

Role of Psychological Distress in the Assessment of Chronic Illness Care and Self-Management Behaviors of Elderly Patients with T2DM Chronic Complications

Xiao Sun¹, Xue Wang², Rongrong Zhou³, Wei Deng⁴, Jinxia Jiang², Yan Shi⁵

¹Department of Nursing, Shanghai Fourth People's Hospital, School of Medicine, Tongji University, Shanghai, 200072, People's Republic of China; ²Department of Emergency, Tenth People's Hospital, School of Medicine, Tongji University, Shanghai, 200072, People's Republic of China; ³School of Medicine, Tongji University, Shanghai, 200072, People's Republic of China; ⁴Department of Colorectal Disease, Tenth People's Hospital, School of Medicine, Tongji University, Shanghai, 200072, People's Republic of China; ⁵Department of Nursing, Tenth People's Hospital, School of Medicine, Tongji University, Shanghai, 200072, People's Republic of China

Correspondence: Jinxia Jiang; Yan Shi, Email jiangjinxia99@163.com; 2080153@tongji.edu.cn

Background: This study sought to explore the interrelationship between diabetes-related distress, patient evaluations of chronic illness management, and self-management practices among older adults diagnosed with T2DM and associated chronic complications.

Methods: This was a cross-sectional study including 264 older adults with T2DM in Shanghai, China. Chinese version of Problem Areas in Diabetes Scale (PAID-C), Patient Assessment of Chronic Illness Care (PACIC) and Diabetes Self-Management Behaviour for Older (DSMB-O) were employed. Student's *t*-test, one-way ANOVA or the nonparametric analysis (Mann–Whitney *U*-test), Pearson correlation coefficient and structural equation model (SEM) were used to analyse the data.

Results: A total of 264 participants (157 males [59.47%], with an average age of 71.07±6.47 years) were included in the study; their duration of T2DM ranged from 5 to 30 years, with a mean duration of 11.19±6.96 years. The DSMB-O scores exhibited a negative correlation with the PAID-C scores ($r=-0.250$, $p<0.01$), while showing a positive correlation with PACIC scores ($r=0.348$, $p<0.01$). Additionally, PAID-C scores demonstrated a negative correlation with PACIC scores ($r=-0.182$, $p<0.01$). The indirect effect of PAID-C on DSMB-O through PACIC was calculated as ($-0.70 \times -0.39 = 0.27$). Furthermore, the total effect of PAID-C on DSMB-O via PACIC was determined to be ($0.27 + 0.22 = 0.49$). Notably, the mediating effect accounted for 54.99%.

Conclusion: Psychological distress is intricately linked to self-management behaviour among elderly patients suffering from T2DM and chronic complications. Our findings carry significant implications for T2DM healthcare, indicating that addressing psychological distress may enhance the quality of chronic illnesses, ultimately fostering improved self-management practices and yielding better health outcomes.

Keywords: psychological distress, chronic illness care, self-management behaviors, elderly, type 2 diabetes mellitus

Introduction

Diabetes has become one of the major public health issues in the worldwide, seriously affecting the health of patients. It is anticipated that the global prevalence of diabetes will rise to 643 million by 2030 and further escalate to 783.2 million by 2045.¹ T2DM patients account for over 90% in all diabetes patients,² and the number of individuals diagnosed with T2DM over 65 years is still increasing.³ By the year 2045, it is projected that the prevalence of diabetes among individuals aged 65 and older in China will reach 66.7 million.⁴

73.2% of diabetes patients suffer from chronic complications.⁵ Individuals with T2DM experience chronic complications resulting from suboptimal glycemic control, encompassing conditions such as visual impairment, renal failure, cerebrovascular events, cardiovascular diseases, limb amputation, and increased mortality risk.⁶ T2DM in the elderly

with complications are more likely to experience adverse outcomes such as cognitive impairment, falls, depression, and stomatological diseases due to increased risk of hypoglycemia, geriatric syndrome, and comorbidities.⁷ The medical cost related to diabetes-related chronic complications accounts for more than 80% of total cost for diabetes patients.⁸

Nevertheless, the long-term complications associated with T2DM are both preventable and manageable, even at the point of diabetes diagnosis.⁹ The median duration until the onset of chronic complications associated with T2DM is approximately 3 to 5 years, representing a crucial window for the implementation of preventive strategies aimed at mitigating the progression of these complications.⁹ The primary factor contributing to chronic complications of T2DM in the elderly population is the inadequate attention to self-care practices.¹⁰ Cigolle et al¹¹ demonstrated that older adults were more prone to encountering difficulties in self-managing their diabetes and tend to exhibit a poorer overall health status. Diabetes-related distress represents a prevalent negative emotional experience, referring to adverse emotional reactions when facing disease management, emotional burden, and treatment.^{12–14} Relevant studies have shown that Chinese diabetes patients generally have moderate-to-severe depression, which further leads to poor self-management and negatively affects disease management.¹⁵ The American Diabetes Association (ADA) advocates for the implementation of person-centered collaborative care, emphasizing shared decision-making in the selection of treatment regimens, facilitating access to essential medical and psychosocial resources, and jointly monitoring adherence to mutually agreed-upon regimens and lifestyle modifications.¹⁶ The evaluation of chronic illness care by patients demonstrated a positive correlation with self-management behaviors, aligning with the findings reported by Glasgow R E et al.¹⁷ However, little is known about the correlation among chronic illness care, diabetes-related distress and health behaviors. The objective of this study was to conduct an investigation about the impact of psychological issues and perceptions regarding chronic disease management on health behavior outcomes among elderly patients with T2DM and associated chronic complications, thereby providing evidence for the development of strategies aimed at reducing chronic complications in older T2DM patients.

Materials and Methods

Survey Objectives

The research protocol received approval from the Ethics Committee of Tenth People's Hospital, School of Medicine, Tongji University (21K194). Informed consent was secured from each participant in the study. The study complied with the Declaration of Helsinki and written informed consent was obtained from each patient. This was a cross-sectional study and the sample size was calculated according to previously reported:¹⁸ $n = [\text{Max}(\text{number of items}) \times (5\sim 10)] \times [1 + (10\% \sim 30\%)]$. In this study, there were 20 items in the diabetes-related questionnaire, 20 items in the perceived chronic disease management questionnaire, and 14 items in the chronic complication health behaviors assessment questionnaire for T2DM patients. Taking into account a maximum of 20 items in the questionnaires and adjusting for invalid responses, the sample size was increased by 10% to 30%, culminating in a total sample size of 277.

Based on participants' availability and convenience, a cross-sectional study was conducted in T2DM patients in Shanghai, China. The inclusion criteria were as follows: 1) patients were 60 years old or older; 2) patients were diagnosed with T2DM at least 5 years before the study; 3) patients were able to cooperate with clinicians. The exclusion criteria were as follows: 1) patients diagnosed with type 1 diabetes or gestational diabetes; 2) critically ill patients; 3) patients unable to or refusing to sign informed consent; and 4) patients with a serious psychiatric illness. Data were collected from January 2022 to July 2022. The investigators contacted the participants and scheduled a face-to-face interview. The participants did not receive any monetary incentives or reimbursements for participating in this study.¹⁹

Measurements

Demographic Questionnaire

This questionnaire was meticulously crafted by our team, and the demographic information including age, gender, race, marital status, history of smoking and drinking, history of physical exercise, number of children was collected. Information about the medical condition, including the course of T2DM and diabetes-related complications, was also collected. Socioeconomic factors included living conditions, education level, occupation, monthly income, and medicare.

Chinese Version of the Problem Areas in Diabetes Scale (PAID-C)

This scale is mainly used to evaluate the psychological distress and stress-related problems of diabetes patients and was developed by Polonsky et al.²⁰ PAID-C²¹ consists of four dimensions and 20 items (“emotional problems” domain including 6 items, “treatment problems” domain including 4 items, “dietary problems” domain including 5 items, and “social support problems” domain including 5 items). A 5-point Likert scale is employed, where the responses “not a problem”, “a minor problem”, “a moderate problem”, “a somewhat serious problem”, and “a serious problem” are assigned scores of 0, 1, 2, 3, and 4, respectively. The overall score varies from 0 to 100, calculated by aggregating the responses ranging from 0 to 4 for 20 PAID items and subsequently multiplying the total by a factor of 1.25.²² A total score of 40 or higher indicates severe diabetes distress, while individual item scores of 3 or 4 reflect moderate-to-severe distress.²³ The PAID scale demonstrates consistently high internal reliability, with a Cronbach’s alpha of 0.95, and exhibits robust two-month test–retest reliability ($r = 0.83$) within a cohort of patients.²²

Patient Assessment of Chronic Illness Care (PACIC)

This PACIC is used to evaluate the performance of communities in the management of chronic diseases and the perceived level of management by patients.²⁴ The scale consists of five dimensions: Patient Activation (items 1–3); Delivery System Design and Decision Support (items 4–6); Goal Setting and Tailoring (items 7–11); Problem Solving in Contextual Settings (items 12–15); as well as Follow-up and Coordination (items 16–20). A 5-point scoring system is used, and the answers are “none, very few, some, quite a bit, always” which are scored as “1, 2, 3, 4 and 5” respectively. Each subscale is evaluated by calculating the mean of the items completed within that scale, while the overall PACIC score represents the average across all 20 items.²⁴ The higher scores indicate that doctors can provide more effective guidance for patients in the management of chronic diseases, and the perceived level of chronic disease management by patients is higher. The reliability and validity of this scale was confirmed in a previous study.²⁵

Diabetes Self-Management Behaviour for Older (DSMB-O) Scale

The DSMB-O developed by Seo K et al is used to evaluate the self-management behaviors of diabetes in older adults with T2DM.²⁶ Chinese version of the DSMB-O developed by Liang Wei et al in 2019.²⁷ The scale consists of seven dimensions and 14 items (“being active”, “healthy eating”, and “healthy coping” domains each include 2 items, while the “taking medication”, “monitoring”, and “problem-solving” domains each includes 1 item, and the “reducing risks” domain includes 5 items). Items 1 through 8 were designed to be evaluated using a four-point Likert scale, where 0 represents “Never” and 3 signifies “Always”. Item 9 was intended to elicit a dichotomous response (“Yes=3”/“No=0”). The domain of “Reducing Risks”, comprising five items (items 10 through 14), was also structured to yield a dichotomous response (“Yes=0.6”/“No=0”). The total score can range from 0 to 30 points, with higher scores indicating improved self-management behaviors in diabetes.

Data Collection

The investigation was conducted by a trained investigator who was familiar with the study design. After obtaining the informed consent, the investigator explained participants the purpose, content, and filling requirements of the survey, ensuring the anonymity and confidentiality of the investigation. The questionnaire was filled out and double-checked. For patients who were unable to read or write, the investigator read the questions one by one, and recorded the answers reported by the patients.

Statistical Analysis

A database was established and double-checked. Statistical analysis was performed with SPSS version 22.0 (company). Frequency and percentage were used to describe qualitative data. Continuous data conforming to a normal distribution were expressed as mean \pm standard deviation (SD). Student’s *t*-test, one-way ANOVA, or nonparametric analysis (Mann–Whitney *U*-test) were employed to compare the means of scale scores across different groups. Subgroup comparisons (post hoc tests) were performed for significant ANOVA results in DSMB-O. The Pearson correlation coefficient was calculated to evaluate the relationship between variables. Amos 24.0 structural equation model (SEM) was used to verify the impact pathway of psychological problems and perceived level of chronic disease management on the health

behaviors of elderly patients with T2DM and chronic complications. A P-value of less than 0.05 was deemed statistically significant.

Results

In this study, questionnaires were administered in a total of 272 patients, but valid questionnaires were obtained from 264 patients (98.11%). There were 157 males (59.47%) and 107 females (40.53%), and all the patients were Han Chinese. The age ranged from 60 years to 96 years (average, 71.07±6.47 years). The course of diabetes was 5–30 years (average, 11.19±6.96 years). Other general information is shown in Table 1.

Table 1 Demographic Characteristics of Elderly T2DM Patients with Chronic Complications

Characteristics	n (%)	DSMB-O		PAID-C		PACIC	
		Mean±SD	p	Mean±SD	p	Mean±SD	p
Age (years)			0.212		0.331		0.933
60–69	84 (31.82)	12.95±4.22		59.29±13.51		1.88±0.83	
70–75	61 (23.11)	13.99±5.70		58.75±16.21		1.88±0.83	
≥76	119 (45.08)	12.52±5.73		61.93±16.91		1.92±0.69	
Gender			0.103		0.787		0.902
Female	107 (40.53)	13.44±5.39		60.68±16.55		1.89±0.80	
Male	157 (59.47)	12.35±5.13		60.14±15.22		1.90±0.74	
Education level			0.609		0.897		0.462
Primary school or below	241 (91.29)	12.95±5.32		60.32±15.80		1.90±0.78	
Middle school or above	23 (8.71)	13.54±5.20		60.76±15.52		1.82±0.55	
Marital status			0.484		0.132		0.003
Single	52 (19.70)	12.53±4.93		62.96±13.08		1.65±0.63	
Married	212 (80.30)	13.11±5.39		59.72±16.29		1.96±0.79	
Employment			0.907		0.172		0.788
None or retired	232 (87.88)	13.01±5.46		60.77±16.13		1.89±0.76	
Employed	32 (12.12)	12.89±4.01		57.38±12.44		1.93±0.79	
Living status			0.502		0.604		0.891
Living alone	55 (20.83)	13.43±5.66		59.55±11.81		1.91±0.56	
Living with family/others	209 (79.17)	12.88±5.21		60.57±16.64		1.90±0.81	
Number of children			0.577		0.630		0.827
0	25 (9.47)	13.06±5.18		61.10±11.90		1.83±0.60	
1	156 (59.09)	13.25±5.55		60.97±15.99		1.89±0.82	
≥2	83 (31.44)	12.50±4.86		58.98±16.34		1.94±0.71	
Diabetes family history			0.979		0.783		0.055
No	167 (63.26)	12.99±5.44		60.17±15.75		1.97±0.76	
Yes	97 (36.74)	13.01±5.10		60.73±15.88		1.78±0.76	
Income (RMB)			0.025		0.288		0.100
<3000	32 (12.12)	10.73±4.10		57.34±15.92		1.91±0.70	
3000–6000	116 (43.94)	13.02±4.99		59.66±14.68		2.01±0.79	
≥6000	116 (43.94)	13.60±5.75		61.89±16.66		1.79±0.75	
Sleeping			0.039		0.001		0.282
Poor	107 (40.53)	12.52±0.49		63.94±16.54		1.81±0.71	
Generally good	128 (48.48)	12.88±5.09		62.93±17.22		1.95±0.81	
Great	29 (10.98)	15.31±6.64		56.78±13.94		2.01±0.76	
Smoking status			0.527		0.040		0.167
No	197 (74.62)	13.12±5.36		59.09±14.95		1.96±0.77	
Yes	67 (25.38)	12.64±5.14		64.07±17.47		1.79±0.71	

(Continued)

Table 1 (Continued).

Characteristics	n (%)	DSMB-O		PAID-C		PACIC	
		Mean±SD	p	Mean±SD	p	Mean±SD	p
Alcohol consumption			0.089		0.131		0.236
No	219 (82.95)	12.75±5.38		60.95±16.12		1.93±0.75	
Yes	45 (17.05)	14.22±4.77		57.44±13.55		1.78±0.82	
Physical exercise			0.035		0.288		0.007
No	140 (53.03)	12.17±5.32		59.38±16.48		1.78±0.69	
Yes	124 (46.97)	13.57±5.12		61.45±14.86		2.04±0.83	
Course of T2DM (years)			0.525		0.002		0.306
5–9	138 (52.27)	12.88±5.15		57.17±14.96		1.88±0.82	
10–19	74 (28.03)	13.55±5.30		62.75±15.40		0.79±0.09	
≥20	52 (19.70)	12.52±5.72		65.38±16.60		0.55±0.08	
NO. of chronic complication			<0.001		0.069		0.001
1	172/65.15	14.01±5.53		58.74±14.24		2.02±0.83	
2	61/23.10	12.26±4.59		63.92±18.87		1.76±0.60	
>2	31/11.74	10.71±4.16		61.71±15.74		1.52±0.48	
Category of chronic complication			0.734		0.003		0.105
Diabetic Retinopathy	131/49.62	13.11±5.27		63.92±18.19		1.80±0.73	
Diabetic Nephropathy	26/9.85	14.49±4.17		60.24±13.05		1.96±0.73	
Diabetic Foot	76/28.79	13.05±4.89		56.51±11.98		1.92±0.81	
Macrovascular Events	14/5.30	12.57±6.67		57.59±10.57		2.28±0.67	
Other	17/6.44	12.92±4.13		52.50±10.44		2.16±0.89	

Subgroup comparisons (post hoc test) revealed statistically significant differences in DSMB-O between the generally good sleeping group and poor sleeping group, as well as the great sleeping group, with p-values of 0.005 and 0.011, respectively. Similarly, the differences in DSMB-O between the income <3000 RMB group and income 3000–6000 RMB group, as well as ≥6000 RMB group, were found to be statistically significant with p-values of 0.005 and 0.034, respectively. Furthermore, a statistically significant difference in DSMB-O was observed between the 1 chronic complication group and 2 chronic complication groups with a p-value of <0.001.

The scoring range of DSMB-O was 3–30 and the total score was 13.10±5.04. Higher income (p=0.025), physical exercise (p=0.035) good sleep quality (p=0.039), and number of chronic complications (p < 0.001) were associated with higher DSMB-O scores. The scoring range of PAID-C was 25–100 and total score was 60.36±15.74. Poor sleeping (p = 0.001), smoking (p = 0.040), diabetic retinopathy (p = 0.003) and course of T2DM>20 (p = 0.002) were associated with higher PAID-C scores. The mean PACIC score was 1.90±0.77. Married (p = 0.003), physical exercise (p = 0.007) and number of chronic complications (p = 0.001) were associated with higher PACIC scores (Tables 1 and 2).

The DSMB-O, PAID-C and PACIC subscale feature among elderly T2DM patients of chronic complications are showed as Table 2. On a 6-point subscale of DSMB-O, the lowest score was observed in the category of ‘actively responding to problems’ (2.58±1.07), while on a 3-point subscale of DSMB-O, the lowest score was found in the category of “reducing risks” (0.77±0.12). It was observed that the PAID-C subscore for “emotional problems” (18.29 ±4.87) was the highest, while the PAID-C subscore for “food-related problems” (12.06±3.33) was the lowest. The lowest subscale of PACIC was “goal setting/tailoring” (2.58±0.82).

Based on the total score of PAID-C, the patients were categorized without severe diabetes distress (<40, 12/4.55%) and with severe diabetes distress (≥40, 252/95.45%), it meant that most of elderly T2DM patients of chronic complications suffered from severe diabetes distress. And the total score of PAID-C of patients with severe diabetes distress was (61.67±14.86). In addition, comparing the PACIC and DSMB-O of patients with and without severe diabetes distress, it found that the difference of DSMB-O (p=0.043), “being active” (p=0.003), “healthy copying” (p=0.007), “delivery system/practice design” subscale belonging to PACIC was statistically significant (p=0.046) (Table 3).

Table 2 DSMB-O, PAID-C and PACIC Subscale and Total Score Among Elderly T2DM Patients of Chronic Complications (n=264)

Characteristics	Mean±SD
DSMB-O	13.10±5.04
Active exercise	2.76±1.84
Eating a healthy diet	2.80±1.47
Medication	1.34±0.97
Blood sugar monitoring	1.41±1.01
Deal with problems	1.55±0.94
Actively respond to problems	2.58±1.07
Reducing risks	0.77±0.12
PAID-C	60.36±15.74
Emotional problems	18.29±4.87
Food-related problems	12.06±3.33
Treatment-related problems	15.06±3.33
Social support-related problems	14.91±4.93
PACIC	1.90±0.77
Patient Activation	2.80±0.95
Delivery System Design/Decision Support	2.65±0.84
Goal Setting/Tailoring	2.58±0.82
Problem Solving/Contextual	2.68±0.99
Follow-up/Coordination	2.69±0.96

Table 3 Comparing the DSMB-O and PACIC of Patients with and without Severe Diabetes Distress

	Without Severe Diabetes Distress (Mean±SD)(n=12)	With Severe Diabetes Distress (Mean±SD)(n=252)	p
DSMB-O	16.15±5.51	12.96±4.98	0.043
Being active	4.33±1.87	2.69±1.80	0.003**
Healthy eating	2.58±1.78	2.81±1.45	0.844
Taking medication	1.50±1.24	1.40±1.00	0.428
Monitoring	1.33±1.23	1.56±0.92	0.178
Problem solving	1.00±0.27	1.34±0.99	0.255
Healthy coping	4.25±2.60	2.50±2.01	0.007**
Reducing risks	1.15±0.21	0.76±0.07	0.249
PACIC	1.68±0.91	1.91±0.96	0.119
Patient Activation	2.61±1.38	3.03±1.05	0.213
Delivery System Design/Decision Support	2.36±1.05	2.95±0.91	0.046*
Goal Setting/Tailoring	2.37±0.92	2.88±0.93	0.098
Problem Solving/Contextual	2.54±0.84	2.89±1.05	0.252
Follow-up/Coordination	2.28±0.88	2.82±1.01	0.079

Notes: **: p<0.01; *: p<0.05.

Pearson Correlation coefficient revealed a weak negative correlation between the DSMB-O scores and the PAID-C scores ($r=-0.348$, $p < 0.001$), as well as a weak positive correlation with the PACIC scores ($r=0.244$, $p = 0.004$). Additionally, the PACIC scores showed a weak negative association with the PAID-C scores ($r=-0.182$, $p = 0.004$) (Table 4).

The SEM was developed to investigate the interrelationships among PAID-C, PACIC, and DSMB-O in older adults suffering from chronic complications associated with T2DM. The effects of PAID-C on DSMB-O in older adults with chronic complications of T2DM included one direct path and one indirect path: 1) PAID-C had a direct effect on DSMB-

Table 4 Correlations Among PAID-C, PACIC and DSMB-O Among Elderly T2DM Patients with Chronic Complications

	PAID-C	PACIC	DSMB-O
PAID-C	1.00		
PACIC	-0.182**	1.00	
DSMB-O	-0.250**	0.348**	1.00

Notes: r meant Pearson correlation coefficient; **: $p < 0.01$.

O (-0.39), and 2) PAID-C had an indirect effect on DSMB-O through PACIC ($-0.70 \times -0.39 = 0.27$). PAID-C had a total effect on DSMB-O through PACIC ($0.27 + 0.22 = 0.49$). The mediating effect accounted for 54.99% ($0.27/0.49$) of total effect. The final fitting indexes of the model were $\chi^2/df = 2.40 < 3$, comparative fit index (CFI) = 0.938, Tucker-Lewis index (TLI) = 0.917, and root mean square error of approximation (RMSEA) = 0.07 (Figure 1).

Discussion

The concept of self-management entails actively engaging in self-care practices to optimize behaviors and promote overall well-being. The management of diabetes entails a focus on adopting a healthy diet, engaging in physical activity, monitoring blood sugar levels, adhering to medication regimens, employing effective problem-solving strategies, and cultivating adaptive coping mechanisms.²⁸ These factors are crucial for reducing glycosylated hemoglobin (HbA1c), delaying the onset of acute and chronic complications, and enhancing overall quality of life.²⁹ The findings of this study indicate that older adults with T2DM and chronic complications exhibit suboptimal levels of self-management behaviors (13.10 ± 5.04). The findings of other studies have also indicated a correlation between patients exhibiting inadequate self-management behaviors and low levels of self-care.^{29,30} Zhao et al³¹ revealed that the self-management behaviors of T2DM patients were at moderate level. In addition, this study also found that the revealed of “actively responding to problems” (2.58 ± 1.07) and “reducing risks” (0.77 ± 0.12) in DSMB-O were relatively low. This suggested that elderly T2DM patients with chronic complications might encounter challenges in coping with problems and attending regular

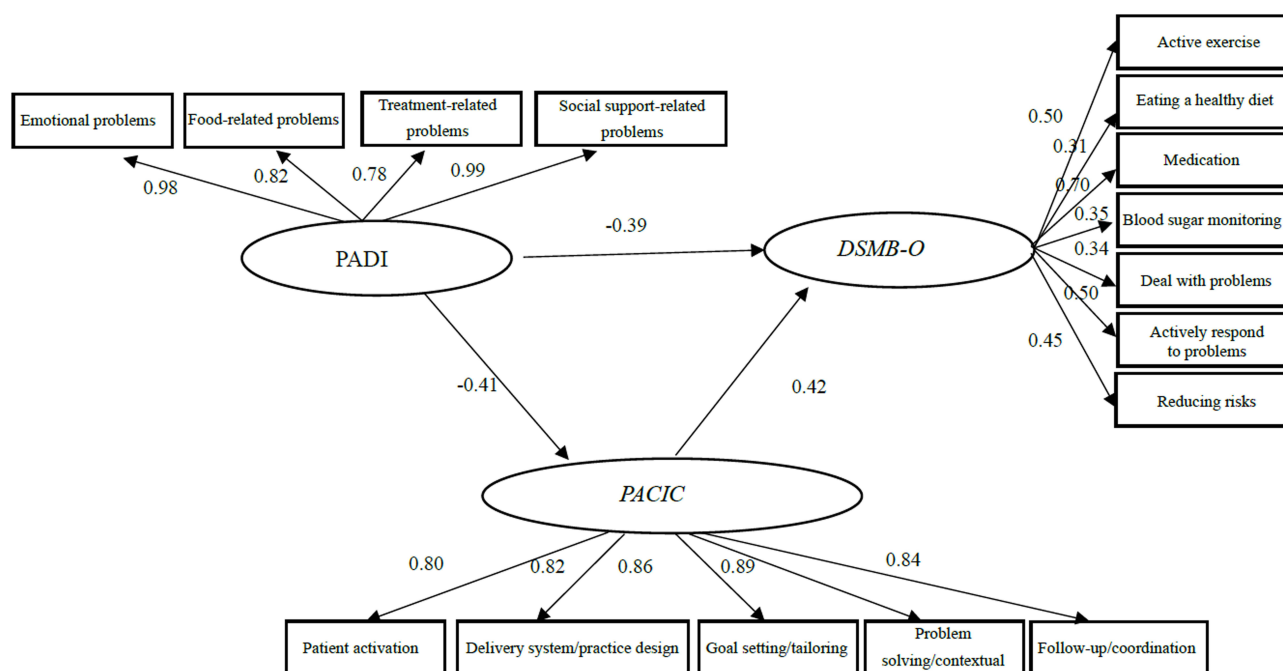


Figure 1 Path analysis of PAID-C, PACIC and DSMB-O among elderly T2DM patients with chronic complications.

hospital check-ups to detect risk factors early. This indicated that their abilities to control the chronic complications of diabetes and engage in daily monitoring were suboptimal, leading to the occurrence and progression of these complications. The objective is to implement measures aimed at enhancing self-management skills in order to decrease the occurrence of chronic complications associated with T2DM.^{32–34} The results also showed that elderly patients with chronic complications of T2DM who had higher economic income, physical exercise, good sleep quality and fewer chronic complications, tended to have better health behaviors management. The low-income patients may choose to disregard symptoms of pain due to financial constraints, in order to minimize economic costs. Conversely, patients from higher income families have greater financial security for medical expenses and are more focused on self-management behaviors. Physical exercise is not only an independent variable, but also a key dimension in the assessment of DSMB-O. As research in exercise psychology advances, patients who actively engage in physical exercise gradually recognize that consistent participation in regular physical activities over time is necessary to achieve the desired effects and can proactively exhibit purposeful behaviors to attain established goals. The study conducted by Chasens ER et al revealed a significant association between poor sleep quality and impaired diabetes self-management in adults with T2DM.³⁵ Eve et al revealed a negative correlation between the number of complications and diabetes awareness levels, as well as self-management scores among patients.³⁶ It explains that patients with good self-management skills pay more attention to self-care, and tend to seek professional help in a timely manner, which reduced the risk of complications.³²

Diabetes distress encompasses the anxieties, apprehensions, fears, and challenges associated with managing a demanding chronic illness like diabetes over an extended period of time.³⁷ These concerns include disease management, potential complications, deterioration in functionality, and worries regarding access to healthcare.³⁷ The prevalence of diabetes-related distress ranges from 21% to 49% across various regions worldwide.³⁸ In this study, 95.45% elderly T2DM patients with chronic complications suffered from severe diabetes distress, and the total scores of the participants' diabetes-related distress score was 60.36 ± 15.74 , which was higher than previous reports. The varied outcomes may be attributed to several factors. The discrepant results could suggest a substantial sampling bias, with the sample showing a tendency to overreport their distress levels. Another potential explanation could be rater bias, as the investigator read the scale items to illiterate patients, including 241 (91.29%) in this study, and scored their responses. This may be also attributed to the selection of research participants in this study, including those aged ≥ 60 , with a duration of ≥ 5 years and diagnosed with T2DM and retinopathy. Other studies had also indicated that factors such as advanced age, longer duration of diabetes, and the level of social support may contribute to the experience of distress among individuals with diabetes.^{38,39} Khashayar P et al discovered significant associations between diabetes-related distress and several factors, including being female, hypertension, elevated hemoglobin A1C levels, nephropathy, and retinopathy.³⁸ We could not assess or find these in our study, and this discrepancy requires further research. As the disease progresses, T2DM patients with inadequate glycemic control are at a higher risk of developing chronic complications, such as retinopathy leading to visual impairment or even blindness, and peripheral neuropathy resulting in diabetic foot ulcers or potential amputation. These adverse effects make patients susceptible to psychological problems and even depression.⁴⁰ In this study, we also found that the elderly with diabetic retinopathy had worse diabetic-distress, which was similar to other findings. Khoo K et al demonstrated a significant correlation between retinopathy/diabetic macular edema (DR/DME) and associated vision loss, highlighting their profound impact on psychosocial well-being.³⁸ So it is necessary to prevent and delay progression of DR/DME for prevention the emergence of poor psychological outcomes, and early detect through screening to manage the poor psychological by multidisciplinary care for patients.⁴⁰ In addition, the significant burden of diabetic complications necessitates frequent hospital visits and admissions.⁴¹ The study conducted by Young CF et al demonstrated a significant association between participants' total scores on the PAID questionnaire and their 10-year predicted fatal CHD risks.⁴² Dalsgaard EM et al revealed that individuals with both T2DM and psychological distress exhibited a 1.7-fold increased risk of experiencing a cardiovascular disease event, as well as a 1.8-fold higher mortality rate compared to those without reported distress.⁴³ Elderly patients with T2DM and chronic complications face some disease-related psychological problems that negatively predict healthy behaviors. As the result of this study, the DSMB-O total score difference of patients with and without severe diabetes distress was statistically significant, especially "being active" ($P=0.003$) and "healthy copying" ($P=0.007$). The negative impact of patients' concerns regarding their condition on diabetes management outcomes has been widely acknowledged by healthcare providers.⁴⁴ Therefore, it is

imperative to screen for the diabetes-related problems using diabetes-specific validated measures.⁴⁵ If deemed necessary, the individual should be referred for subsequent medical attention. Various educational and behavioral intervention strategies have demonstrated positive outcomes in managing diabetes distress and glycemic control, which include providing education, implementing psychological therapies such as cognitive-behavioral therapy and mindfulness-based therapies, as well as adopting approaches that promote changes in health behaviors like motivational interviewing.^{46–49} The available evidence suggests that psychological interventions have been shown to enhance dietary behaviors and improve quality of life.⁵⁰ The effectiveness of cognitive-behavioural therapy and counselling has been well established, with cognitive-behavioral therapy also showing potential for cost-effectiveness.⁵⁰ Studies have indicated that the Eight Pieces of Brocade exercise in the community management helps to promote blood circulation, improve blood glucose control, regulate emotional states, and enhance standard of living of T2DM patients.⁵¹ Stress inoculation training can also effectively reduced diabetes-related stress and perceived level of stress in patients.^{52,53}

The PACIC is a validated, concise patient self-report tool designed to assess the extent of patient-centered healthcare resources available.²² A higher PACIC score indicates a more favorable perception of care quality and increased support from healthcare providers.⁵⁴ This study showed that PACIC among elderly patients with T2DM and chronic complications was at moderately low level (1.90 ± 0.77) and the lowest subscale of PACIC was “goal setting/tailoring” (2.58 ± 0.82). Upon analysis of the components of “goal setting/tailoring”, it was found that greater emphasis should be placed on developing individualized treatment goals for patients after thorough assessments, as well as promoting patient involvement in health education. The transition from reactive and event-driven medical care to proactive and planned care is essential for the management of chronic illnesses.²² Nursing staff should encourage patients to participate in the planning of disease management goals, the two-way communication with patients so as to enhance their understanding and utilization of medical support, and respect patients’ experiences.^{31,51} The healthcare professionals should gain a comprehensive understanding of the specific needs of individuals with T2DM when implementing interventions, develop patient-centered intervention strategies, enhance their utilization of medical support, and consistently promote the adoption of healthy behaviors. The Institute of Medicine has determined that patient-centric collaborative care plays a pivotal role in improving the management of chronic illnesses.⁵² Diabetes Self-Management Education and Support (DSMES) has demonstrated its efficacy in facilitating well-informed decision-making, cultivating self-care practices, nurturing problem-solving abilities, as well as fostering dynamic collaboration with healthcare professionals to optimize clinical outcomes, promote better health status, and enhance overall well-being in an economically efficient manner.⁵³

Based on Pearson Correlation coefficient, the PACIC demonstrated a positive correlation with behaviors related to self-management, which aligns with the findings reported by Glasgow et al.⁵⁵ Furthermore, a negative correlation was discovered between diabetes-related distress and self-management behaviors, in accordance with the findings of a previous study.⁵⁶ The SEM revealed that diabetes-related distress exerted an indirect influence on self-management behaviors in older adults with T2DM and chronic complications, mediated by PACIC, which elucidates the explanatory role of these two variables, namely diabetes-related distress and PACIC, within the context of managing diabetes effectively. This study suggests that the PACIC serves as a partial mediator in the relationship between distress related to diabetes and self-management behaviors. Additionally, it has been indicated by other studies that numerous healthcare providers lack confidence in their ability to identify and assess psychological issues, as well as provide support for patients experiencing such problems.⁴⁴ These factors serve as significant barriers to enhancing care quality and improving the overall quality of life for individuals with diabetes.⁴⁴ Medical professionals can employ a myriad of strategies to augment self-management behaviors in elderly individuals afflicted with T2DM and chronic complications. Implementing an intervention that focuses on enhancing the PACIC and mitigating distress associated with diabetes may result in improved self-management behaviors among this population.

The study necessitates careful consideration of several limitations. The adoption of a cross-sectional design necessitated the utilization of convenience sampling, potentially introducing sampling bias and constraining the generalizability of the findings to populations in other geographic regions. Dependence on self-report instruments introduces the potential for response bias, whereby respondents’ answers may diverge as a result of psychological or personality predispositions.⁵⁷ Furthermore, the potential for social desirability bias must be acknowledged, as certain respondents may modify their genuine intentions to foster a favorable impression or safeguard themselves in accordance with societal

norms.⁵⁸ Notwithstanding these limitations, self-report measures continue to represent one of the most pragmatic approaches for data collection.⁵⁸ In conclusion, among older adults with T2DM and chronic complications, diabetes-related distress demonstrated significant correlations with the Patient Activation Measure for PACIC and self-management behaviors. Notably, diabetes-related distress had both a direct influence on self-management behaviors and an indirect effect mediated by PACIC. This study revealed deficiencies in PACIC, diabetes-related distress, and self-management practices among older adults with T2DM and chronic complications in China. PACIC was recognized as a significant partial mediator in the intricate relationship between diabetes-related distress and self-management behaviors.

Abbreviations

(T2DM), Type 2 diabetes mellitus; (PAID), Problem Areas in Diabetes Scale; (PACIC) Patient Assessment of Chronic Illness Care; (DSMB-O), Diabetes Self-Management Behavior for Older.

Ethics

The study was approved by the Ethics Committee of the Tenth People's Hospital of Tongji University (No. SHSY-IEC-4.1/21-284/01). Informed consent was obtained from the participants before study.

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Disclosure

The authors report no conflicts of interest in this work.

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