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Factorial structure and psychometric analysis of the Persian version of Perceived Competence Scale for Diabetes (PCSD-P)

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Abstract: Background: Level of perceived competence as a basic psychological need could trigger achievement of diabetes self-management goals. Due to lack of a specific data collection tool to measure level of self-competence among Persian speaking patients with diabetes this study was conducted for cross-cultural adaptation and psychometric assessment of the Persian version of Perceived Competence Scale for Diabetes (PCSD-P). **Methods:** Standard translation/back-translation procedure was carried out to prepare a preliminary draft of the PCSD-P. Content and face validity of the early draft were checked by an expert panel including 15 scholars in the field of health education and promotion as well as nursing education with experience of working and research on diabetes. The final drafted questionnaire was completed by 177 randomly selected patients with type 2 diabetes. Based on the collected data structural validity of the contrived version was appraised using exploratory and confirmatory factor analysis (EFA, CFA). Cronbach's alpha and Intraclass Correlation coefficients (ICC) were used to check the scale's reliability and internal consistency. (3) **Results:** The estimated measures of Content Validity Index (CVI= 0.95) and Content Validity Ratio (CVR= 0.8) were in the range of acceptable recommended limits. The EFA analysis results demonstrated a single factor solution according to the items' loadings for the component. The model fit indices i.e. RMSEA= 0.000, CFI=1, TLI=1, GFI= 0.998, NFI= 0.999 RFI= 0.995 confirmed consistency of the hypothesized one-factor solution. Values of the internal consistency and reliability coefficients were also in the vicinity of acceptable range ($\alpha= 0.892$, ICC=0. 886, P= 0.001). **Conclusions:** The study findings revealed good internal validity and applicability of the PCSD-P to measure degree of self-competence among Persian speaking type 2 diabetes patients to manage the chronic disease. Due to unrepresentativeness of the study sample future cross-cultural test of PCSD-P on diverse and broader Persian speaking populations is recommended.

Keywords: Validation; Questionnaire Design; Self-Perception; Diabetes Mellitus; Self Care

1. Introduction

Perceived competence to perform disease management tasks and accomplish allied self-care expectations could be an important player in combating against devastating complications of a lifelong persisting disorder such as diabetes. This subjective sense of capability could help patients with diabetes in attempts to manage their disease i.e. maintain recommended level of blood glucose and prevent its related complications [1].

Successful management of disease and provision of required cares for patients with diabetes substantially has evolved to one of the major challenges for health systems in recent decades. Given the current number of recognized cases of type 2 diabetes (425 million) [2] it is a ponderous task for

many health care networks to consolidate generally limited resources for diabetes care and prevention of the related complications [3].

Robust research evidence exist to indicate reciprocal association between perceived competence for self-management of type 2 diabetes and outcome measure of blood glucose level [1,4]. The competence is generally reflected on the patients' nutritional behavior, physical activity pattern and stress control and maintaining and overall type 2 diabetes compatible life style [4,5].

Perceived competence is closely related to concept of self-efficacy [1] and introduced as one of the important constructs of the Self-Determination Theory (SDT) [6,7] in addition to the motivation and perceived support for individual autonomy [1]. Based on the theory; support of autonomy and motivation could independently lead to adaption of health boosting behaviors and consequent better health profile [1].

Due to wide range of attributes that might affect control of blood glucose level in patients with type 2 diabetes such as severity of the disease, stressful life events, depression, social support and the patients' socioeconomic status and baseline mental status, health care providers (HCPs) should take into account psychological needs of the patients by supporting their autonomy, respecting their viewpoints and dignity simultaneously with provision of consistent information about the disease management skills. All these circumspections have been proven to pose favorable effects on level of perceived competence amongst type 2 diabetes patients for self-management of their illness, acquisition of healthy behaviors and maintaining of a decent lifestyle over the disease life course [1,4,6].

Different scales were invented to assess perceived competence level including the Children's Perceived Competence Scale (CPCS) which was used in study on chronic diseases [8] perceived competence for patient-centered obesity counseling [9] and physical activity [10-11], health related quality of life [12], to predict health behavior and health-related quality of life in patients with cardiovascular disease [13] and also measurement of competence level for learning medical contents [14]. The Perceived Competence Scale (PCS) is another tool for measurement of perceived competence based on the SDT and have four short parts. The PCS was suggested to be a consistent instrument for application in different behavioral domains for prediction of participants' feelings or compliance with certain commitments. [15]

The Perceived Competence Scale for Diabetes (PCSD) which was derived from PCS, had been developed by Williams et al. [16] and could be applicable for assessment of the type 2 diabetes patients' self-competence in managing their disease and regulating their daily activities. PCSD has been used in various studies on perceived competence of patients with type 2 diabetes and its impact on the disease control and management [1,16-21]. The PCSD was psychometrically tested in various investigations for application in different languages [16,20,22]. Since, the PCSD was not validated for use in Persian language and due to growing number of type 2 diabetes cases in Iran [23-26] and other Persian speaking countries e.g. Afghanistan [27] and Tajikistan [28] this study was aimed to translate and assess psychometric properties of the PCSD-P for use in Persian speaking patients with type 2 diabetes.

2. Materials and Methods

Study objectives

Main purpose of this study was to translate and psychometric analysis of the Persian version of the Perceived Competency Scale for Diabetes (PCSD-P). Face and content validity appraisal and reliability assessment of the scale was performed according to the standard procedures [29] and exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to test the structural validity of the instrument. Internal consistency and reproducibility of the measure was speculated using the Cronbach α and test-retest Intraclass correlation (ICC) coefficients.

Study Sample

The study participants were 177 randomly selected patients with type 2 diabetes registered in the diabetes clinic of the Shahid Madani Hospital within the city of Khoy, North West of Iran. The sample size was decided to comply with the recommended number of cases per item (at least 5) in order to assure the factor analysis [30-31]. Inclusion criteria were having an active profile in the Diabetes Clinic, age over 30 years old and native Iranian nationality. Exclusion criteria were emigration to other provinces or countries, hospitalization due to severe disabling conditions, considerable limiting mental disorders such as Alzheimer's disease or congenital mental retardation or having a severe limiting disability such as quadriplegia or limiting cardiovascular disease. All these criteria were sought by the research team to guarantee precision of the study attendants' sampling.

Measurements

The original Perceived Competence Scale for Diabetes (PCDS) [16] is a 4-item tool that could measure the degree to which type 2 diabetes patients feel that they can control and manage several aspects of their disease on a daily basis. The respondents rate their degree of agreement with each item of the questionnaire in a 7-point scale (from 1 representing not at all to 7 representing completely true). The lowest achievable total score of the scale is 4 that suggests the lowest perceived level of competence and the highest average score is 28 that indicates a higher perceived self-care competence [17, 22, 32].

The standard translation/ back-translation procedure was applied [33-34] to translate the original English version of the PCSD into Persian (PCSD-P). Two fluent translator at the first stage were changed the English PCSD into Persian and two other proficient translators back translated the Persian version into English. At the latest stage of the process the prepared back translated English version of the PCSD was compared with the original version, minor corrections were made and the final draft was approved by the research team.

Content validity of the PCSD-P was quantitatively and qualitatively appraised through sending the drafted final version of the PCSD-P to a panel of experts including 15 specialists in the field of health education and promotion and nursing staff in the diabetes clinic. Based upon the experts' feedbacks about relevancy, clearness and lucidity of the wordings, the Lawshe introduced item-level content validity ratio (CVR) and the instrument level content validity index (CVI) were calculated which all were in the vicinity of acceptable range (CVI > 0.79 and CVR= 0.49) [29].

To assess internal consistency and reliability of the PCSD-P Cronbach's alpha and Intraclass Correlation (ICC) coefficients were also measured (ICC calculated after completing the PCSD-P by 20 patients twice in 20 days interval).

Data collection: The PCSD-P was completed by the trained interviewers for all the study respondents in face-to-face interview in a non-directive manner and inside one of the clinic's separate and private rooms. The average scale's completion time was in the range of 10-15 minutes. During the interview session the study participants were also questioned about their age, sex, marital status, occupation, level of education, permanent living place, nationality and income.

Procedure and ethical considerations

Ethical approval for this study was obtained from the Medical Ethics Board of Trustees within the Tabriz University of Medical Sciences (approval number: IR.TBZMED.REC.1396.192). All the study participants were provided information about the study objectives, their right to withdraw from the study at any stage without jeopardizing their routine diabetes care or obligation to give reason and also confidentiality of the study data was addressed at the beginning of interview sessions. Written informed consent was received from all the study attendants.

Statistical analysis

The study participants' PCSD-P scores distribution was checked for skewness (standard value between -1 and +1) and kurtosis (standard value of +1.96 to -1.96) and mean and standard deviation

of the scores were estimated [35]. The PCSD-P scores were also examined for ceiling and floor effects i.e to check whether more than 15% of the study participants achieved the highest and lowest possible scores, respectively [30].

The scale's estimated Cronbach's alpha reliability index was deemed satisfactory with value above the threshold level of 0.7 and ICC coefficient as an intuitive measure of the scale's test-retest consistency was approved with its value above 0.61 [30].

To appraise construct validity of the PCSD-P exploratory and confirmatory factor analyses (EFA and CFA) were performed. Calculation of the Keyser-Meyer-Olkin (KMO) index of sampling adequacy and Bartlett's Test of Sphericity to confirm existence of patterned correlation among the scale's items were carried out in the EFA string using the extraction method of Principal Axis Factoring (PAF) and Varimax Rotation. Eigenvalue greater than 1 and factor loadings above 0.3 at this stage were considered significant and used for the factor(s) identification [30]. In the confirmatory factor analysis the considered acceptable ranges were 0.5-0.8 for the Root Mean Square Error Approximation (RMSEA), 0.90-0.95 for the Comparative Fit Index (CFI), $\chi^2 < 3$ for the value of chi square test, values above 0.95 for the Normed fit (NFI) Relative Fit (RFI), Incremental fit (IFI) and Tucker-Lewis indices (TLI) [36-37]. To improve the item-level goodness of fit values and with the modification indices (MI) greater than 7 some residual covariances were added to the model [38-39]. The Statistical Package for the Social Sciences (SPSS) (IBM SPSS, Version 20) and its added module AMOS (Analysis of a Moment Structures) (IBM SPSS Amos Version 22) were used for statistical analysis.

3. Results

3.1. Sample characteristics

Skewness test of the study data revealed a symmetric pattern in the range of a normal distribution (-0.77). The mean total PCSD-P score of the study attendants was 20.79 with the standard deviation of ± 6.46 . Among the study participants 3 individuals (1.7%) had the lowest score (4) and 40 participants (22.6%) the highest score (28).

Mean age and standard deviation of the study sample was 57.49 ± 11.57 (years) of them 64.4% were female and 85.3% were married. Other attributes of the participants were summarized in Table 1.

Table 1. Socio-demographic characteristics of the study participants to assess psychometric properties of the Perceived Competence Scale For Diabetes in Persian (PCSD-P).

Characteristics		Frequency	Rang %
Gender	Male	63	35.6
	Female	114	64.4
Marital Status	Single	2	1.1
	Married	151	85.3
	Widow	22	12.4
	Divorced	2	1.1
Occupation	Employees	10	5.6
	Retired	26	14.7
	Self-employed	23	13
	Housewife	104	58
	Unemployed	3	1.7
	Farmers/ Stockbreeder	11	6.2

Education	Illiterate	63	35.6
	Primary	44	24
	Secondary	23	13
	High school	30	16.9
	Post-graduate degree	17	9.6
Habitation	Urban	145	81.9
	Rural	32	18.1
Income level (RLs: The Iranian national currency)	< 15 million	106	59.9
	≥ 15 million	69	39
	Without any income	2	1.1

Content validity

The calculated CVI and CVR based on the panel of experts' feedbacks verified content and face validity of the PCSD-P. The values of CVR for three questions were higher than 0.8 and for one of the questions above 0.6. The total CVI score of the scale was 0.95 in the vicinity of acceptable range [24].

3.2.2. Construct validity

The EFA preliminary results based on the KMO measure of sampling adequacy (0.842) and value of the χ^2 (748.414, df= 6, P=0.000) ascertained suitability of performing the analysis on the study data. A single factor four-item model fit was identified with all the factor loadings above 0.92 as indicated in Table 2. The pinpointed factor explained 87.470% of the total variance within the study data. The model fit was consistent with the empirically derived model in other psychometric studies of the PCSD [16, 22, 40]. The conducted CFA was also confirmed the structure of the extracted single factor model in the EFA phase (RMSEA=0.000, CFI=1, TLI=1, GFI =.998, NFI= .999 RFI=.995) (Figure 1).

Table 2. Eigenvalues and fit indices in the Psychometric appraisal of the Perceived Competence Scale for Diabetes in Persian (PCSD-P).

Item	PCSD
PCSD1	0.927
PCSD2	0.953
PCSD3	0.934
PCSD4	0.927

Extraction method: principal axis factoring. Rotation method: Varimax,

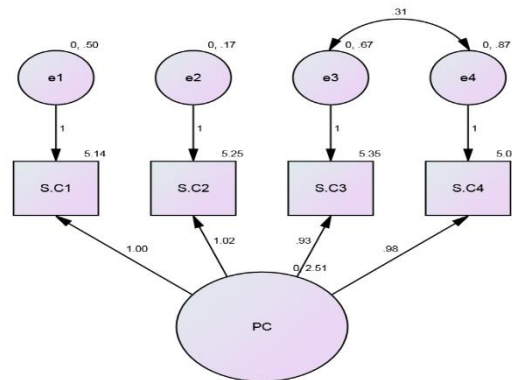


Figure 1. Visual representation of the items loadings in one component model obtained from confirmatory factor analysis ($n=177$) in the Psychometric appraisal of the Persian Perceived Competence Scale for Diabetes (PCSD-P).

3.4. Reliability

The estimated Cronbach's alpha measure of the scale reliability (0.892) and test-retest Intraclass correlation coefficient (ICC) of the scale's consistency and stability over time (0.865, $P=0.001$) all were in the acceptable ranges.

4. Discussion

Main purpose of this study was to psychometric analysis of the Persian version of PCSD (PCSD-P) to be used in research and practice settings for determining degree of perceived competence for self-care among type 2 diabetes patients. The study findings revealed a good and acceptable psychometric property for application in Persian speaking patients suffering from type 2 diabetes. Based on the results which were almost similar to the outputs of other studies on the psychometric assessment of the PCSD in different languages [1, 16-18,20-22], this scale can be considered as a useful tool for pre-assessment of the patients with type 2 diabetes in clinical or research settings for planning of a tailor-made empowerment intervention or for post intervention impact assessments of behavioral change programs that are intended to target type 2 diabetes patients.

Content validity: The estimated reliability and internal consistency index of Cronbach's alpha for PCSD-P in this study was almost in the range of calculated measure in other psychometric studies of the PCSD ($\alpha > 0.8$) [16, 20,22, 40]. The approved unidimensionality of the instrument in this study was identical to the results obtained in other studies (16,22, 40).

Limitation

Cross-sectional design of this study prevented the study team to check whether degree of perceived competence for self-care among the studied type 2 diabetes patients could actually lead to a long term better self-care behavioral profile. Reliance on only cognitive perception of the patients for self-care and not asking questions about actual disease oriented self- management behavioral pattern which could lead in turn to a germane glycemetic control algorithm is the most important curtailment of the instrument.

At the time of this study implementation the researchers were not aware of the degree of success study participants had in their disease management; a potential confounder that might posed effect

on the study attendants' responses. It was probable that patients with a better health profile had a comparable answer pattern than those who had a worse health profile. This is somehow related to the overall mentality of the patients in the time of responding to questions rather than to their actual perceived self-competence.

Despite all these limitations, this study findings in line with results of other studies confirm that the short scale could be applicable as an efficient summary measure to examine perceived competence level in patients with type 2 diabetes and also relate the findings with the patients' success in better control of glucose level and most importantly prevent the disease costly and non-reversible complications.

5. Conclusions

The current study results provide initial support for the use of the PCSD-P in Persian-speaking type 2 diabetes patients by clinicians and researchers. The findings illustrated applicability of the translated PCDS-P for assessment of the patients' perceived competence for self-care and corroborate the previously reported psychometric properties of the scale in other populations. The results were also offered insight into one of the most neglected attributes in care provision for sufferers of the one of the millennium chronic and devastating disease. The scale could also be applicable as a generic template to be altered and adapted for use with other chronic medical conditions. Further research is recommended for cross-cultural validation of the instrument to its application in wider and international scope for comparison purposes. Prospective studies also are recommended to study sensitivity and predictive validity of the scale in measurement of perceived competence changes overtime and self-care outcome when self-care competency improvement interventions are in vain for overall health promotion purposes.

Supplementary Materials: No supplementary materials were provided by the authors for this publication.

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