

Diabetes Distress and Self-Efficacy Mediate the Relationship Between Family Function and Coping in Young and Middle-Aged Patients with Type 2 Diabetes Mellitus

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Aim: To explore the parallel mediating effects of diabetes distress and self-efficacy on the relationship between family function and coping and adaptation ability in young and middle-aged patients with type 2 diabetes mellitus (T2DM).

Methods: From February to December 2023, a convenience sample of 236 young and middle-aged patients with T2DM was recruited from the endocrinology departments of two tertiary hospitals. Questionnaires were administered to collect sociodemographic and disease characteristics, the short version of the Coping and Adaptation Processing Scale (CAPS-SF-C), the Adaptation, Partnership, Growth, Affection, and Resolve (APGAR), the Diabetes Distress Scale (DDS), and the Self-Efficacy for Diabetes (SED). The SPSS 26.0 software was used for univariate analysis and Pearson correlation analysis. Model 4 of the SPSS macro program Process v3.4.1 was used to assess parallel mediation effects, with Bootstrap resampling set to 5,000 iterations.

Results: Pearson correlation analysis revealed that coping and adaptation ability was positively associated with family function ($r=0.545$, $P < 0.01$) and self-efficacy ($r=0.578$, $P < 0.01$) and negatively associated with diabetes distress ($r=-0.508$, $P < 0.01$). Additionally, diabetes distress and self-efficacy were found to play a parallel mediation between family function and coping and adaptation ability. The indirect effect of self-efficacy (0.081), and the indirect effect of diabetes distress (0.065) accounted for 19.06%, and 15.29% of the total effect (0.466).

Conclusion: As the first study confirming dual-channel mediation in this population, we demonstrate that diabetes distress and self-efficacy functioned as parallel mediators in the relationship between family function and coping and adaptation ability. Healthcare professionals are encouraged to incorporate family-focused interventions into the management of T2DM. Reducing psychological stress and routinely monitoring self-efficacy levels are crucial for enhancing patients' coping and adaptation ability.

Keywords: coping and adaptation ability, family function, diabetes distress, self-efficacy, young and middle-aged, type 2 diabetes mellitus

Introduction

According to the International Diabetes Federation (IDF), approximately 540 million people worldwide live with diabetes.¹ Southeast Asia had a comparative diabetes prevalence of 10.0%, based on rates standardized to the world population.¹ Notably, the incidence of type 2 diabetes mellitus (T2DM) in young and middle-aged patients has shown a rising trend in recent years,^{2,3} with recent studies in China showing a prevalence of 24.9% in this demographic.⁴ Beyond its high prevalence, young and middle-aged patients with T2DM face unique health challenges. For instance, a meta-analysis revealed that the fracture risk for middle-aged and young adults with T2DM is nearly double that of non-diabetic peers.⁵ This finding was of particular concern, as fractures not only cause pain and functional impairment but

may also substantially compromise work capacity and quality of life. The underlying pathophysiological mechanisms for increased fracture risk are likely associated with diabetes-related abnormal bone metabolism and microvascular complications.⁶ Furthermore, and of greater concern, Saeedi et al⁷ pointed out that almost half of global diabetes-related deaths annually involve young and middle-aged patients. Consequently, young and middle-aged T2DM patients represent a critical subgroup confronting multifaceted challenges, necessitating targeted interventions addressing both physical and psychosocial factors.

Young and middle-aged patients with T2DM often face unique challenges, balancing career demands, financial burdens, and psychological stress, which can conflict with diabetes self-management,^{8–10} making it difficult for them to adapt well to their role as patients. Coping and adaptation ability refers to individuals' capacity to perceive and address adaptation challenges when faced with life demands and environmental changes. Middle-range theory of adaptation to chronic illness suggests that individuals exhibit specific behavioral responses to disease-related stimuli. For young and middle-aged patients with T2DM, the diagnosis serves as a stimulus, where a high level of coping and adaptation ability represents a positive behavioral response. Studies have shown that coping and adaptation ability significantly influence patient recovery and treatment outcomes. Within this context, coping and adaptation ability, defined as the capacity of individuals to recognize and effectively manage adaptive challenges when responding to life demands and environmental changes,¹¹ emerges as a core determinant influencing health outcomes. The middle-range theory describes specific behavioral responses exhibited by individuals when confronted with disease-related stimuli.¹² Specifically, influenced by stimuli (primarily the illness itself), individuals process and integrate these through their cognitive appraisal system, resulting in varied behavioral responses. Effective coping and adaptation facilitates harmony between the individual and their environment, leading to positive health outcomes,¹³ whereas maladaptive coping results in adverse health consequences. This theory conceptualizes adaptation as a continuous, multidimensional process of regulation and equilibrium. Among young and middle-aged patients with T2DM, low levels of coping and adaptation ability significantly impair diabetes management efficacy and hinder rehabilitation progress. This impairment manifests concretely as difficulties in dietary control, insufficient physical activity, poor adherence to insulin therapy, and engagement in high-risk behaviors such as syringe reuse.^{14–16} Consequently, enhancing the coping and adaptation ability within this population is an urgent priority.

Among the multitude of factors influencing patients' coping and adaptation ability, family function plays a pivotal role. Family function refers to the capacity of family members to provide emotional support, express affection, communicate effectively, and collaboratively manage life events and stressors.¹⁷ Patients experiencing positive family function demonstrate characteristics such as open discussion of disease-related challenges among members and the provision of timely emotional reassurance and practical assistance when the patient feels discouraged. Conversely, dysfunctional family function is prevalent. Wang et al¹⁸ reported that only 5.7% of older adults experienced high levels of family function, while dysfunction was associated with multiple adverse outcomes: including reduced sleep quality, increased risks of depression and loneliness, a heightened sense of burden, consequently diminishing quality of life in individuals with diabetes,^{19,20} and even an elevated suicide risk.²¹

For young and middle-aged patients with T2DM, stable family emotional bonds and family resilience in the face of disease-related pressures directly shape their coping and adaptation ability. A supportive family environment characterized by effective communication and clearly defined roles fosters collaborative patient-family synergy, significantly enhancing adherence to diabetes management regimens.^{22,23} Therefore, the impact of family function on the coping and adaptation ability of young and middle-aged T2DM patients is profound and far-reaching.

Simultaneously, psychological factors, particularly diabetes distress, constitute a pivotal influence on the adaptation process. Diabetes distress can be defined as a range of negative emotional responses triggered by concerns over disease management, disease support, the emotional burden, and treatment methods.²⁴ A meta-analysis revealed that the prevalence of diabetes distress among Chinese patients with type 2 diabetes was 53%.²⁵ For young and middle-aged T2DM patients, factors such as medication side effects, pain of insulin injections, and dietary restrictions can exacerbate diabetes distress.²⁶ Critically, the experience of diabetes distress has been associated with several adverse outcomes, including poor treatment compliance, suboptimal blood glucose control, fear of hypoglycemia, and a higher risk of diabetes complications.^{27–30} Furthermore, T2DM patients often face psychological pressure and social discrimination.³¹

Wen et al³² observed that patients frequently experience pessimistic or world-weary emotions during treatment. Szydlo et al³³ observed that adolescents with diabetes tended to reduce their participation in activities due to concerns about potential stigmatization by their peers. Additionally, Lau et al³⁴ noted that patients employing negative coping strategies often show elevated distress levels, particularly regarding long-term disease management, thereby diminishing their coping and adaptation abilities.

Self-efficacy describes individuals' confidence in handling challenges and reflects their self-assessed abilities.³⁵ Self-efficacy theory asserts that when individuals believe there is a high probability of accomplishing a task, they will adopt a positive mindset, thereby achieving a well-adjusted development. Research has demonstrated that self-efficacy significantly impacts blood glucose control,^{36,37} likely because patients with high self-efficacy feel more robust control over their disease. Evidence confirms family function plays a crucial role in establishing self-efficacy.³⁸ Social cognitive theory emphasizes the dynamic interplay among environmental factors, individual cognition/affect, and behavior.³⁹ According to this perspective, family function, as a core external environmental support system, influences target behaviors through dual pathways: affective states and efficacy beliefs. For young and middle-aged adults with T2DM, positive family function fosters adaptive outcomes by providing a stable support network. On the one hand, it helps buffer disease-related negative emotions, effectively mitigating diabetes distress. On the other hand, it enhances intrinsic motivation for adopting healthy behaviors, thereby strengthening self-efficacy. Ultimately, these synergistic effects converge to promote positive adaptation outcomes.

Although existing studies have separately examined the relationships among family function, diabetes distress, self-efficacy, and coping and adaptation ability in patients with T2DM, research exhibited significant limitations: (1) a paucity of investigations specifically targeting the young and middle-aged population; (2) a lack of research elucidating the underlying mechanisms through which family function, distress, and self-efficacy operate. Consequently, this study aimed to investigate the mechanism by which family function influences the coping and adaptation ability of young and middle-aged adults with T2DM, grounded in social cognitive theory. The model assumptions were shown in Figure 1. The proposed model postulated that family function not only directly enhance coping and adaptation ability but also exert indirect effects through two parallel mediating pathways: by reducing diabetes distress and by enhancing self-efficacy.

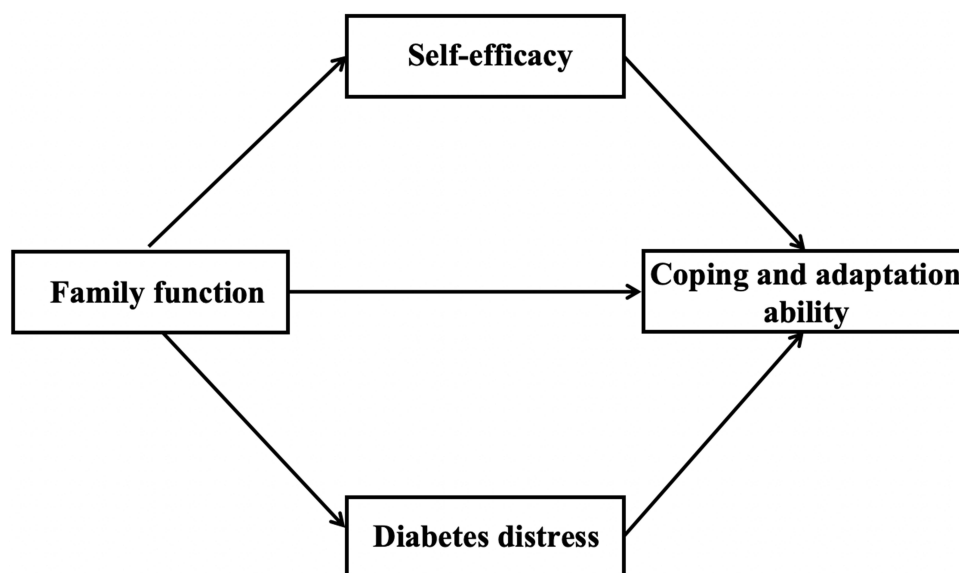


Figure 1 Conceptual model.

Materials and Methods

Study Design

This study conducted a cross-sectional investigation using convenience sampling to examine young and middle-aged T2DM patients hospitalized in the endocrinology departments of two tertiary general hospitals between February and December 2023.

Setting and Sampling

The following individuals were included in the study: Meeting the 1999 World Health Organization diagnostic criteria for T2DM,⁴⁰ age 18–59 years, with clear consciousness and effective verbal communication skills, informed consent, voluntary participation, and be able to complete the questionnaire independently or under the guidance of the researcher. Individuals who met the following criteria were excluded from the study: communication barrier, history of cognitive impairment or mental illness, questionnaires with missing key information (eg, demographic characteristics, core scale items) that could not be completed on-site, and presence of severe acute diabetic complications (eg, diabetic ketoacidosis, hyperglycemic hyperosmolar state) or other severe systemic comorbidities potentially interfering with study assessments.

The sample size was determined to satisfy dual criteria: (a) Based on cross-sectional study standards requiring 5–10 cases per independent variable,⁴¹ a baseline of 186 participants was calculated (31 variables×6) considering a 20% allowance for invalid responses; (b) Meeting the minimum threshold of 200 subjects for detecting mediation effects.⁴² The study has been approved by Ethics Committee.

The study was carried out by a uniformly trained research team at both hospital sites. Patients who met the inclusion and exclusion criteria were selected. The study's purpose and procedures were explained in detail, including the principle of data confidentiality and the estimated completion time of 20–25 minutes for the questionnaire battery. After obtaining the patients' consent, they were asked to complete the questionnaire in the presence of the researchers. Standardized assistance was provided only when necessary (eg, literacy difficulties, unclear item meaning), ensuring minimal influence on participant responses. Immediately upon completion, on-site verification was performed. Any omissions or logical inconsistencies identified were addressed by gently prompting the participant to provide supplementary information or corrections. A total of 242 questionnaires were distributed. Following collection and rigorous review, 6 questionnaires were excluded as invalid due to extensive missing key information that could not be supplemented retrospectively. Consequently, 236 valid questionnaires were included in the final analysis, yielding an effective response rate of 97.52%.

Measurements

Sociodemographic and Disease Characteristics

Data included sociodemographic (age, gender, BMI, educational level, monthly household income, occupation, marital status, place of residence, religious beliefs) and clinical characteristics (family history of diabetes, treatments in the past six months, diabetes with complications, the course of diabetes, glycosylated hemoglobin). Educational levels were categorized as primary school and below, junior middle school, high school/technical secondary school, and junior college and above. The occupations were classified as self-employed, farmer/worker, enterprise worker, and others. Treatments in the past 6 months were categorized as no medication, oral medication therapy, insulin therapy, and oral medication and insulin therapy. Diabetes with complications was classified as no or yes. Body mass index (BMI) was calculated as weight by height squared (kg/m^2). For more details, please refer to [Table 1](#).

Coping and Adaptation Processing Scale: Short Form (CAPS-SF-C)

We used the validated Chinese Short Form of the Coping and Adaptation Processing Scale (CAPS-SF-C), a 15-item version refined from the original 47-item scale by Roy et al.⁴³ The Chinese adaptation was performed by Wang et al (2020),⁴⁴ confirming its cross-cultural validity. The Chinese version of the CAPS-SF-C had a Cronbach's alpha of 0.82.⁴³ This scale has four dimensions: resourceful and focused, self-initiated and knowing-based, physical and fixed, positive and systematic. A total of 15 items were scored on Likert level 4, with 1–4 points for “never”, “rarely”, “sometimes”, and “always”, among which three items were reverse scoring questions. The total score ranged from 15 to 60 points, and higher scores reflected better adaptability. In this study, the Cronbach's α coefficient of this scale was 0.788.

Table 1 Description and Analysis of Variance of Demographic and Clinical Characteristics in Young and Middle-Aged Patients with T2DM (N=236)

Characteristics	n, %	CAPS-SF-C ($\bar{x} \pm s$)	t/F	p
Age (years)			3.279	0.001
18~44	49(20.76)	45.86±5.08		
45~59	187(79.24)	42.45±6.78		
Gender			0.195	0.845
Male	138(58.47)	43.23±6.40		
Female	98(41.53)	43.06±6.90		
BMI (kg/m ²)			0.805	0.492
<18.5	10(4.24)	40.70±8.01		
18.5~23.9	106(44.92)	43.08±6.67		
24.0~27.9	86(36.44)	43.78±5.85		
≥28.0	34(14.41)	42.59±7.71		
Educational level			6.800	<0.001
Primary school and below	24(10.17)	40.12±7.50		
Junior middle school	84(35.59)	41.51±6.28		
High school/technical secondary school	73(30.93)	45.22±5.43		
Junior college and above	55(23.31)	44.27±7.09		
Monthly household income (RMB)			9.369	0.001
<2000	56(23.73)	40.09±7.27		
2000~5000	103(43.64)	43.58±5.81		
>5000	77(32.63)	44.83±6.40		
Occupation			1.826	0.143
Self-employed	54(22.88)	42.96±6.24		
Farmer/worker	36(15.25)	44.81±6.01		
Enterprise worker	69(29.24)	41.87±6.80		
Others	77(32.63)	43.69±6.81		
Marital status			-1.706	0.089
Unmarried	18(7.63)	40.78±6.31		
Married	195(82.63)	43.47±6.42		
Divorced/widowed	23(9.75)	42.39±8.05		
Place of residence			-2.098	0.037
Rural	89(37.71)	42.01±7.06		
Urban	147(62.29)	43.86±6.22		
Religious beliefs			0.680	0.497
No	136(57.63)	43.41±6.58		
Yes	100(42.37)	42.82±6.64		
Family history of diabetes			-3.115	0.002
No	131(55.51)	41.98±6.72		
Yes	105(44.49)	44.63±6.16		
Treatments in the past six months			7.428	<0.001
No medication	43(18.22)	44.63±5.70		
Oral medication therapy	63(26.69)	45.25±5.65		
Insulin therapy	69(29.24)	42.93±6.42		
Oral medication and insulin therapy	61(25.85)	40.23±7.29		
Diabetes with complications			1.063	0.289
No	126(53.39)	43.59±6.06		
Yes	110(46.61)	42.67±7.16		
The course of diabetes(years)			11.493	<0.001
<5	81(34.32)	40.89±6.40		
5~10	93(39.41)	43.25±6.35		
>10	62(26.27)	46.00±6.18		
HbA1c(≥7.0%)			3.066	0.002
No	69(29.24)	45.17±6.36		
Yes	167(70.76)	42.33±6.53		

Abbreviations: *BMI, Body Mass Index; CAPS-SF-C, Coping and Adaptation Processing Scale: Short Form.

Adaptation, Partnership, Growth, Affection, and Resolve (APGAR)

Designed by Smilkstein,⁴⁵ it was used to assess subjects' subjective satisfaction with family function. The Chinese version of the APGAR had a Cronbach's alpha of 0.853.²⁰ The scale of five items was divided into five dimensions: adaptation, partnership, growth, affection, and resolve. A three-point scale ranged from "almost rarely", "sometimes", and "often", with values of 0, 1, and 2, respectively. The total score ranged from 0 to 10. The higher the total score, the higher the patient's family function level. A score of 7 to 10 indicated good family function, 4 to 6 indicated fair family function, and 0 to 3 indicated severe family function. The Cronbach's α coefficient for the scale in this study was 0.774.

Diabetes Distress Scale (DDS)

The scale, initially developed by Polonsky,⁴⁶ was translated into Chinese by Yang et al.⁴⁷ The Chinese version of the DDS had a Cronbach's alpha of 0.95.⁴⁷ It consisted of 17 items, including four dimensions: emotional burden subscale, physician-related distress subscale, regimen-related distress subscale, and diabetes-related interpersonal distress. Each item was scored on a 6-point Likert scale, with "no problem" to "very serious problem" ranging from 1 to 6, and the total score ranging from 17 to 102. Higher scores denoted higher levels of diabetes distress. In this study, the Cronbach's α coefficient for this study was 0.915.

The Self-Efficacy for Diabetes (SED)

Developed by Lorig et al⁴⁸ of Stanford University, USA. The Chinese version of this scale, modified by Chinese scholar Hu⁴⁹ in 2013, was culturally adapted for use in China. The Chinese version of the SED had a Cronbach's alpha of 0.878.⁴⁹ It consisted of 9 items, including four dimensions: dietary efficacy, exercise efficacy, blood glucose management efficacy, and disease control efficacy. The scale used a 5-point Likert scale, ranging from "no confidence at all" to "complete confidence", with scores of 1–5, and the total score ranged from 9 to 45. Higher scores indicated a higher level of self-efficacy. The Cronbach's α coefficient of this scale in this study was 0.853.

Statistical Methods

All variables were normally distributed, and statistical analysis was conducted using the IBM SPSS Statistics 26 software. Descriptive statistics for continuous variables were performed as mean \pm standard deviations, while categorical variables were shown as frequencies and percentages. Univariate analysis (*t*-test or ANOVA) was used to demonstrate the diversity and representativeness of the sample. Bivariate average distribution data were analyzed using Pearson's correlation. The hypothetical mediation model was constructed with coping and adaptation ability as the dependent variable, family function as the independent variable, and diabetes distress and self-efficacy as mediators. Additionally, covariates were selected through univariate screening ($p < 0.05$ criterion) from the prespecified categorical variables. These same categorical variables were then employed as control variables in the final mediation analysis models. All variables were standardized. Following the mediation effect test process,⁵⁰ the SPSS macro program Process v3.4.1 Model 4 was employed to analyze the mediating effect, with the Bootstrap method set to 5000 repetitions. If the 95% confidence interval (CI) did not include zero, it can be concluded that the mediating effect was statistically significant.

Results

Participants' Characteristics

The study enrolled 236 young and middle-aged T2DM patients characterized by: predominant age 45–59 years (79.24%), male majority (58.47%), and BMI of 18.5–23.9 kg/m² in 44.92%. Regarding socioeconomic status, 35.44% attained junior high school education, 43.64% reported monthly household income of ¥2000-5000, and 32.63% held other occupations. Demographically, most were married (82.63%), urban residents (62.29%), and non-religious (57.63%). Clinically, 55.51% had no diabetic family history, 26.69% used oral medication within the previous six months, 53.39% were free of diabetic complications, 39.41% had 5–10 years diabetes duration, and 70.76% exhibited HbA1c >7.0%. Please refer to [Table 1](#) for further details.

Univariate analysis showed significant differences in coping and adaptation ability scores based on age, education level, monthly household income, place of residence, family history of diabetes, treatments in the past six months, the course of diabetes, and HbA1c ($P < 0.05$). Please refer to Table 1 for further details.

Correlation Analysis of Coping and Adaptation Ability, Family Function, Diabetes Distress, and Self-Efficacy

The results of the correlation analysis are shown in Table 2. Coping and adaptation ability was significantly positively correlated with family function ($r = 0.545$, $P < 0.01$) and self-efficacy ($r = 0.578$, $P < 0.01$) and significantly negatively correlated with diabetes distress ($r = -0.508$, $P < 0.01$). Family function had a negative correlation with diabetes distress ($r = -0.410$, $P < 0.01$) and significantly positively correlated with self-efficacy ($r = 0.454$, $P < 0.01$). Diabetes distress was significantly negatively correlated with self-efficacy ($r = -0.517$, $P < 0.01$).

The Parallel Mediating Roles of Diabetes Distress and Self-Efficacy Between Family Function and Coping and Adaptation Ability

The results demonstrated that better family function was significantly associated with coping and adaptation ability ($\beta=0.425$, $P<0.05$), family function positively predicted self-efficacy ($\beta=0.338$, $P<0.05$), and negatively predicted diabetes distress ($\beta=-0.346$, $P<0.05$). Self-efficacy positively predicted coping and adaptation ability ($\beta=0.241$, $P<0.05$), while diabetes distress negatively predicted coping and adaptation ability ($\beta=-0.188$, $P<0.05$). After including self-efficacy and diabetes distress as mediating variables in the model, the direct association between family function and coping and adaptation ability was attenuated but remained statistically significant ($\beta=0.279$, $P<0.05$).

Results of the mediation analysis indicated that the 95% CI of the total effect was (0.320, 0.531), the 95% CI for the direct effect of family function on coping and adaptation ability was (0.173, 0.385), and the 95% CI for the indirect effect of family function on coping and adaptation ability through self-efficacy was (0.030, 0.141). Additionally, the 95% CI for the indirect effect of family function on coping and adaptation ability through diabetes distress was (0.018, 0.118). The 95% confidence intervals excluded zero, indicating that the total, direct, and indirect effects were all statistically significant. The findings demonstrated that family function exhibited both a direct association with coping and adaptation ability and an indirect linkage through the parallel mediating roles of diabetes distress and self-efficacy. Specifically, the direct effect of family function on coping and adaptation ability (0.279), the indirect effect of self-efficacy (0.081), and the indirect effect of diabetes distress (0.065) accounted for 65.65%, 19.06%, and 15.29% of the total effect (0.466), respectively. Additional details were presented in Tables 3, 4 and Figure 2.

Discussion

This study identified the influencing factors of coping and adaptation ability, thoroughly exploring the mechanisms underlying these relationships. To our knowledge, it is the first to examine the parallel mediating roles of diabetes distress

Table 2 Correlation Analysis of Coping and Adaptation Ability, Family Function, Diabetes Distress, and Self-Efficacy (n=236)

Variables	CAPS-SF-C	APGAR	DDS	SED
CAPS-SF-C	I			
APGAR	0.545**	I		
DDS	-0.508**	-0.410**	I	
SED	0.578**	0.454**	-0.517**	I

Notes: ** $P < 0.01$.

Abbreviations: *CAPS-SF-C, Coping and Adaptation Processing Scale: Short Form; APGAR, Adaptation, Partnership, Growth, Affection, and Resolve; DDS, Diabetes Distress Scale; SED, Self-Efficacy for Diabetes Scale.

Table 3 Parallel Mediation Model Analysis of Diabetes Distress and Self-Efficacy (n=236)

Variables	Model 1		Model 2		Model 3		Model 4	
	Coping and adaptation ability (Dependent variable)		Diabetes distress (Dependent variable)		Self-efficacy (Dependent variable)		Coping and adaptation ability (Dependent variable)	
	β	<i>t</i>	β	<i>t</i>	β	<i>t</i>	β	<i>t</i>
Family function	0.425	7.941*	-0.346	-5.536*	0.338	5.619*	0.279	5.175*
Self-efficacy							0.241	4.091*
Diabetes distress							-0.188	-3.321*
R^2	0.676		0.513		0.563		0.739	
Adjusted R^2	0.458		0.263		0.317		0.547	
<i>F</i>	17.173*		7.255*		9.443*		20.609*	

Notes: *The covariables of the models were age, education level, monthly household income, place of residence, family history of diabetes, treatments in the past six months, the course of diabetes, and HbA1c; * $P < 0.05$.

Table 4 Bootstrap Results of the Parallel Mediation Model (n=236)

Path	Effect Value	Boot Standard Error	Boot 95% CI		Relative Effect Value (%)
			LLCI	ULCI	
Total effect	0.425	0.054	0.320	0.531	
Direct effect (Family function→Coping and adaptation ability)	0.279	0.054	0.173	0.385	65.65%
Total indirect effect	0.146	0.034	0.084	0.217	34.35%
Indirect effect (Family function→Self-efficacy→Coping and adaptation ability)	0.081	0.028	0.030	0.141	19.06%
Indirect effect (Family function→Diabetes distress→Coping and adaptation ability)	0.065	0.026	0.018	0.118	15.29%

Notes: *CI, confidence interval; Effect contribution percentages were calculated using SSPSS macro program Process v3.4.1. All values were rounded to nearest whole number for clinical interpretability.

and self-efficacy between family function and coping and adaptation abilities among young and middle-aged T2DM patients in China. Thus, this research offers a robust theoretical foundation for future targeted interventions to enhance coping and adaptation abilities.

The results revealed a strong positive correlation between family function and coping and adaptation ability, even after controlling for confounders. The findings of our study were consistent with Li et al.⁵¹ Good family function is typically characterized by a culture of mutual support and understanding among family members.⁵² The timely exchange of information, the collaborative resolution of issues, and the provision of emotional support assist patients in maintaining an optimistic outlook about their adaptation to diabetes.⁵³ Patients with robust family support systems often benefit from a more comprehensive array of supportive actions, such as involvement in medical decision-making, emotional encouragement, and glycemic management.^{54,55} This support strengthens diabetes self-management, indicating that these patients are better equipped to adapt to the lifestyle changes associated with diabetes. Healthcare providers are advised to encourage family members to participate in diabetes management training to help them gain a better understanding of diabetes care.⁵⁶ This will help people with diabetes to cope and adapt more effectively to the disease. Medical-related practitioners can systematically assess family functioning to provide targeted support and skills training, thereby enhancing patients' overall coping and adaptation ability when facing diabetes.

This study showed that diabetes distress mediated the relationship between family function and coping and adaptation ability, with a path effect size of 0.065, accounting for 15.29% of the total effect. This indicated that stronger family function correlated with lower diabetes distress and better coping and adaptation ability among young and middle-aged individuals with T2DM. In a family environment lacking in emotional support, patients often have tremendous psychological pressure and burden, and even guilt about having diabetes.⁵⁷ They also feel powerless and anxious about developing diabetes and are prone to a vicious cycle of rumination and negative emotions.⁵⁸ They then cope and adapt to diabetes with a negative attitude. This

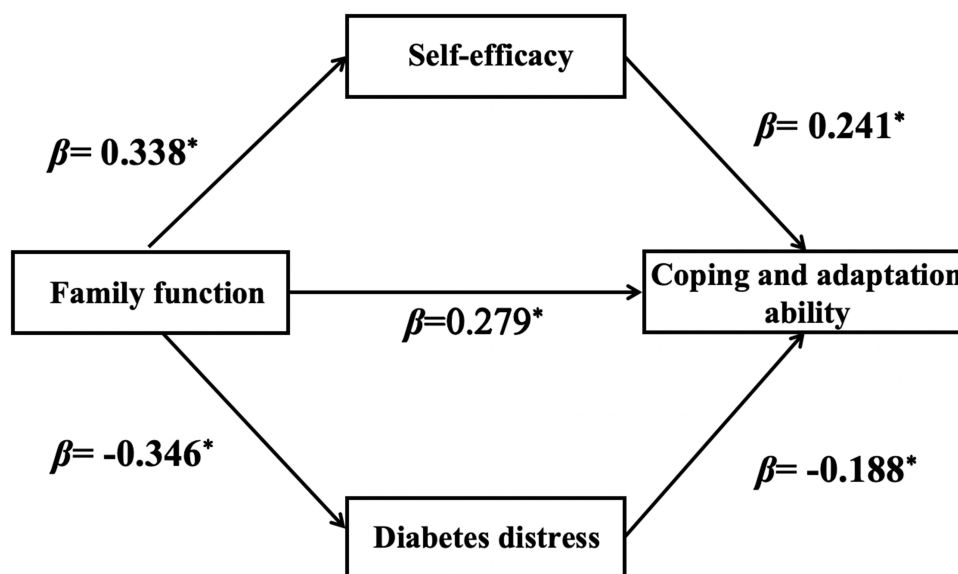


Figure 2 Parallel mediation model diagram of self-efficacy and diabetes distress in family function and coping and adaptation ability. *Control variables were age, education level, monthly household income, place of residence, family history of diabetes, treatments in the past six months, the course of diabetes, and HbA1c. * $p < 0.05$.

Abbreviations: CAPS-SF-C, Coping and Adaptation Processing Scale: Short Form; APGAR, Adaptation, Partnership, Growth, Affection, and Resolve; DDS, Diabetes Distress Scale; SED, Self-Efficacy for Diabetes Scale.

finding aligned with Wang et al⁵⁹ who found that patients with stronger family relationships were more likely to accept medical care and experience less psychological distress. Zhang et al⁶⁰ further observed that family interventions can reduce the level of psychological distress in diabetic patients, making it easier for patients to accept the fact that they have diabetes and adjust their daily lifestyle to manage the disease. This may be because when family members are actively involved in patient's diabetes management, patients' confidence and motivation in managing the condition increase. In the future, health educators should prioritize developing emotional regulation skills in people with diabetes, such as self-compassion training,⁶¹ to alleviate the distress associated with diabetes.

The path analysis indicated an indirect association between family function and coping and adaptation ability operating through self-efficacy, with a path effect of 0.081, accounting for 19.06% of the total effect. This indicated that better family function coincided with elevated self-efficacy levels, corresponding to improved coping and adaptation outcomes. Encouraging words from family members prompt patients to adopt positive health behaviors,⁶² such as medication adherence, regular blood glucose monitoring, and dietary management, facilitating their adjustment to self-care roles. Patients with high self-efficacy exhibit greater confidence in managing blood glucose levels.⁶³ This positive belief helps reduce negative emotions such as anxiety and depression,⁶⁴ thereby strengthening coping and adaptation ability. Zhang et al⁶⁵ pointed out that individuals with high self-efficacy are more inclined to adopt positive coping strategies and actively seek medical guidance and lifestyle changes to manage their condition. Therefore, family members can provide diabetes-related information to young and middle-aged T2DM patients, bolstering their confidence in adapting to lifestyle changes associated with the disease.⁶⁶

Limitations of the Study

This study had several limitations. First, the sample was drawn exclusively from endocrinology departments of two tertiary general hospitals, limiting its representation across diverse cultural backgrounds and age groups. Second, while this study identified potential pathways for family function, diabetes distress, self-efficacy, and coping and adaptation ability, our study design was cross-sectional. Hence, we cannot infer causal relationships. Third, the study did not account for potential confounding effects of newer antihyperglycemic agents (eg, GLP-1 RAs, dual incretins). In the end, data were collected solely through patient self-reports, potentially introducing reporting bias. Future studies should consider providing a more objective and reliable coping and adaptation ability assessment.

Conclusions

This study found that family function was not only directly associated with coping and adaptation ability in young and middle-aged T2DM patients, but also exhibited an indirect association with coping and adaptation through parallel mediating pathways of diabetes distress and self-efficacy. Looking ahead, future research should prioritize longitudinal designs to clarify causal pathways and capture the dynamic evolution over time of the relationships between family function, diabetes distress, self-efficacy, and coping and adaptation ability. Further exploration is needed to identify additional influential variables within the diabetes context. Specifically, exploring resilience factors beyond self-efficacy, such as specific coping styles, personality traits, and illness perceptions, could provide deeper insights. Additionally, understanding how cultural contexts shape family dynamics and coping strategies would significantly enrich our comprehension of adaptation processes in young and middle-aged patients with T2DM.

Abbreviations

T2DM, Type 2 diabetes mellitus; CAPS-SF-C, Coping and Adaptation Processing Scale; APGAR, Adaptation, Partnership, Growth, Affection, and Resolve; DDS, Diabetes Distress Scale; SED, Self-Efficacy for Diabetes.

Data Sharing Statement

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

Ethics Approval and Consent to Participate

This study was conducted with approval from the Ethics Committee of Yangzhou University (Approval No: YZUHL20230037). This study was conducted in accordance with the declaration of Helsinki. Written informed consent was obtained from all participants.

Consent for Publication

All participants signed a document of informed consent.

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The authors declare that they have no competing interests in this work.

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