exploratory factor analysis (EFA) using a principal component method with Promax rotation was used to examine the factor structure of retained items. Items with a factor loading lower than 0.7, which indicated that the explained variance was lower than 50%, were discarded. To cross-validate the factor structure produced by EFA, confirmatory factor analysis (CFA) was conducted on different samples. The full sample (n = 855) was divided randomly into two groups. Data on 428 patients (group 1) and 427 patients (group 2) were used to perform EFA and CFA, respectively.

CFA was performed using a structural equation-modeling program by EQS (version 6.1). Goodness-of-fit was evaluated using the χ²/df ratio, comparative fit index (CFI), nonnormed fit index (NNFI), and root mean square error of approximation (RMSEA). The model fit was considered acceptable if the χ²/df ratio was lower than 3, both the CFI and NNFI were higher than 0.90, and the RMSEA was lower than 0.08 (Hu & Bentler, 1999; Ullman, 2006).

Correlations between SF-PAID-C, PAID-C, and baseline HbA1c were examined to assess the concurrent validity of the SF-PAID-C. Correlations between the SF-PAID-C and the 3-month HbA1c and 12-month HbA1c were used to examine the predictive validity of the SF-PAID-C. Cronbach’s α was calculated to assess internal consistency. Data from 855 participants were used in this step.

The SF-PAID-C was administered to 24 patients with type 2 DM who satisfied the inclusion criteria in a 2-week interval. The intraclass correlation coefficient was calculated to assess test–retest reliability.

A cutoff score of ≥33 for the 20-item PAID-C was the criterion used to examine SF-PAID-C sensitivity and specificity. Receiver operating characteristic curve analysis was used to identify the diagnostic accuracy and optimal cutoff scores of SF-PAID-C.

### Results

**Participant Characteristics**

Participant mean age was 59.8 ± 11.8 years, with 411 men (48.2%) and 444 women (51.8%). Mean duration of diabetes was 8.9 ± 6.9 years. In terms of treatment methods, 62 (7.2%) used insulin, 631 (73.8%) used oral antihyperglycemic drugs, and 162 (19.0%) used insulin combined with oral antihyperglycemic drugs. The HbA1c levels at baseline, 3 months, and 12 months were 7.84 ± 1.55 (n = 855), 7.70 ± 1.43 (n = 809), and 7.49 ± 1.33 (n = 743), respectively.

**Item Analysis**

After item analysis, nine items (items 5, 7, 12, 13, 14, 15, 16, 19, and 20) had an absolute value of skewness and kurtosis greater than 2.0 and two items (items 3 and 4) had an item–total correlation of <0.4. These items were discarded, and items 1, 2, 6, 8, 9, 10, 11, 17, and 18 were retained. The item–total correlation of the retained items ranged from 0.49 to 0.63. Items related to treatment-related problems and social-related problems were all deleted in the item analysis.

### Construct Validity

First, EFA was conducted on group 1. The value of Kaiser–Meyer–Olkin measure of sampling adequacy was 0.874 (Bartlett’s Test of Sphericity: χ² = 1380.317, df = 45, and p < .001). Item 1 was deleted because the factor loading was lower than 0.7. Two factors that explained 59.59% of the total variance were produced (Table 1), including “diabetes-related emotional problems” (six items) and “food-related problems” (two items).

Second, CFA was conducted on group 2. At least three first-order factors are required for a second-order factor (Rindskopf & Rose, 1988). We performed a two-correlated first-order factor CFA rather than a two-first-order factor to a second-order factor CFA on the 8-item SF-PAID-C. As shown in Table 1, all 8 items were significantly loaded on their corresponding factors produced by EFA. The fit indices were acceptable, with χ²/df = 26.21, df = 19, p < .001, χ²/df ratio = 1.38, NFI = 0.99, NNFI = 0.99, CFI = 0.99, and RMSEA = 0.033 (90% CI [0.001, 0.055]). The correlation coefficient between the two first-order factors was .56.

### Concurrent Validity, Predictive Validity, Internal Consistency, and Test–Retest Reliability

For 855 samples, the score of the SF-PAID-C correlated significantly with the PAID-C (r = .941, p < .001), baseline HbA1c (r = .148, p < .001), 3-month HbA1c (r = .147, p < .001), and 12-month HbA1c (r = .142, p < .001). The Cronbach’s α and intraclass correlation coefficient of the SF-PAID-C were .85 and .93, respectively.

### Sensitivity and Specificity

As shown in Figure 1, a cutoff score for SF-PAID-C of 15 was closest to the intersection of the receiver operating characteristic curve and the dotted diagonal line. The score of 15 provided an optimal balance between sensitivity (93.2%) and specificity (94.2%). The area under curve was 0.98.

### Discussion

This was the first study to develop and test the psychometric properties of the SF-PAID-C in a Chinese population. Our findings suggested that the SF-PAID-C possesses good validity and reliability.

Consistent with PAID5 developed for Western populations, items that related to treatment-related problems were discarded in SF-PAID-C. A previous study indicated that emotional distress related to regimen adherence was not crucial in a Chinese population with type 2 DM (Wang et al., 2011).
Furthermore, patients with diabetes generally perceive a good level of care from care providers because of Taiwan’s nationalized healthcare program (Tien et al., 2008). Therefore, items related to treatment-related problems did not contribute to emotional distress for patients with type 2 DM in Taiwan. Items related to social support-related problems were not included in SF-PAID-C. This result differed from PAID5, which included one item on social support-related problems. Patients with diabetes often perceive a middle-to-high level of social support in Taiwan (Bai, Chiou, Chang, & Lam, 2008). This situation may result in social support-related problems being unimportant for emotional distress among patients with type 2 DM in Taiwan. Food is important in Chinese culture. Thus, it is not surprising that two items related to the food-related problems were retained in the SF-PAID-C. In SF-PAID-C, only the item “feeling guilty or anxious when you get off track with your diabetes management” was also included in PAID5. The structure of SF-PAID-C differed from PAID5. It supported that key indicators of diabetes-related emotional distress differed in different cultures. Chinese populations with type 2 DM place relatively strong emphasis on diabetes-related emotional problems and food-related problems.

In the CFA, the correlation between the subscale of diabetes-related emotional problems and subscale of food-related problems was 0.56, which was lower than .90. This indicates that the subscales of diabetes-related emotional problems and food-related problems can measure their specific constructs (Kline, 2011). Thus, the construct of SF-PAID-C is adequate.

Although SF-PAID-C included only 8 items, the score of SF-PAID-C highly correlated with the score of PAID-C ($r = .941$). SF-PAID-C had a power similar to PAID-C to measure emotional distress. SF-PAID-C was significantly correlated with baseline HbA1c. These results indicated that the SF-PAID-C had good concurrent validity. In addition, SF-PAID-C could predict 3-month and 12-month HbA1c. The SF-PAID-C has satisfactory predictive validity. Because the score of the SF-PAID-C can predict prospective glycemic control, healthcare providers can apply the SF-PAID-C to educate patients with type 2 DM about the importance of emotional distress for their diabetes control. The Cronbach’s $\alpha$ and intraclass correlation coefficient of SF-PAID-C were higher than 0.7 (Rosner, 2006). The SF-PAID-C has satisfactory reliability.

The area under curve was 0.98, indicating outstanding discrimination for SF-PAID-C (Biggerstaff, 2000). SF-PAID-C sensitivity and specificity were both above 90%, indicating satisfactory screening ability. However, the cutoff criterion ($\geq 33$ of PAID-C) referenced Western populations and thus

![Figure 1. Receiver operating characteristic curve of the SF-PAID-C for screening diabetic-related emotional distress problem.](image-url)
may not be appropriate for Chinese populations. In the future, it will be necessary to test the screening ability of the SF-PAID-C by comparing it with the Chinese version Center for Epidemiology Studies Depression Scale (Cheng, Chan, & Fung, 2006). Furthermore, the Center for Epidemiology Studies Depression Scale can be used as a criterion for testing the concurrent validity of SF-PAID-C.

Participants in this study were selected from a single outpatient clinic, which may limit the generalizability of findings. Follow-on studies should recruit patients from different hospitals to further assess this limitation of the SF-PAID-C. In conclusion, the SF-PAID-C is a shorter and more convenient-to-use tool than the PAID-C that offers comparable validity and reliability in clinical settings. Healthcare providers can use the SF-PAID-C to screen emotional problems in Chinese patients with type 2 DM in the clinic.

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台灣簡版糖尿病問題量表發展及信、效度檢測

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背 景 糖尿病問題量表（Problem Areas in Diabetes, PAID）被廣泛用於評估第二型糖尿病人的
情緒困擾。

目 的 發展台灣簡版之糖尿病問題量表（short-form Chinese-version Problem Areas in Diabetes
scale, SF-PAID-C），並探討其信、效度。

方 法 以20題之中文版糖尿病問題量表（PAID-C）調查855名第二型糖尿病患，透過項目分
析，探索性因素分析及驗證性因素分析簡化量表並評估其建構效度。以SF-PAID-C得分
與PAID-C得分，填寫PAID-C時（基礎）、3個月後及1年後之HbA1c，檢測同時效度及
預測效度。利用ROC曲線（receiver operating characteristic curve）探討簡版量表之敏感
度及特異度。以Cronbach’s α探討內部一致性，以24位第二型糖尿病患探討隔期兩週的
再測信度。

結 果 簡版的8題SF-PAID-C包含「糖尿病相關情緒問題」及「飲食相關問題」次量表。
SF-PAID-C與PAID-C有顯著相關性（r = .941; p < .001），也與基礎、3個月及12個月
HbA1c皆顯著相關（r = .124~0.148, p < .001），敏感度及特異度分別為93.2%及94.2%。
Cronbach’s α為.85，再測信度為.93。

結 論／ 實務應用 簡版8題版糖尿病問題量表具有良好信、效度，未來可用於臨床快速評估糖尿病病患情
緒困擾問題。

關鍵詞：糖尿病、糖尿病問題量表、情緒困擾。