

Mediating Effect of Coping Style Between Risk Perception of Complications and Self-Management in Patients with Type 2 Diabetes Mellitus

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Purpose: To examine how coping style mediates the relationship between risk perception of diabetic complications and self-management, so as to provide evidence for improving the self-management level of patients with type 2 diabetes.

Patients and Methods: We recruited patients with type 2 diabetes mellitus and conducted a cross-sectional survey using a general information questionnaire, the risk perception survey-diabetes mellitus (RPS-DM), the medical coping modes questionnaire (MCMQ), and the summary of Diabetes Self-Care Activities (SDSCA). Descriptive analysis and Pearson correlation analysis were carried out with SPSS 25.0 software, and a structural equation model was constructed with AMOS 24.0 software to verify the mediating effect.

Results: A total of 343 valid questionnaires were collected. Diabetes patients' risk perception of complications has a positive impact on self-management behavior. Cope style was analyzed in three dimensions: confrontation, avoidance and acceptance-resignation, where the confrontation dimension is positively correlated with risk perception of complications and self-management behavior, and the acceptance-resignation dimension is negatively correlated with risk perception of complications and self-management behavior. These two dimensions have partial mediating effects ($\beta=0.115$, 95% CI = 0.041–0.225; $\beta = 0.147$, 95% CI = 0.056–0.283) between risk perception of complications and self-management behaviors, accounting for 15.9% and 20.3% of the total effects, respectively.

Conclusion: Our study discovered that the risk perception of complications can affect self-management behavior via various coping styles, suggesting that clinical medical staff should assist patients with type 2 diabetes in facing the perceived risk of complications positively, and thus improve their self-management behavior.

Keywords: type 2 diabetes mellitus, risk perception, complications, coping style, self-management, mediation analysis

Introduction

Diabetes has become a global public health issue with major consequences for human health. China has the highest proportion of diabetic patients in the world, accounting for 24% of the global diabetic patients.¹ The course of diabetes is long, and the self-management ability of patients is critical to the disease's progression. If the condition is not effectively managed, it will easily lead to multiple organ complications. It is estimated that 4.2 million adults aged 20–79 died of diabetes and its complications worldwide, accounting for 11.3% of all causes of death.² These complications seriously threaten patients' physical and mental health, and significantly increase patients' utilization rate and utilization level of medical services, bringing heavy disease burden to individuals, families and society.³

Risk perception is an individual's subjective judgment of disease susceptibility,⁴ and it has a significant impact on individual health behavior and self-management ability.⁵ Studies have shown that diabetic patients' perception of the risk of complications will help improve their self-management behavior.^{6,7} When diabetic patients perceive the risk of

complications, they can motivate individuals to take preventive health behaviors, thus improving their self-management ability.⁸ Coping style refers to a series of complex reaction processes when individuals are exposed to pressure or perceive threats from the environment.⁹ When faced with stress or traumatic experiences, general population often responds differently, with some responding positively and others responding negatively.⁹ Previous studies have shown that patients with a positive coping strategy may actively seek information related to diabetes and obtain assistance from others,¹⁰ thus improving their self-management behavior. Whereas a negative coping style affects patients' ability to adapt to diseases, making it difficult for them to adapt to life changes and long-term treatment caused by diseases, and gradually generating anxiety, disgust and other psychology, which leads to the decrease of their treatment compliance and affects their self-management behavior.¹¹

Previous research focused more on the direct effect between complication risk perception and self-management behavior. According to coping theory,¹² when people perceive or estimate stressful situations, they seek knowledge, investigate potential solutions, and take appropriate measures to adjust external stimuli. Studies have shown that when patients with type 2 diabetes realize that they are facing great risk of complications, they will be encouraged to take active preventive health behaviors, while patients who underestimate their own risk of illness usually think that they are not easily affected by diabetes and complications and have low treatment compliance.¹³ However, some researchers believe that risk perception is not enough to urge diabetic patients to change their health behavior.¹⁴ Therefore, the relationship between risk perception of complications, coping style and self-management behavior of patients with type 2 diabetes needs further discussion. The purpose of this study is to explore the mechanism of complication risk perception on self-management behavior using existing research and to make recommendations for enhancing the self-management ability of patients with type 2 diabetes.

Methods

Study Design and Population

This was a cross-sectional study. Patients with type 2 diabetes mellitus at the inpatient department of the Third Affiliated Hospital of Guangzhou Medical University were selected from January to June 2024 using convenience sampling, and the survey scale was provided to those who met the inclusion criteria. Inclusion criteria are as follows: (1) Individuals with type 2 diabetes who fulfill the diagnostic requirements;¹⁵ (2) The course of diabetes is ≥ 6 months; (3) Age 18–85 years old; (4) Conscious, able to communicate in words or language, with certain cognitive ability, stable condition; (5) Informed consent and voluntary participation. Exclusion criteria: (1) patients with acute complications of diabetes (hypoglycemia coma, diabetic ketoacidosis, hyperglycemia, and hyperosmotic state); (2) People with mental disorders; accompanied by serious heart, liver, renal insufficiency, respiratory failure, malignant tumor, and other complications. To estimate the sample size, using equation modeling, we applied the general rule of 5 to 10 observations per estimation.¹⁶ The estimated number of variables in this study was 31, in addition to considering a 20% sample attrition rate, the required sample size was at least 186 cases, and 343 cases were actually included in this study. Before the investigation, we explained the purpose and content of the study to the participants and obtained their informed consent. All patients signed the informed consent form.

Measures

We have compiled a general information questionnaire, including age, gender, education level, marital status, family history, course of disease and so on. This questionnaire is used to investigate the socio-demographic information of the subjects.

Risk perception of complications was measured by the Risk Perception Survey-Diabetes Mellitus (RPS-DM). The scale was developed by Walker et al¹⁷ in 2007 and translated by Huiling Ma et al¹⁸ in 2022. The Chinese version includes 23 items across five dimensions: personal disease risk, relative environmental risk, optimistic prejudice, personal control, and concern. Each item adopts a four-level scoring method, ranging from “completely agree/almost no risk” to “completely disagree/high risk” with 1–4 points, respectively, while items 3, 5, and 6 are scored in reverse. The scores of the summary table and dimension are the arithmetic mean of the sum of the scores of subordinate items, which range

from 1 to 4 points. The higher the score, the higher the risk perception level of diabetic complications. The Cronbach's alpha of the Chinese version scale is 0.91.

Coping style adopts the Medical Coping Style Questionnaire (MCMQ), which is a kind of questionnaire specially used to evaluate patients' coping style. It was compiled by Feifel et al¹⁹ and later translated by Xiaohong Shen et al²⁰ including 20 items in three dimensions: confrontation, avoidance, and acceptance-resignation. A Likert 4 scale was used to evaluate the strength of each coping event, with 1–4 points from low to high, among which 8 items were scored negatively, with a score range of 20–80 points. The higher the score of a certain medical coping dimension, the more inclined individuals are to adopt this medical coping style when facing stress, and the Cronbach's alpha of each sub-scale was 0.69, 0.60, and 0.76 respectively. In this study, the Cronbach's alpha of each sub-scale are 0.77, 0.82, and 0.85.

Self-management behaviors of diabetic patients were measured by the Summary of Diabetes Self-Care Activities (SDSCA). The scale was compiled by Toobert²¹ and translated into Chinese by China scholar Qiaoqin Wan et al²². The Cronbach's alpha was 0.62, the test-retest reliability was 0.83, and the reliability and validity were good. The scale consists of six dimensions: general diet (2 items), special diet (2 items), exercise (2 items), blood sugar monitoring (2 items), foot care (2 items) and medication (1 item), with a total of 11 items, of which 10 items are scored positively and 1 item is scored reversely, and each item is scored at 8 levels from 0 to 7. The calculation method of total score and dimension score is as follows: each item is added and divided by the number of items, where ≤ 4.1 is poor, 4.2–5.5 is moderate, and ≥ 5.6 is good.

Statistical Analysis

First, data were analysed using SPSS 25.0. The social demographic information about diabetic patients is described by frequency and composition ratio. The measurement data obey a normal distribution, and the scores of each scale are described by ($\bar{x} \pm s$). Second, the main variables affecting the risk perception of complications in patients with type 2 diabetes were investigated using Hierarchical multiple regression analysis, and the correlations between variables were analyzed using Pearson correlation analysis. Lastly, structural equation modeling was conducted using AMOS 24.0 software. The test level $\alpha=0.05$. We evaluated the fit of the hypothesized model and estimated the direct and indirect effects by the bootstrap method to calculate the confidence intervals of each effect. If the 95% confidence interval (CI) does not contain 0, the corresponding effect is significant.

Results

Study Population Characteristics

Table 1 presents the participant's socio-demographic information. A total of 343 patients with type 2 diabetes were included in this study, including 171 males (49.9%) and 172 females (50.1%). There are 27 people aged 18 to 39 (7.9%), 88 people aged 40 to 59 (25.7%), and 228 people aged 60 to 85 (66.5%). There were 17 patients (5.0%) with a course of diabetes 6 months to 1 year, 77 patients (22.4%) with a course of diabetes 1 year to 5 years, 66 patients (19.2%) with a course of diabetes 5 years to 10 years, and 183 patients (53.4%) with a course of diabetes more than 10 years. A total of 173 (50.4%) had family history of diabetes, and 170 (49.6%) had no family history of diabetes. A total of 206 patients (60.1%) only took hypoglycemic drugs, 39 patients (11.4%) took insulin, and 98 patients (28.6%) took hypoglycemic drugs together with insulin. There were 147 cases (42.9%) without complications, 164 cases (47.8%) with 1 or 2 kinds of complications, 31 cases (9.0%) with 3 or 4 kinds of complications and 1 case (0.3%) with more than 5 kinds of complications. There were 258 patients (75.2%) with other diseases, and 85 patients (24.8%) without other diseases.

Score of Each Scale

The average score of RPS-DM was (2.50 ± 0.44). In the medical coping style, the score of confrontation dimension was (18.53 ± 3.99), the score of avoidance dimension was (12.60 ± 4.00), and the score of acceptance-resignation dimension was (7.78 ± 2.84). The average score of SDSCA was (4.70 ± 1.00).

Table I Descriptive Statistics of the Participants (n = 343)

Characteristics	N(%)	Risk Perception	t/F	P
Gender			−0.637 ^a	0.525
Male	171(49.9)	2.48±0.43		
Female	172(50.1)	2.51±0.46		
Age			5.496 ^b	0.004
18–39	27(7.9)	2.32±0.26		
40–59	88(25.7)	2.42±0.30		
60–85	228(66.5)	2.55±0.50		
Education			1.217 ^b	0.303
Primary school or below	78(22.7)	2.53±0.50		
Middle school	107(31.2)	2.47±0.43		
High school	99(28.9)	2.55±0.44		
College or above	59(17.2)	2.43±0.39		
Marital status			2.204 ^b	0.087
Unmarried	13(3.8)	2.40±0.33		
Married	279(81.3)	2.49±0.44		
Divorced	12(3.5)	2.36±0.34		
Widowed	39(11.4)	2.65±0.52		
Living style			1.724 ^b	0.162
Live alone	44(12.8)	2.54±0.45		
Live with spouse	151(44.0)	2.54±0.42		
Live with family	138(40.2)	2.46±0.47		
Others	10(2.9)	2.27±0.27		
Course of a disease			10.163 ^b	<0.001
6 months–1 year	17(5.0)	2.23±0.35		
1 year–5 years	77(22.4)	2.34±0.38		
5 years–10 years	66(19.2)	2.46±0.36		
More than 10 years	183(53.4)	2.61±0.47		
Family history			5.759 ^a	<0.001
Yes	173(50.4)	2.63±0.41		
No	170(49.6)	2.37±0.44		
Therapeutic regimen			4.704 ^b	0.010
Take hypoglycemic drugs	206(60.1)	2.48±0.44		
Inject insulin	39(11.4)	2.35±0.43		

(Continued)

Table 1 (Continued).

Characteristics	N(%)	Risk Perception	t/F	P
The above two together	98(28.6)	2.60±0.44		
Kind of complications			3.582 ^b	0.014
0	147(42.9)	2.41±0.42		
1–2	164(47.8)	2.55±0.43		
3–4	31(9.0)	2.63±0.54		
More than 5 kinds	1(0.3)	2.65±0.00		
Combined with other diseases			2.784 ^a	0.006
Yes	258(75.2)	2.53±0.45		
No	85(24.8)	2.39±0.40		

Notes: ^at-test, ^bone-way ANOVA test.

Correlation Analysis Among Key Variables

Table 2 shows the results of Pearson correlation analysis. The risk perception of complications was positively correlated with confrontation and self-management behaviors ($r = 0.199$, $P < 0.01$; $R = 0.344$, $P < 0.01$), which was negatively correlated with acceptance-resignation ($r = -0.223$, $P < 0.01$); Self-management behavior is positively correlated with confrontation ($r = 0.469$, $P < 0.01$) and negatively correlated with avoidance and acceptance-resignation ($r = -0.268$, $P < 0.01$, $r = -0.492$, $P < 0.01$).

Model Construction

In this study, the VIF value was less than 5 through the multicollinearity test, which indicated that there was no multicollinearity problem between variables. A structural equation model was created using the dimensions of confrontation and acceptance-resignation in coping style as the intermediary factors, self-management behavior as the dependent variable, and risk perception of complications as the independent variable (Figure 1). The model fit results showed that all pathways were statistically significant ($P < 0.001$). The initial model was revised and fitted repeatedly by the maximum likelihood approach. The final results showed that $\chi^2/df = 2.640$, RMSEA = 0.069, GFI = 0.933, CFI = 0.920, and IFI = 0.921, which all achieved the ideal values, indicating that the structural equation model constructed has good adaptability (Table 3).

The results of path analysis showed that there was a positive predictive relationship between diabetic complication risk perception and self-management behavior, and the standardized path coefficient was 0.400, which indicates that the higher the diabetic patient's perception level of complication risk, the higher his level of self-management. There was

Table 2 Correlation Coefficient of Each Variable

Variables	Risk Perception	Confrontation	Avoidance	Acceptance-Resignation	Self Management
Risk perception	I				
Confrontation	0.199**	I			
Avoidance	-0.105	-0.358**	I		
Acceptance-Resignation	-0.223**	-0.324**	0.250**	I	
Self management	0.344**	0.469**	-0.268**	-0.492**	I

Notes: ** $P < 0.01$.

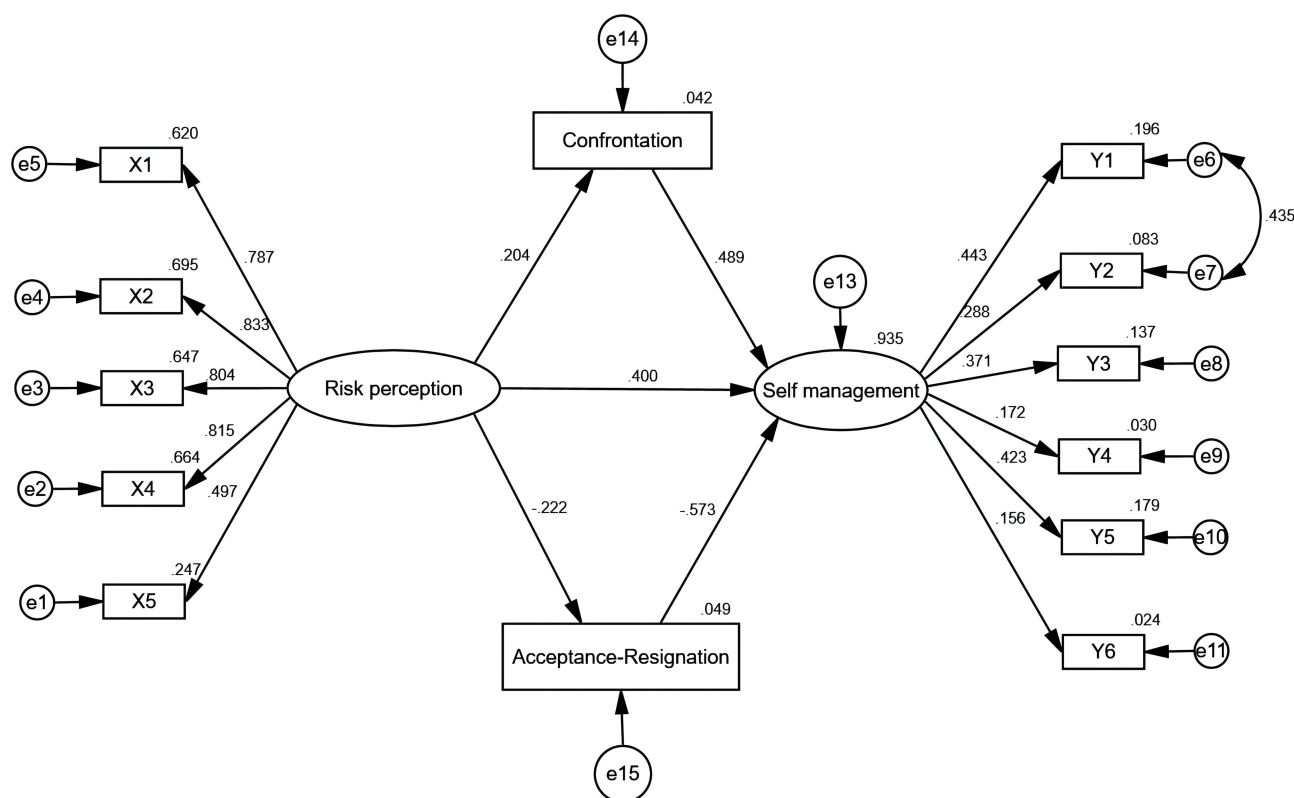


Figure 1 Structural equation model of self-management behavior.

a positive predictive relationship between risk perception of diabetic complications and confrontation, and the standardized path coefficient was 0.204. The standardized path coefficient was -0.222 , indicating that diabetic patients perceive a high level of complication risk and tend to adopt a confrontation coping style. There was a positive predictive relationship between confrontation and self-management behavior, and the standardized path coefficient was 0.489. This suggested that diabetic patients who embrace confrontation as a coping technique will enhance their diabetes self-management ability. Conversely, a negative predictive relationship was found between acceptance-resignation and self-management behavior; the standardized path coefficient was -0.573 , indicating that diabetic patients who adopt an acceptance-resignation coping style will have greater difficulty managing their diabetes (Table 4).

Bias-corrected percentile Bootstrap test was used to test the mediating effect of diabetes complication risk perception and self-management behavior in the model. The bootstrap analyses showed that the total effect of risk perception of diabetic complications on self-management behavior was 0.724 (95% CI: 0.448–1.073). The size of the direct effect of diabetic complications on self-management behavior was 0.462 (95% CI: 0.276–0.718); the indirect mediation effects via two types of coping style were 0.115 (95% CI: 0.041–0.225) and 0.147 (95% CI: 0.056–0.283). Therefore, in this mediation model, confrontation and acceptance-resignation are partial mediators in the risk perception and self-management behavior of diabetic complications, and the mediation effect accounts for 36.2% of the total effect (Table 5).

Table 3 The Fitting Results of SEM

Fit indices	χ^2/df	RMSEA	GFI	CFI	IFI
Model fit	2.640	0.069	0.933	0.920	0.921
Standards of fit indices	1.00–3.00	<0.08	>0.90	>0.90	>0.90

Table 4 Path Coefficient of SEM

Relations between variables	β	SE	CR	P
Risk perception→Confrontation	0.204	0.225	3.414	<0.001
Risk perception→Acceptance-Resignation	-0.222	0.162	-3.695	<0.001
Risk perception→Self management	0.400	0.106	4.340	<0.001
Confrontation→Self management	0.489	0.025	5.957	<0.001
Acceptance-Resignation→Self management	-0.573	0.037	-6.605	<0.001

Table 5 Mediating Effect of Coping Style

Paths	Standardized coefficient	Bootstrap 95% CI		P
		Lower bounds	Upper bounds	
Total effect	0.724	0.448	1.073	<0.001
Direct effect	0.462	0.276	0.718	<0.001
Indirect effect				
Risk perception→Confrontation→Self management	0.115	0.041	0.225	0.001
Risk perception→Acceptance-Resignation→Self management	0.147	0.056	0.283	0.001

Discussion

Current Status of Risk Perception of Complications and Self-Management Behaviors in Patients with Type 2 Diabetes Mellitus

This study found that the average score of RPS-DM was (2.50 ± 0.44), comparable to those found in most domestic and foreign research,^{6,13,23} higher than the results of the study by scholar Yifan Gu,²⁴ and the overall perception level was medium. Among them, the scores of concern dimension and optimistic bias dimension were high, which showed that patients with type 2 diabetes in this study are generally worried about complications, but there are still some optimistic attitudes, thinking that they are less likely to have complications than people of the same age and gender. The lower scores in the personal control dimension, personal disease risk perception dimension, and relative environmental risk dimension indicated that patients with type 2 diabetes have a low perception of actual complications risk, suggesting that medical staff should improve the content of health education regarding the risks associated with complications.

The average score of SDSCA was (4.70 ± 1.00), which was higher than the average scores reported by Yanmei Su et al²⁵ and Xiaoning Liu et al²⁶ and the overall level was in the middle. The reason for this may be that 53.4% of the patients with type 2 diabetes in this study had a course of disease for more than 10 years. Patients with a longer course of the disease tend to have stronger self-management awareness and higher level of self-management behavior. However, the score of the blood glucose monitoring dimension was the lowest. This could be because the majority of the patients are between the ages of 60 and 85, and learning how to measure blood sugar can be difficult for the elderly, most of them rely on their children and medical staff. Additionally, the majority of patients reported that they were unable to monitor their blood sugar because they were unsure of where to obtain test strips when they ran out. When caring for elderly patients, medical professionals should explain the significance of blood sugar monitoring, specific procedures, and guide them on equipment purchases, while also encouraging patients and their families to participate in diabetes self-management.

Risk Perception, Coping Style and Self-Management Behavior are Related to Each Other

This study found that the perception of complication risk was positively correlated with the confrontation in coping style and negatively correlated with the acceptance-resignation, indicating that the patients with a higher level of complication risk perception are more likely to choose a confrontational approach. According to the positive coping theory,²⁷ people anticipate stressful situations and take precautions to prevent or mitigate them. During the hospitalization of patients with type 2 diabetes, medical staff will educate the patient on risk factors for diabetes complications and the gravity of diabetes complications. Most patients have a certain understanding of complications and agree that complications should be controlled as soon as possible to delay their progress. Therefore, when patients perceive the risk of complications, they tend to prefer a confrontational strategy with aggressive screening and early treatment.

Confrontation was positively correlated with self-management behavior, while avoidance and acceptance-resignation were negatively correlated with self-management behavior, which is consistent with the results of domestic and foreign research.^{28–31} When patients take an active role in their own disease management, this can encourage patients to change their eating behavior, develop exercise habits, actively measure their daily blood sugar, pay attention to the health of their feet, and demonstrate significant progress in managing blood sugar discomfort.¹³ Opting out of treatment and giving in to negative coping will affect the enthusiasm of treatment, make patients feel uncertain about long-term treatment, and create resistance to the therapy, which will result in poor self-management behavior.¹¹

In addition, the risk perception of complications was positively correlated with self-management behavior, which is consistent with the research at home and abroad.^{7,12,32} Patients who perceive a higher risk of complications are more likely to believe they are at greater risk for diabetic complications. In order to avoid or delay the occurrence and development of complications, they will heed medical professional recommendations and carry out self-management in many areas, including nutrition, exercise, medication, and blood sugar monitoring.³³ Patients who perceive a low risk of complications may relax and disregard their self-management behavior, thinking they are not susceptible to complications. Therefore, medical staff should help patients to accurately assess their physical condition and disease progression, and guide them to face the perceived risks and take effective measures to prevent and delay the occurrence of diabetes complications through active self-management.

The Mediating Role of Coping Style Between Risk Perception and Self-Management Behavior

In this study, we found that the confrontation and acceptance-resignation dimensions mediate the relationship between the risk perception and self-management behavior, accounting for 36.2% of the effect. That is, the risk perception affects the self-management behavior of patients with type 2 diabetes both directly and indirectly through confrontation and acceptance-resignation coping styles. According to the protective motivation theory, individuals with a high perception of risk are more likely to adopt healthy behaviors.³⁴ It is suggested that medical staff can start with patients' risk perception of their own complications. They should raise patients' awareness of the possibility of complications, emphasizing the importance of preventing diabetic complications and the gravity of the prognosis, encouraging patients to actively confront the risk of complications after early detection, enhancing their behavior in self-management, carrying out timely clinical interventions, and ultimately improving patients' quality of life. However, some research indicates that patients' negative emotions, such as anxiety and nervousness, are positively correlated with their perception of the risk of diabetic complications.³⁵ This implies that medical staff should be aware of patients' psychological state, provide them with emotional support to help adjust their negative emotions, and correctly understand the risk of diabetic complications, thereby promoting their self-management.

Limitations

There are some limitations in this study. Firstly, the research subjects are only adults with type 2 diabetes from a hospital, so the research results could be biased. In the future, we can consider focusing on specific age subgroups and conducting multi-center research to investigate the similarities and differences in the risk

perception of complications and self-management among patients with type 2 diabetes of various ages and regions, which will provide a solid foundation for developing targeted interventions. At the same time, although the existing literature has shown the correlation between risk perception of complications and emotional state, we suggest that the follow-up study should not only include emotional related variables, but also use a longitudinal study design to reveal the causal relationship between self-management behavior and other key variables more accurately.

Conclusion

In summary, our study found a positive correlation between risk perception of complications and self-management behavior, with coping style mediating this relationship. It is suggested that medical personnel should educate patients with type 2 diabetes on complications, advising those with low-risk perception to always be aware of their own condition, not underestimate the disease, to conduct regular self-monitoring, and follow-up with the hospital as scheduled. For patients with a high-risk perception of complications, medical staff should assess whether there is excessive worry in patients, correct patients' erroneous fears promptly, and prevent it from causing unhealthy behaviors. If patients are indeed at high risk of complications, they should be encouraged to actively participate in medical decision-making, inform them of the preventable and controllable complications of diabetes, enhance their confidence in treatment and promote their self-management.

Ethical Approval

The study was authorized by the ethics committee of The Third Affiliated Hospital of Guangzhou Medical University (approval No. LCYJ-2023-058), and it adhered to medical ethics. The Declaration of Helsinki's ethical standards served as the foundation for this research.

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Disclosure

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