Doctoral Dissertation

Development and Evaluation of a Self-Management Promotion Program for Type 2 Diabetes Patients of the Bai Ethnicity in China

Department of Nursing
Graduate School of Keimyung University

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Supervised by Professor Jun Sangeun

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Yuan Yingmei

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I. Introduction

1. Background

In 2019, there were 116 million diabetes patients in China, 77 million in India, and 31 million in the United States of America, the three countries with the largest number of diabetes patients in the world (Sun et al., 2022), and in 2020, approximately 6.05 million diabetes patients aged 30 years or older in South Korean (Bae et al., 2022). The disease burden of diabetes in China has been increasing rapidly in the past 30 years and may keep growing in the future (Ma et al., 2023).

In China, the diabetes mellitus (DM) prevalence was 11.2%, with type 2 diabetes mellitus (T2DM) accounting for over 90%. However, the awareness rate is only 36.5%, the treatment rate is 32.2%, and among the treatment rate the control rate is 49.2% (Diabetes Society of the Chinese Medical Association, 2021). And as a nation of diverse ethnicities, diabetes prevalence is increasing rapidly among ethnic minorities alongside rising living standards, accompanied by significant regional and ethnic variations (Li & Yuan, 2017; Diabetes Society of the Chinese Medical Association, 2021). Poor glycemic control is the most prevalent in minority populations, those living in poverty, and with low educational levels (Liburd, Jack, Williams, & Tucker, 2005). According to the “2021 China Statistical Yearbook”, approximately 1.66 million of the 2.1 million Bai populations reside in Yunnan Province. Among rural Bai people over 35, diabetes prevalence is 7.8%, rising to 17.2% in those over 60; however, the glycemic control rate is just 26.6%, markedly below the national average of 49.2% (Chen, Zou, Zhang, Fang, & Fan, 2017; Chen, Yang, et al., 2018; Zuo et al., 2021).

This phenomenon is influenced by unique dietary preference, cultural backgrounds, limited healthcare access, and language barriers. A secondary analysis from 'Self-management Behavior of Patients with T2DM in a Border Area of Southwest China' (Yuan & Jun 2022) revealed that the Bai T2DM patients have a significantly low level of self-management. Factors such as Bai diet, rich in high-salt and high-fat foods, and a tradition of frequent liquor consumption exacerbate the situation (Wang, Cao, Xia, Li, & Zhou, 2006; Zhang, 2009; Wang, B., Wang, X., & Yang, 2018). Additionally, many Bai people reside in specific remote, mountainous areas with limited medical resources and low Mandarin language proficiency, leading to considerable barriers in communication (You et al., 2022).

Effective self-management can improve symptoms and quality of life, while reducing complications, and usually achieved through professional education, self-monitoring, and social support (Lorig et al., 2001; Bo, Hua, & Mcgowan, 2003; Kisokanth, Prathapan, Indrakumar, & Joseph, 2013). Recipients of self-management interventions benefit more than usual care in knowledge, self-management behaviors, self-efficacy, and health statues (Barlow, Sturt, & Hearnshaw, 2002). The health belief model, protection motivation theory, adult learning theory et al. were used in diabetes self-management intervention and effective for some aspects (Jalilian, Motlagh, Solhi, & Gharibnavaz, 2014; Shakibazadeh, Bartholomew, Rashidian, & Larijani, 2015; Kang et al., 2016). However, successful educational programs have focused on empowerment of patients through enhancing their knowledge, skills and motivation necessary to influence their behavior, then improving the biomedical and psychosocial outcomes (Shakibazadeh et al., 2015; Chatterjee et al., 2018). In comparison, the Information-Motivation-Behavioral (IMB) skills model fits the view better (Fisher, J. D., & Fisher, W. A., 1992). This model was applied to T2DM intervention programs

which found to very effectively improve the self-management behavior and health related outcomes of T2DM patients (Osborn, Rivet Amico, Fisher, W. A., Egede, & Fisher, J. D., 2010; Gao, Wang, Zhu, & Yu, 2013).

Diabetes management education in China generally through lectures or oral education at hospital, and patients were passive in learning (Diabetes Education and Management Group of Diabetes Society of Chinese Medical Association, 2017). Despite 80% of T2DM patients received various health education (Diabetes Education and Management Group of Diabetes Society of Chinese Medical Association, 2010), and perhaps some education programs were developed, the contents of most programs were monotonous and arbitrary, lack of systematic evaluation, education not consistent with behavioral changes, out of touch with patient needs and lack of individualized guidance, and the self-management program cannot be implemented well. (Guo & Lou, 2011; Ji et al., 2014; Zhang, Lv, Liang, & Li, 2014).

Especially the educations not meet the needs of ethnic minorities, and targeted educations based on the characteristics are necessity (Li & Yuan, 2014). Culturally tailored health education programs may positively influence health behavior in individuals for minorities (Nicolaou et al., 2014). For Bai T2DM patients, in addition to improving social security and regional medical services, it is positive meaningful to paid attention and improves the self-management level. The IMB model-based self-management program in Bai T2DM patients never reported, particularly when adapted to be a better resource based on the unique cultural attributes of these populations. Therefore, it is necessary to develop and evaluate an effective self-management program grounded in theoretical frameworks base on IMB model, aiming to promote the self-management behaviors and health outcomes in Bai T2DM patients.

2. Research purpose

The purpose of this study was to develop a self-management promotion (SMP) program for T2DM patients of Bai ethnicity in China, and to evaluate its effects on self-management behavior and health-related outcomes.

3. Research hypothesis

To evaluate the effect of the developed SMP program, the experimental group participated in the SMP program for 5 weeks, while the control group received usual care for the same period. To determine whether three constructs of the IMB model were enhanced through the SMP program and to ascertain if such enhancements led to improved health-related outcomes, the following research hypotheses were established.

Hypothesis 1: Diabetes knowledge will be higher in the experimental group compared to the control group.

Hypothesis 2: The motivation level will be higher in the experimental group compared to the control group.

Hypothesis 3: The level of diabetes self-efficacy will be higher in the experimental group compared to the control group.

Hypothesis 4: The level of self-management behavior will be higher in the experimental group compared to the control group.

Hypothesis 5: Fasting blood sugar level will be lower in the experimental group

compared to the control group.

Hypothesis 6: HbA1c level will be lower in the experimental group compared to the control group.

Hypothesis 7: The diabetes-specific quality of life will be higher in the experimental group compared to the control group.

4. Definition of terms

1) Type 2 diabetes mellitus

Type 2 diabetes mellitus (T2DM) is the most common type of diabetes, and exist various degrees of beta-cell dysfunction and insulin resistance; commonly associated with overweight and obesity (WHO, 2020). This study refers to the WHO' s diagnosis criteria of T2DM (WHO, 2020), which includes fasting venous or capillary plasma glucose ≥ 7.0 mmol/L; 2-hour post-load venous plasma glucose ≥ 11.1 mmol/L; 2-hour post-load capillary plasma glucose ≥ 12.2 mmol/L; random plasma glucose ≥ 11.1mmol/L; or, non-essential conditions HbA1c ≥ 6.5%.

2) Diabetes knowledge

Diabetes knowledge is diabetes related knowledge possessed by individuals with diabetes, including basic knowledge of diabetes, experience, self-perception, the decisions to be made, and the actions to be taken (Pouladi, 2018). In this study, it refers to the score obtained from 'The Knowledge Questionnaire for Patients with T2DM' developed by Jiang et al. (2017).

3) Motivation

Motivation refers to reasons that underlie behavior that is characterized by willingness and volition. Intrinsic motivation is animated by personal enjoyment, interest, or pleasure, whereas extrinsic motivation is governed by reinforcement contingencies (Lai, 2011). In the IMB model, motivation pertains to attitude towards behaviors and their consequences (Fisher et al., 1996; Chen et al., 2017). In this study, it refers to the score obtained from the Chinese version of the 'Third Version of the Diabetes Attitude Scale (DAS-3)' developed by Anderson et al. (1998) and translated by Zhou et al. (2012), which assesses motivation in patients with T2DM.

4) Diabetes self-efficacy

Self-efficacy (SE) is a person's particular set of beliefs that determine how well one can execute a plan of action in prospective situations (Bandura, 1977). From this definition, diabetes self-efficacy is the belief and ability of T2DM patients to implement self-management. In this study, it refers to the score obtained from the 'Diabetes Management Self-Efficacy Scale (DMSES)' developed by Bijl (1999), and translated into Chinese version by Liu et al. (2008).

5) Self-management behavior

Self-management behavior (SMB) is an individual's ability to manage the symptoms, treatment, physical and psychosocial consequences and lifestyle changes inherent in living with a chronic condition (Lorig & Holman, 2003; Audulv, Packer, Hutchinson, Roger, & Kephart, 2016). In this study, it refers to the score obtained from 'The Summary of Diabetes Self Care Activities (SDSCA)' developed and revised by Sigurthardottir (2005), and translated into the Chinese version by Wan et al. (2008).

6) Fasting blood sugar

Fasting blood sugar (FBS) quantifies blood glucose levels following a minimum of 8 hours of fasting, providing an indicator of glycemic controls (Chen, 2018). In this study, it refers to the T2DM patients' self-test by non-uniformed rapid response blood glucose meters to measures capillary blood glucose in overnight fasting state to get an intuitive value.

7) Glycated hemoglobin

Glycated hemoglobin (HbA1c) reflects the nonenzymatic glycation of hemoglobin's beta chain in red blood cells, indicative of average blood glucose levels over approximately three months (Lowrey, Lyness, & Soeldner, 1985). In this study, it refers to the HbA1c value obtained using a dry fluorescence immunoassay analyzer to assess the glucose control status in T2DM patients.

8) Diabetes-specific quality of life

Diabetes-specific quality of life (DSQOL) refers to diabetics' quality of life related to diabetes variables (HbA1c, insulin injection, duration of disease, complications, understanding of the impact of the disease, etc.), treatment compliance (self-monitoring blood glucose, foot care, diet, weight regulation, exercise, smoking, drinking, daily life regulation, etc.), and demographic variables (age, gender, education, social relationship status, etc.) (Hanestad, 1989). In this study, it refers to the score obtained from 'The Diabetes-specific quality of life Scale (DSQL)' developed by Fang et al. (2000).

II. Literature Review

1. Self-management and predictors of T2DM patients

As the course of the disease prolongs, the physical role function of DM patients decreases, the greater the number of complications, the worse the physical function; the emotional function declines most significantly. As a result, the quality of life in diabetes patients generally declines. Therefore, improving the QOL of DM patients should start from the early stage (Wang, W., Wang, K., & Shi, 2001). At the health management of diabetes mellitus, 95% of the tasks are performed by patients, that is, self-management of the daily activities performed by patients to control their blood glucose and reduce the effects of diabetes on their health scientifically and rationally. Studies shows level of self-management in diabetic patients determines disease prognosis and quality of life (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002).

In China, community health resources are insufficient, self-management of chronic diseases far from being universally recognized and widely disseminated (Yang & Jiang, 2011). According to a comprehensive analysis report of studies from 2009 to 2018, the result showed that self-management of T2DM patients in China was generally at a low level, and the self-management has not received sufficient attention (Huang & Jian, 2021). Insufficient awareness of self-management and with nearly half remaining uninformed about complications and glycosylated hemoglobin levels; overall blood sugar control is poor, the rate of chronic complications is high, and episodes of hypoglycemia are frequent (Diabetes Education and Management Group of Diabetes Society of Chinese Medical Association, 2010).

Self-management occurs in the context of family, community and environment, and is affected by risk and protection factors (Grey, Knafl, & McCorkle, 2006). A multi-national investigation from Europe, Australia, Asia and the Americas shows that diabetes patients self-management skills, willingness to prevent complications, mobile medical technology and high education level are the driving forces of diabetes patients' self -management; (Adu, Malabu, Malau-Aduli, A. E., & Malau-Aduli, B. S., 2019). In China, studies in different regions showed the impact factors of diabetes self-management are quite different (Wang, Ma, & Li, 2017; Zhang, 2017; Li, S., Li, Y., & Zhang, 2021; Li, 2021; Du, Li, Y., Li, H., & Huang, 2022).

Diabetes knowledge is a predictor of T2DM self-management (Kueh, Morris, Borkoles, & Shee, 2015). Knowledge of diabetes can become a cornerstone in decision making on diet, exercise, blood glucose monitoring, use of medication, weight control, and foot care (Murata et al., 2003). In China, studies showed that DM knowledge, self-management levels were positively related to T2DM patients (Sun, 2011; Huang, Liu, Zhang, & Yao, 2013). However, the mastery of knowledge in T2DM patients is mainly at a poor level (Huang et al., 2013).

Diabetes self-management involves performing a complex series of monitoring tasks and lifestyle adjustments. In addition to knowledge, it is crucial for diabetics to develop and maintain motivation for self-management. (Swanson & Maltinsky, 2019). Individuals with higher levels of autonomous motivation reported higher frequencies for maintaining diet and testing blood glucose (Shigaki et al., 2010) In China, study showed that motivational intervention can effectively improve the psychological state and quality of life of T2DM patients and reduce their blood sugar levels (Yao, Zhang, Du, & Gao, 2021).

The objective ability of diabetes skills is the ability to implement T2DM

self-management activities (Anderson, 1995). Patients with diabetes with higher skills usually have higher perceived self-management (Persell et al., 2004). Skill training can effectively improve living ability, quality of life and self-management ability of diabetic patients (Cheng, 2018). Effective implementation skills of T2DM patients in Bai minority area have a significant impact on self-management behavior (Yuan et al., 2022).

The concept of self-efficacy originates from Bandura's social cognitive theory (Bandura & Walters, 1977). As an importance factor, self-efficacy is a strong predictor of self-management behavior of diabetes patients (Johnston-Brooks, Lewis, & Garg, 2002). In China, studies also showed a positive correlation between self-efficacy and self-management behavioral (Li, Y., Tuo, Li, J., & Lu, 2018; Yao et al., 2019); Thus, need to find ways to increase patients' self-efficacy in their ability to manage their disease may increase their likelihood of using skills for self-management (Dou et al., 2017).

To sum up, self-management plays a crucial role in T2DM, and promoting self-management in patients with T2DM has always been necessary. Especially according to the situation in China, the promotion of self-management in T2DM is a long and arduous task. At the same time, the predictors that affect self-management behavior are complex. Diabetes knowledge, motivation, diabetes skills, and self-efficacy are all effective predictors in T2DM self-management behavior. For the Bai ethnicity, some characteristics derived from minority cultural attributes may associate with the T2DM self-management.

2. Population characteristics related to T2DM self-management of Bai ethnicity

In China, it is lack of research on self-management of T2DM among ethnic minorities. However, the minorities mostly live in mountainous or remote areas, and the economic backwardness and the lack of edical resources make patients lack T2DM self-management awareness (Su et al., 2016). A small number of studies showed that minority patients lack of Chinese ability leads to difficulties in health education and learning knowledge. Factors such as traditional diet and religious beliefs also affect the self-management of diabetes (Wang & Gao, 2011; Luo, Dai, Meng, & Wei, 2013; Yan, 2017).

Similarly, as a minority, the Bai ethnicity mainly lives in the southwest border area of China, and the economic status is relatively backward. The dietary habits and lifestyle of Bai people are different from those of Han Chinese (Chen, Yang, et al., 2018). The high incidence of diabetes in the Bai group is related to the improvement of living standards and the special living habits of minority areas (Wang et al., 2006). Some ethnic characteristics that influence the disease or T2DM self-management include dietary habits, minority language, cultural activities and religious belief.

Study showed that excessive salt intake can cause elevated blood sugar levels (Piziak, 2012). Bai people are very fond of high-salt foods, especially pickled meats and vegetables, smoked foods, and boiled fish (Wang et al., 2006; Yang, 2009), these foods all high in salt. Another study showed, increasing the amount of fat in the diet from 30% to 50% has a statistically significant effect on blood sugar fluctuations (Ding, 2014). Bai people also preference high-fat foods, such as steamed pork, pig trotters, braised pork, etc., at the same time, the dietary structure of people is unreasonable, and the intake of protein food is insufficient (Wang et al., 2006). Alcohol can enhance insulin sensitivity, and moderate drinking, i.e. about 13 grams per day can reduce fasting blood sugar and HbA1c in patients with T2DM (Shai et al.,

2007). Most Bai people like drinking, but the middle-aged men drink more frequently than others (Zhang, 2009; Wang et al., 2018).

However, due to the influence of traditional medicine, Bai people have the concept of health preservation and disease prevention in diet, such as ‘dual-use food and medicine’, ‘flower food’, ‘medicinal tea’, ‘scented tea’, and ‘medicinal liquor’ (Wang et al., 2018). The special geographical make this area have a long history of tea planting and drinking (Yang, 2020). Tea role in lowering blood sugar and preventing diabetic complications have also been confirmed (Zhang, Peng, & Shan, 2022). Studies showed that polysaccharides in edible mushrooms have good hypoglycemic and antidiabetic effects, and have a certain blood lipid lowering effect (Liu, Bao, & Jiang, 2007; Dai, Liu, & Xiao, 2015). Yunnan is the most concentrated area for the growth and consumption of wild mushrooms in China (Yunnan Cuisine Association, 2008), and mushrooms is a favorite food among the Bai people, such as commonly termitomyces , xianggu, and auricularia, which have a significant regulatory effect on blood sugar (Zong, 2007; Liu, 2010; Feng, Zhang, & Wu, 2023). These special dietary cultures play an auxiliary role in prevention and treatment of diseases.

For minority diabetic patients, how to communicate with them through easy-to-understand language is a new topic for health educators (Wei et al., 2017). A study pointed out that Bai diabetic patients with low Chinese communication skills have poor treatment compliance, low blood sugar level compliance rate, early complications, and low quality of life; especially lack of awareness of the risk of diabetic foot (DF). And after intervening in patients using bilingualism (i.e. Bai language and Chinese) for education, the knowledge, skills and satisfaction of patients improved to varying degrees (Zhang, 2015). At the same times, peer education, family education or the application of Bai health educators can be adopted, so that patients

who only speak Bai language can also enjoy the right to promote health (You et al., 2021).

Affected by customs, Bai people have formed sports activities with regional and national characteristics in their life and labor, such as national dance, horse racing, dragon boat racing, archery, dragon and lion dance (Wang et al., 2018). Among them, the 'Rattle Stick Dance' is the most distinctive dance and a reflection of the social life, and can be participated by all ages (Sun, 2008). Bai collective dances can not only relieve the fatigue of daily labor, improve interpersonal relations, but also relieve stress and change bad emotions, and of positive significance for health preservation and disease prevention (Wang et al., 2018).

The collective religious beliefs of the Bai ethnicity from ancient times to the present have certain inference on their health. The belief in 'Benzhu God' is a unique religious faith of the Bai people. They believe that any difficulties they encounter can be solved by praying (Chen, 2013). Furthermore, Bai ethnicity has its own national medicine since ancient, and they believe in 'Medicine Gods'. And has formed diversification, such as the integration medicine with different religions, traditional Chinese medicine, and the Western medicine (Lv, Zhang, L., Zhang, X., & Yang, 2020). These may lead Bai people to seek multiple treatments when they are sick.

However, from a positive perspective, the Buddhist beliefs guide Bai people to 'self-cultivation' to prevent diseases and keep fit; the sense of security, balance, belonging and a positive attitude generated by the beliefs are of great significance to maintaining the mental health (Wang et al., 2018). Due to the religious beliefs, Bai people can actively participate in various sacrificial and social activities according to their hobbies, needs and abilities. These activities provide a place for Bai people to exchange ideas and enjoy a happy life, and play an important role in maintaining the

psychological health of the Bai people (Yang & Baden, 2012; Chen, 2013).

To sum up, diabetes is a disease closely related to lifestyle, and different ethnic groups have their own unique cultural background and social customs, which have a great impact on the formation of their lifestyle for a long time. Bad lifestyle is of great significance to the occurrence and development of diabetes in different ethnic groups (Li et al., 2017). In an ethnically diverse society, health professionals will increasingly need to promote lifestyle changes in a manner, nutritionists and other professionals will need to ensure that interventions are culturally appropriate (Szczepura, 2011). Bai ethnicity has distinctive characteristics, it is necessary to develop a SMP program for Bai T2DM patients from a cultural perspective. Since the IMB model based program has never been conducted in Bai T2DM patients, developing and evaluating and this form of program for the ethnic group is a creative attempt.

3. T2DM self-management program based on IMB model

The viewpoint of lifestyle change strategies of patients with T2DM emphasizes the importance of combining behavior change strategies with a program, which should be based on behavior change theory and adjusted according to cultural, socio-economic, religious and other factors (Albelbisi, Windle, & Blake, 2015). And the key factors of the diabetes self-management program were to promote the patients' knowledge, motivation, and skills necessary for diabetes self-management (Haas et al., 2012). Studies showed, for diabetic education, in addition to knowledge, it should target personal and social motivation to effect behavior change, thus, the IMB model is an appropriate, comprehensive health behavior change framework for diabetes self-management (Osborn & Egede, 2010), and the barriers to self-management

behaviors in diabetic patients were consistent with the behavioral change model of Information-Motivation-Behavioral skills (Albelbisi et al., 2015). Furthermore, the IMB model related diabetes self-management asserts that diabetes self-management behaviors are directly linked to health outcomes, which has been well supported in literatures (Liu et al., 2018).

In China, the IMB model change was used to conceptualize the determinants of diabetes self-management behavior of Chinese adults with T2DM. Results also showed that information, motivation, and behaviors skills are important critical prerequisites to performing self-management in diabetes (Gao et al., 2013). Another study of Shanghai city proved that glycemic control (represented by HbA1c level) can be well involved in the IMB model, and validated the utility of the modified IMB model in this population (Chen, Wang, et al., 2018).

To sum up, programs based on IMB health behavior model, can effectively promote self-management behaviors and health-related outcomes in patients with T2DM and promote. Therefore, utilizing the IMB model as a program theoretical framework to promote self-management of Bai T2DM patients expected applicable and effective.

III. Theoretical Background and Framework

1. Theoretical background

The Information-Motivation-Behavioral (IMB) Skills Model was developed by Fisher and colleagues in 1992 (Figure 1), and the developers initially sought to understand the mechanisms behind HIV-risk behavioral changes. They found that behavioral changes were a function of individuals possessing three determinants of information, motivation, and behavioral skills, and they combined these three constructs into a generalizable model (Fisher et al., 1992; Fisher et al., 1996).

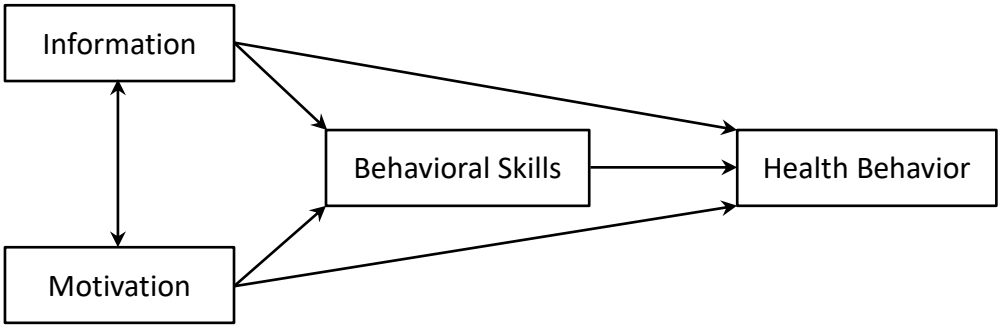

Figure 1. Information-motivation-behavioral skills model (Fisher, 1992)

In the IMB model, three core constructs were explained specifically. The ‘information’ means that individuals have relevant information about behavior and its influence (Fisher et al., 1996; Chen et al., 2017). The ‘motivation’ was explained an individual's attitude towards behavior and its consequences, and this attitude is influenced by both personal and social motivations. The personal motivation is the

cognition of attitude towards healthy behavior and personal behavior, while the social motivation is the cognition of making behavioral changes based on social norms and social support (Fisher et al., 1996; Chen et al., 2017). The ‘behavioral skills’ refer to techniques or resources required to perform the behavior, which is an individual’s objective ability and self-efficacy to effectively implement behavioral change. Among them, the objective ability is an individual’s ability to practice behavior, and the self-efficacy is an individual’s belief in their ability to perform a behavior (Fisher et al., 1996; Chen et al., 2017).

Among them, information and motivation are generally regarded as independent constructs in the model, they can promote each other, and able to independently or directly affect behavior (Fisher et al., 1992; Fisher, J. D. & Fisher, W. A., 2000; Osborn & Egede, 2010). However，likely to struggle with adopting a complex health behavior in the absence of solid practical skills to do so. Behavioral skills have mediated the relationship between information and behavior, and motivation behavior (Fisher, J. D., Amico, Fisher, W. A., & Harman, 2008).

The IMB model sees behavioral change as a process, first provide specific relevant information to make the individual feel the correct social rules and norms; then create an atmosphere conducive to the individual to start thinking about ‘healthy behavioral change’ and enhance behavior motivation to change, provide and promote acceptable skills; and when the information, motivation and behavior skills have reached a certain level, it will eventually lead to behavior change (Fisher et al., 1992; Fisher et al., 1996).

Due to its generalizability, the model has served as a framework for intervention and as a reference for understanding various behavioral changes both within and outside the health sector. The model has also been applied to influence various types

of behavioral changes; it has been also used to inform various interventions, especially in public health (Chang, Choi, Kim, & Song, 2014). Behavioral interventions supported by the IMB model have been shown to be applicable and effective in the health management of chronically ill patients (Alexander, Hogan, Jordan, DeVellis, & Carpenter, 2017), and research suggests that diabetes education programs should include strategies enhancing patients' knowledge, motivation and behavioral skills to effect behavioral change (Gao et al., 2013).

Within the IMB model framework, failure to perform a diabetes self-management behavior is attributed to deficits in individuals' levels of diabetes self-management behavior-specific information, motivation, or behavioral skills. In the model, information and motivation are generally regarded as independent constructs. This means that individuals who are highly knowledgeable about the importance of performing diabetes self-management behaviors may or may not be highly motivated to perform them. Conversely, those who feel highly motivated might not always possess comprehensive information related to diabetes self-management (Fisher, J. D. & Fisher, W. A., 1992, 2000). Thus, individuals with sufficient information and sufficient motivation will actively improve their behavioral skills; thereby further promoting behavioral change (Fleary, Joseph, & Chang, 2020).

2. Theoretical framework for this study

In this study, the IMB model (Fisher et al., 1992) was as the core theoretical framework and used for self-management promotion program for Bai ethnicity with T2DM (Figure 2). The basic knowledge of T2DM and T2DM self-management were used as the information in the IMB model. The motivation in the IMB model is the

individual's attitude of Bai T2DM patients towards their disease self-management behavior and consequences. This attitude is influenced by the personal and social motivations of T2DM self-management behavior.

Behavioral skills mainly refer to the daily activities, nursing skills and abilities necessary for T2DM patients to complete self-management of their condition. This include adherence to a healthy and reasonable diet, engagement in regular exercise, regular self-monitoring of blood glucose levels, compliance with medication regimens (oral medication and insulin injection technology), foot care practices, emotional management, strategies for coping with acute and chronic complications associated with T2DM (Anderson, 1995; Tomky et al., 2008; Diabetes Education and Management Group of Diabetes Society of Chinese Medical Association, 2017), and the self-efficacy that individual's belief to perform T2DM self-management behavior.

With improved knowledge of T2DM and promotion of motivation for self-management behaviors can mutually strengthen the two constructs. And with the improvement of knowledge and motivation, techniques ability and implement confidence (diabetes self-efficacy will be strengthened. Knowledge and motivation will directly promote the self-management behavior of T2DM patients, or better promote behavior through the mediating role of behavioral skills. The ultimate outcome may be optimal glycemic control (HbA1c and blood glucose) and improved the diabetes special quality of life on patients.

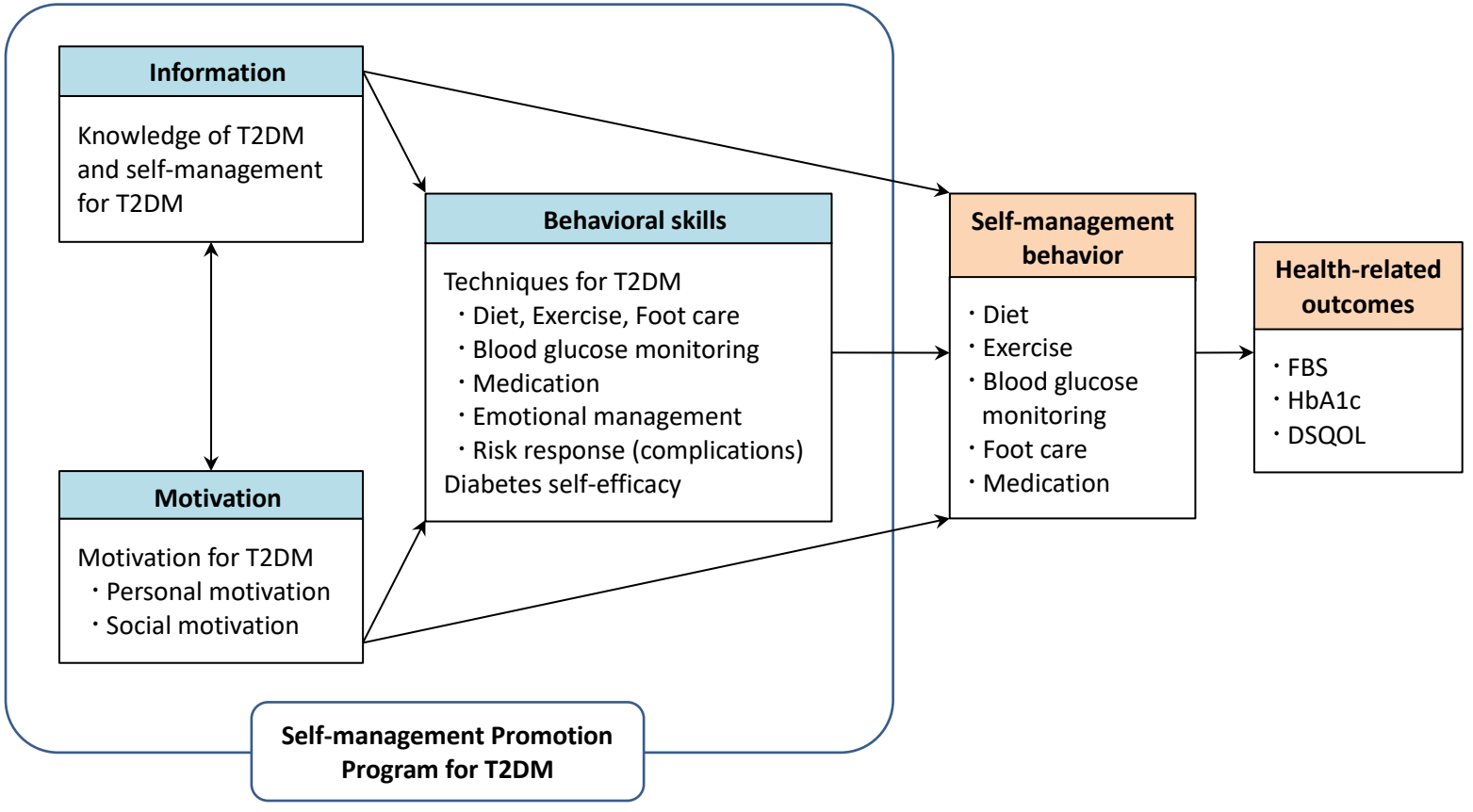

Figure 2. Conceptual framework for this study

DSQOL = Diabetes-specific Quality of Life, FBS = Fasting Blood Sugar, HbA1c = Glycosylated Hemoglobin A1c, T2DM = Type 2 Diabetes Mellitus

IV. Research Design and Methods

In this study, the program was developed based on the ADDIE model (Branch, 2009). As an education and training program for T2DM patients, utilizing this instructional systems design framework helps clarify the main objectives and goals at each development stage. The program development process of this study is as follows (Figure 3).

The first three stages (analysis, design, and development) pertain to program development. Through analysis to determine the learning environment and learners' current knowledge, attitudes, skills and behaviors; design the learning objectives, assessment instruments, exercises, content, subject matter analysis, lesson planning and media selection; develop the contents assets described in the design stage. The last two stages (implementation and evaluation) involve the evaluation of the program. Implement stages develop procedures for training facilitators and learners, and includ evaluation of the design; evaluation can be at each stage of process, and also for completed programs (University of Washington Bothell, n.d.).

1. Analysis

The first stage involves analyzing learners' learning needs, training objectives, content, and environment (Branch, 2009). In this study, to assess the needs for self-management behavior promotion in Bai nationality with T2DM, systematic review, and secondary data analysis from our prior survey, as well as focus group interview with Bai T2DM patients.

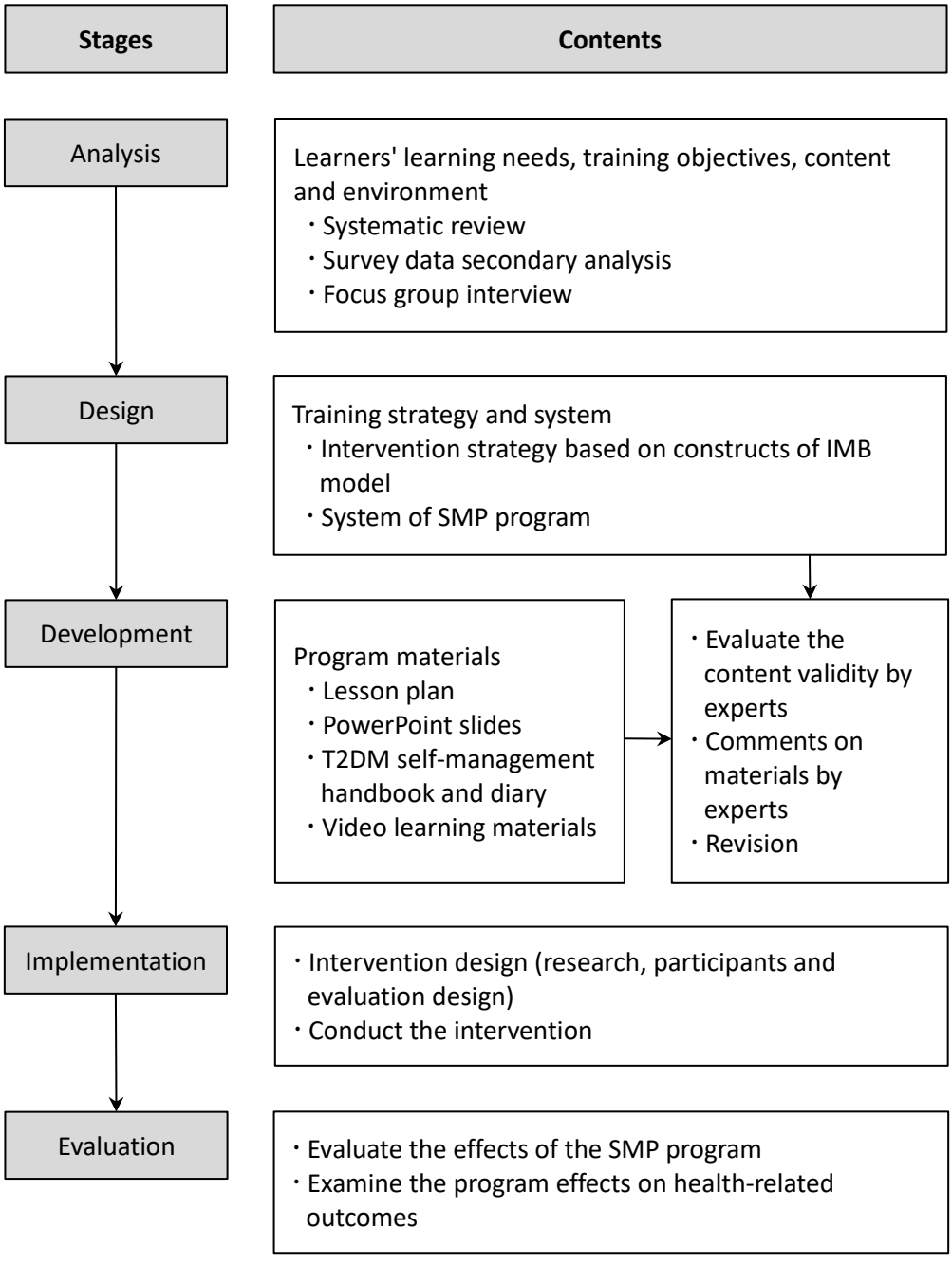

Figure 3. The program development process based on ADDIE model

1) Systematic review

Databases of PubMed, Embase, CINAHL and Google Scholar were systematically searched and identify relevant English studies published from December 2002 to December 2022. The search was performed by combination of the following search terms using the Boolean operators 'OR' and/or 'AND': 'diabetes', 'DM', 'T1DM', 'T2DM', 'IMB', 'information-motivation-behavioral skills', 'self-management' and 'self-care'.

Finally, a total of 2255 studies were identified in the database search. After initial screening of study titles and abstracts, 2226 studies were excluded due to duplication, irrelevance to the IMB model, or conference and dissertation proceedings, and 29 studies were identified as meeting the inclusion criteria. In the secondary screening, after reading the full text of the 29 studies, a total of 20 studies were excluded, that is, non-experimental studies (such as structural equation modeling studies, descriptive studies and secondary analysis studies, etc.), and finally there were 9 studies met the criteria and were included in this review (Figure 4, Appendix 3-1).

2) Secondary analysis of Bai T2DM patients' self-management behaviors

Due to the lack of relevant materials on Bai T2DM patients' self-management behavior, we conducted a secondary analysis using the data from 198 Bai patients within a cohort of 470 Chinese T2DM patients from a previous study (Yuan et al., 2022). This analysis examined the predictors, levels, and dimensions of self-management behaviors among Bai T2DM patients.

3) Collection of qualitative materials related to self-management of Bai T2DM patients

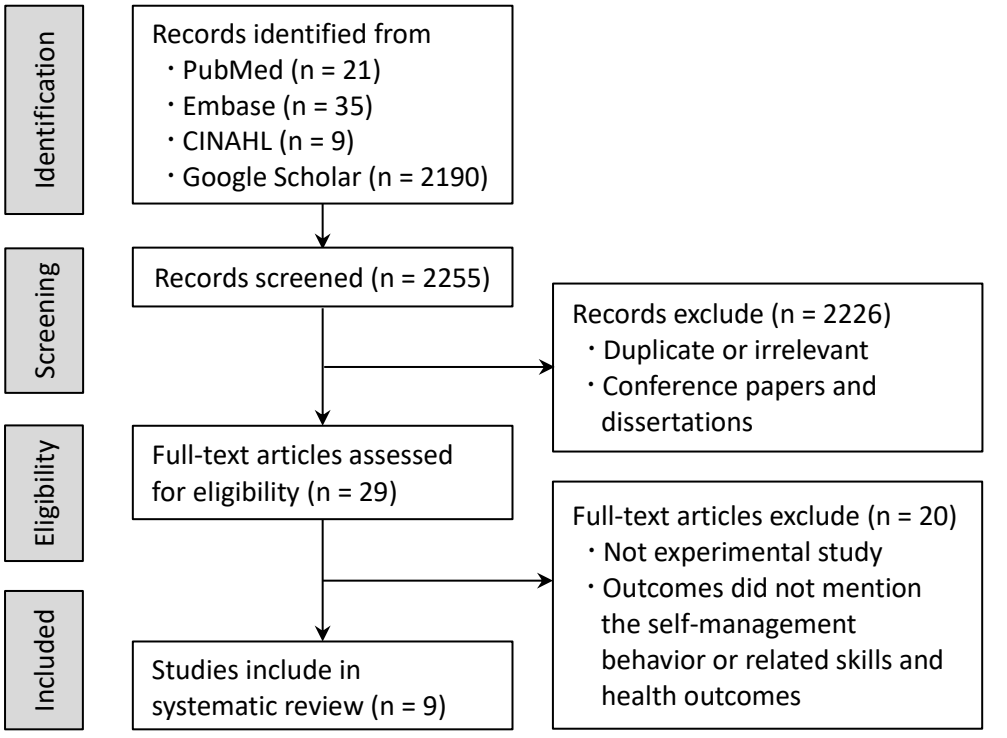

Figure 4. Flow diagram of systematic review

Focus group interview was conducted with 6 Bai T2DM patients who meet the inclusion criteria, comprising 3 males and 3 females aged 46 to 65 with T2DM duration from 2 to 15 years (Appendix 5-1). The interview was conducted in private setting, and the session was recorded after informing the participants of the study's purpose, ensuring anonymity, confidentiality, and the right to withdraw at any time. The interviews took about 90 minutes, and the interviewees were provided with agreed gifts after the interview.

The structured interview included 4 stages: introduction, opening questions, main questions, and conclusion (Appendix 5-2). The main questions were 'What are the impacts of T2DM on your personal life?', 'How is your self-management activity

going?', 'What causes you to fail to do self-management activities?' and 'What factors can promote your confidence or motivation in self-management?'. After the interview, two researchers found out main themes by repeatedly listening to the audio recordings and reading the written records.

2. Design

Design stage is to establish the training system and training strategy. Six aspects are mainly considered in the course design: who, why, when, where, what for (goal), and how (Branch, 2009).

1) Intervention strategies based on the IMB model

The design of the intervention strategies were based on the three constructs of the IMB model. Literature review, data secondary analysis, and focus group interview provide the basis for the design.

(1) Information

Information was operationalized as knowledge of T2DM, its treatment, and self-management principles and skills (Meunier et al., 2016; Jeon & Park, 2019; Kim, Lee, & Seo, 2022). Group or individual in-person 'education' by professional was the most common information intervention strategies (Osborn, Amico, et al., 2010; Yao et al., 2021; Kim et al., 2022). To cater to varying cognitive levels, educational technologies such as handbooks, PowerPoint presentations, along with self-learning resources like videos and PowerPoint slides (Davis et al., 2017; Yao et al., 2021; Kasar, Asiret, Yilmaz, & Canlar, 2022).

(2) Motivation

Motivation in the IMB model is influenced by personal and social factors. However, limitations exist in interpreting and guiding motivation change. Enhancing motivation of T2DM self-management behavior is a key point in such study.

Strategies such as motivation interview, inter-patient sharing, patient-professional communication, or phone-based have been effectively promote the social motivation (Jeon et al., 2019; Bakir, Çavuşoğlu, & Mengen, 2021). 'Encouragement' and 'verbal persuasion' can become effective ways for individual communication and guidance, and 'goal setting' can be referred to a way in improving motivation (Osborn, Amico, et al., 2010).

Focus group interviews with Bai T2DM patients indicated that peer communication can achieve 'mutual encouragement' among patients and can improve the motivation at the same time; by recognizing the threat and adverse consequences of T2DM and the benefits of good self-management behavior (vicarious experience, self-experience), personal motivation may be enhanced; and by improve knowledge and skills of T2DM, motivation may also be enhanced (Appendix 5-3).

(3) Behavioral skills

Secondary data analysis indicates a significant positive correlation between self-management level and behavioral skills among Bai T2DM patients. To enhance behavioral skills, this study was mainly focuses on improving T2DM management techniques and bolstering patients' self-efficacy through 'professional education' (Osborn, Amico, et al., 2010; Yao et al., 2021; Bakir et al, 2021; Kasar et al, 2022). The techniques include diet, exercise, blood sugar monitoring, medications, foot care, emotional management, and complication management. Methods such as group or

individual education, demonstration, and skill training (including self-learning and role-playing) have proven to be fundamental and effective for enhancing behavioral skills (Osborn, Amico, et al., 2010; Yao et al., 2021; Bakir et al., 2021; Kasar et al., 2022).

2) Design of the system of SMP program

The design of the program was based on the analyses stage and the intervention strategies. First, regarding the intervention methods, group intervention and individual intervention are the general methods on IMB-based T2DM self-management interventions. And the effectiveness of group intervention (in-person education or lecture) combined with individual intervention (phone call, visit or interview) or technology-based intervention (self-management app, text messages, network learning material, video material) on self-management behavior, self-efficacy, and other aspects outcomes of T2DM also has been confirmed (Osborn, Amico, et al., 2010; Davis et al., 2017; Yao et al., 2021; Bakir et al, 2021; Kim et al., 2022; Kasar et al., 2022). Second, for the intervention themes' determine in the program, mainly according to the behavioral change process of the IMB model, promote the two independent factors of information and motivation, then strengthen behavioral skills, will more conducive to promoting behavior (Fisher et al., 2008). Besides, the results of survey data secondary analysis showed that should pay more attention on improving the self-management behavior levels of diet, exercise and blood glucose monitoring of Bai T2DM patients (Appendix 4-1), which means it is important of strengthen these three knowledge and skills.

3. Development

The development stage is to select and prepare materials according to the training contents, and adjust the training contents to ensure the pertinence, applicability and effectiveness of the training content (Branch, 2009).

At this stage, an expert group which consisted of two nursing professors, two clinical experts and two professional nurses with over 10 years of clinical experience (including a Bai ethnicity nurse), with a total of 6 experts evaluated the content validity of the strategies and the program. And some contents were revised according to experts' comments.

At the same time, based on the operation contents of the program, intervention materials were developed. The materials involved include: lesson plan which provided to the researchers and professional nurses for teaching; PowerPoint slides which used in group sessions; T2DM self-management handbook which provide to the patients for self-learning; T2DM self-management diary which provide to the patients for self-monitoring of the behavior; and video learning materials used to provide to patients in WeChat app group intervention. Some of materials were revised according to experts' comments.

4. Implementation

1) Research design

To evaluate the effect of the SMP program, a Randomized Controlled Trial (RCT) was conducted (Figure 5). Participants were randomly assigned to the experimental group or control group. The experimental group participates in the SMP program, while the control group received an individual-based usual care.

	Pre-test	Intervention	Post-test I (at the end of intervention)	Post-test II (4 weeks after intervention)
Experimental group	E_1	X	E_2	E_3
Control group	C_1	U	C_2	C_3

- $E_{1,3}$, $C_{1,3}$: diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, diabetes-specific quality of life, FBS level, HbA1c level
- E_2, C_2: diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, diabetes-specific quality of life, FBS level
- X: SMP program for Bai ethnicity with T2DM
- U: usual care for T2DM

Figure 5. Research design of this study

2) Participants

The participants of this study are adult T2DM patients of Bai ethnicity living in Yunnan Province, China. The inclusion criteria were: T2DM diagnosis according to WHO criteria (WHO, 2020), Bai nationality with at least one year's residence in Yunnan; aged 40~65, T2DM diagnosis for over 6 months, ability to use WeChat app (Tencent Technology Co., Shenzhen, China) independently or with assistance, full cognitive and behavioral capacity, and informed consent, and no prior participation in T2DM self-management programs. Exclusion criteria included gestational diabetes, visual impairment from complications, and restricted physical activity and inability to take care of themselves due to serious complications or other reasons.

This study aimed to verify the difference between the two groups using an independent sample t-test. Sample size calculation were conducted using the G-power

program, setting the effect size (*d*) at 0.77 (Wang, Li, Chen, Guo, & Lin, 2022), the significance level (α) at 0.05, test power at 0.8, which resulted in total required sample of 56. To account a potential attrition rate of 15%, the sample size was increased to a total of 66.

3) Measurements

In this study, measurement tools include demographic questionnaires, scales (Appendix 2) and biological evaluation standards. The demographic questionnaire includes age, gender, educational level, residence, employment, income, economic burden, language, and living arrangement. Health-related characteristics include body mass index (BMI), T2DM duration, family history of T2DM, treatment type, and medication.

(1) Diabetes knowledge

The Diabetes knowledge was measured by using the Questionnaire for Patients with Type 2 Diabetes which was developed by Jiang et al. (Jiang, Y., Jiang, J., & Xu, 2017). This composed of 34 items and each item is scored '1, 0, 0' according to the choice of 'True, False, Not sure'. In the original study (Jiang et al., 2017), for 480 T2DM patients, the Cronbach's α is 0.909, in this study, due to the small sample size of 52, the Cronbach's α is 0.537.

(2) Motivation

Motivation was measured using the Chinese version of the Diabetes Attitude Scale (DAS-3) (Zhou, Lou, Zhang, & Zhu, 2012), initially developed by the American Diabetes Council and modified by Anderson et al. (Anderson, Fitzgerald, Funnell, &

Gruppen, 1998). This 33-item instrument employed a 5-point Likert scale (1~5), with total scores ranging from 33 to 165 points; higher scores indicate greater motivation (positive attitudes towards diabetes). The Cronbach's α was 0.742 in the study by Zhou (Zhou et al., 2012), and 0.767 in this study.

(3) Diabetes self-efficacy

Diabetes self-efficacy was measured using the Chinese version of Diabetes Management Self-Efficacy Scale (C-DMSES) (Liu, Peng, & Jiang, 2008), which was originally developed by Bijl et al. (Bijl, Poelgeest-Eeltink, & Shortridge-Baggett, 1999). The scale has a total 20 items, with each item scored from 0 to 10 points, totaling up to 200 points. Higher scores indicated higher self-efficacy or greater confidence in diabetes self-management. The Cronbach's α for the Chinese version was 0.940 (Liu et al., 2008), and in this study, it was 0.870.

(4) Self-management behavior

The T2DM self-management behavior was assessed using the Chinese version of the Summary of Diabetes Self-care Activities (C-SDSCA) (Wan, Shang, Lai, & Pan, 2008), which was originally developed by Schafer (Schafer, Glasgow, McCaul, & Dreher, 1983) and revised by Sigurthardottir for T2DM patients (Sigurðardóttir, 2005). The C-SDSCA includes 11 items addressing diet, exercise, blood glucose monitoring, foot care, and medication adherence in the past 7 days. Each item could be responded to 8-point Likert scale (0~7), and range of the total score from 0 to 77 points, with higher scores indicating higher T2DM self-management behavior. A normalized score (total score / possible highest score × 100) categorized self-management in to low (< 60), moderate (60~80), or high (> 80) levels, The Cronbach's α of study by Wan (Wan

et al., 2008) was 0.830, and 0.644 in this study.

(5) Diabetes-specific quality of life

The Diabetes-specific quality of life was measured using the Diabetes Specific Quality of Life Scale (DSQL) developed by Fang et al. (Fang, 2000). The scale consists of 27 items with four parts of physical function, treatment impact, psychological/spiritual, and social relationship. Each item is rated on a 5-point Likert scale (1~5), with a total score range from 27 to 135 points. Adopting reverse scoring and the lower the score, the higher the quality of life. The Cronbach's α of the scale is 0.950 in study by Fang (Fang, 2000), and in this study, it was 0.874.

(6) Fasting blood sugar

Rapid response blood glucose meter, used for detecting capillary fasting blood glucose, are prevalent in clinical and person settings for their operational ease, simplicity, and immediate results (Zeng & Ouyang, 2010). Optimal fasting blood sugar levels in T2DM patients are recommended to be below 7mmol/L (Diabetes Society of the Chinese Medical Association, 2021). In this study, hospital-based fasting blood sugar testing was not feasible due to distance limitations. Therefore, participants instructed to use their personal rapid-response blood glucometers for three self-tests at home. They were advised by phone the day before testing to maintain a normal diet and measure after fasting for more than 8 hours.

(7) Glycated hemoglobin

Glycated hemoglobin (HbA1c) detection in clinical settings employs techniques targeting hemoglobin glycation sites, including affinity chromatography, ion exchange

chromatography, and immunoassays (Huang et al. 2017). Specifically, immunofluorescence chromatography is preferred for HbA1c determination due to its operational simplicity and rapidity, aligning with clinical requirements (Cao, Lei, Zhang, Wang, & Sun, 2015). In this study, a dry fluorescence immunoassay analyzer was utilized by trained medical personnel to measure HbA1c levels for participants during three scheduled hospital visits. And HbA1c levels are interpreted as follows: below 6.0% indicates non-diabetic; 6.0~6.4% suggests impaired glucose regulation (IGR) or prediabetes; and 6.5% or over signifies T2DM (WHO, 2020).

4) Intervention process

Participant recruitment followed an established protocol after obtaining ethical approval from a Chinese institution, and two training sessions were conducted for the two recruitment assistants. The study was targeted Bai T2DM patients living in the Bai area, both outpatients and inpatients at a hospital (generally, inpatients stay hospitalized for 1~2 weeks). After obtaining cooperation from a general hospital, a recruitment announcement was posted on the bulletin boards. It included information on the study purpose, selection criteria for participants, participation methods, and expected duration of participation.

Interested patients received in-person explanations about the predicted risks, precautions, safety measures, benefits and compensation, and personal information protection measures related to the study. Participants who met the inclusion criteria and voluntarily expressed their willingness to participate signed a consent form.

A total of 67 participants were recruited and randomly assigned to the experimental group (n = 33) and the control group (n = 34) using the random number generator of the SPSS program. During the intervention, 15 participants, including 6 from the

experimental group and 9 from the control group, dropped out. Finally, the experimental group consisted of 27 and the control group of 25, totaling 52 participants (Figure 6).

The research team included four professional nurses with diabetes health education experience, one of whom was of Bai ethnicity. They were mainly responsible for group sessions, phone call intervention, and WeChat app-based group interventions. Before the intervention, all researchers received unified training based on the lesson plans to become acquainted with the intervention methods. Nurses conducting the group session performed teaching demonstration, and those responsible for HbA1c testing received training on using the dry fluorescence immunoassay analyzer.

The experimental group was further divided into 5 subgroups (6~7 per group) and invited to join corresponding WeChat app group.

The intervention for the experimental group lasted 5 weeks. The first 2 weeks involved group sessions at the hospital for 90 minutes each; the third week was tailored home intervention, including a 15-minute phone call to discuss difficulties and encourage positive self-management behaviors; the fourth and fifth weeks involved home-based group interventions via the WeChat app, lasting about 40 minutes each session, and included video materials, answering participants' questions and task submission. Both Chinese and Bai language were used throughout the intervention, and all activities were implemented according to the lesson plan.

The control group received individual-based usual care, including medication, diet, exercise, blood sugar monitoring, prevention and emergency treatment for acute complications during the first two weeks; a 3-minutes phone call follow-up in the third week; and self-learning from general materials at the fourth and fifth week. After the study, the control group also received the T2DM self-management handbook.

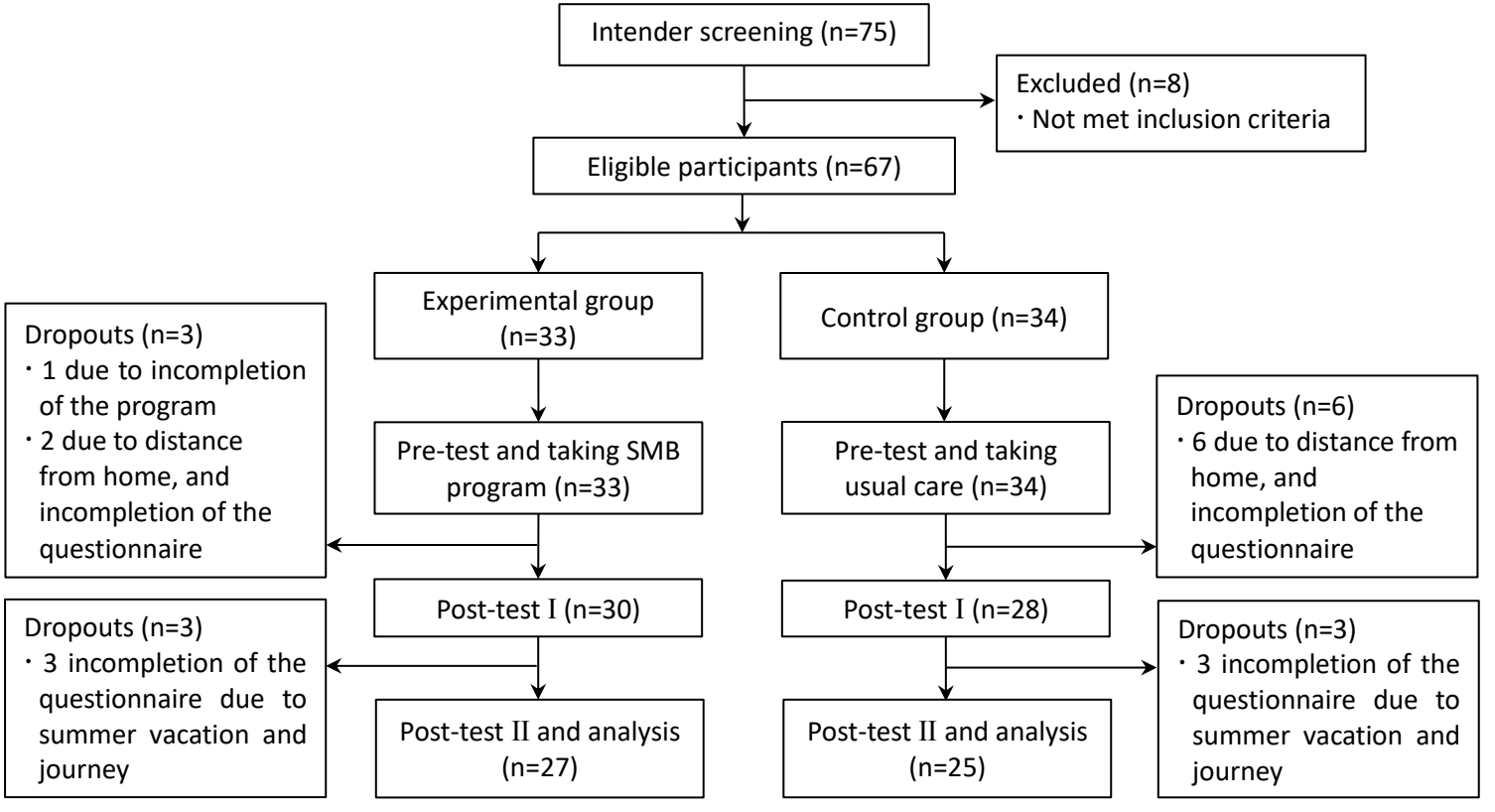

Figure 6. Random allocation and participation process

5. Evaluation

1) Date collection

Before intervention, both the experimental and control group conducted a pre-test using questionnaires with demographic characteristics, diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, diabetes-specific quality of life, along with laboratory tests for fasting blood sugar and HbA1c.

At the end of intervention, both the experimental and control group conducted post-test I using the same questionnaires as the pre-test, and laboratory tests for fasting blood sugar.

According to Ebbinghaus's Forgetting Curve, 21% of the learned content is forgotten after one month (Rohrer, Taylor, Pashler, Wixted, & Cepeda, 2005). Therefore, four weeks after the intervention, both the experimental and control group conducted post-test II, employing the same measures as the pre-test.

2) Data analysis

Data were analyzed using the SPSS 26.0 (IBM, NY, USA). The specific statistical methods used are as follows.

First, descriptive statistics were used to describe the characteristics of the participants. Frequency, mean with standard deviation (M±SD), and percentages (%) were utilized to present descriptive data.

Second, to assess the homogeneity of general characteristics between the experimental and control groups, Chi-square and Fisher’s exact test were conducted. The Shapiro-wilk test was utilized to evaluate the normality of data. For dependent variables, the Independent sample's t-test was used for normally distributed data, while

the Mann-whitney U test was applied for non-normally distributed data.

Third, after the analysis of normally distributed for independent variables in baseline and post-test, some of them not followed normal distribution in three times test, thus hypothesis testing for these variables was conducted using the Generalized estimating equation (GEE). Diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, fasting blood sugar and diabetes-specific quality of life of the two groups measured at baseline, immediately after post-intervention, and four weeks post-intervention were analyzed with GEE. For variables that followed a normal distribution, the Independent samples t-test were used, and HbA1c was analyzed with Independent samples t-test and Levene's test.

6. Ethical considerations and data protection

The study adhered to the 'Declaration of Helsinki' and conducted after the approval from the Medical Ethic Committee of D University in China (IRB No: MECDU-202301-1). Participants were provided with detailed explanations regarding the study, and data were collected only after obtaining their written informed consent (Appendix 1). Upon study completion, participants received appropriate compensated with gifts. To ensure confidentiality, research materials were anonymized, securely stored, and accessed only for research purposes. Data were analyzed confidentially and will be responsibly disposed of after achieving all research objectives. As the intervention was exclusive to the experimental group, the control group received a T2DM self-management handbook after the study.

V. Results

1. Development of a SMP program for Bai ethnicity with T2DM

1) Analysis

(1) Systematic review

A comprehensive review defined nine diabetes patients self-management intervention studies based on IMB model (Appendix 3-2). Predominantly, these studies focused on T2DM patients, with one study addressing both T2DM and T1DM patients (A5), and two studies targeting T1DM patients (A3, A8). Five studies applied RCT designs (A1, A2, A3, A8, A9), one study utilized a pretest-posttest nonequivalent control group design (A4), and three studies conducted single-group pre-posttests (A5, A6, A7).

Six studies detailed the application of the IMB model's construction: information, motivation, and behavioral skills (A1, A2, A3, A4, A5, A9), while five studies measured these constructs (A1, A2, A3, A5, A7). Four studies provided routine care or health education to control groups (A1, A4, A8, A9).

Five studies indicated significant improvements in self-management behavior after interventions (A1, A2, A3, A5, A8). Additionally, some studies reported enhancements in specific self-management skills such as increased medication adherence (A6, A7), improved mental resilience, and more effective diet and exercise behaviors compared to control groups (A2, A4, A8, A9). However, one study noted a decline in average scores for patients' common diet, exercise, and blood glucose monitoring over time (A7).

(2) Secondary analysis

Secondary analysis of the 198 Bai T2DM patients revealed that their self-management behavior were low, particularly in the areas of diet, exercise, and blood-glucose monitoring. It was also noted that peer communication, enhanced self-efficacy and good T2DM care skills could effectively enhance T2DM self-management behavior (Appendix 4-1). These findings together with 'Bai ethnic characteristics such as diet, language, cultural activity, were incorporated as moderating factors to adjust the pertinence and cultural applicability of the intervention of the program (Appendix 4-2).

(3) Focus group interview

Analysis of focus group interview revealed several challenges faced by participants as follows (Appendix 5-3).

First, T2DM was associated with physical discomfort, resulting in anxiety, stress, and lifestyle disruptions due to treatment and complications affecting daily life and work. Second, participants struggled with effective self-management, particularly in blood glucose monitoring, diet, exercise, and medication adherence, and demonstrated a lack of awareness regarding foot care. Third, increase blood glucose levels and the requirement for monitoring and insulin injection contributed to stress and avoidance behaviors, with difficulty in foregoing habits detrimental to health. Fourth, participants expressed a desire to acquire more knowledge for behavior modification, motivated by fear of adverse consequences of disease and family burden. Family support was seen as a confidence booster, while personal hobbies and social activities were identified as means to manage negative emotions.

2) Design

(1) Intervention strategies based on three constructs on IMB model

The strategies for promoting self-management behavior in Bai T2DM patients based on the IMB model are as follows.

Information promotion: Enable patients to learn about T2DM and self-management, provide them with pathways and materials, which can be achieved through ‘education’ and ‘self-learning’.

Motivation promotion: in order to enhance the personal motivation of patients, acquiring knowledge and skills through ‘education’ and ‘self-learning’ to enhance abilities and confidence; by receiving ‘education’ of complications, understanding ‘vicarious experience’ of others’ experiences; reviewing disease experiences, or receiving education of T2DM complications, can gain ‘self-experiences’, thereby recognizing the adverse outcomes and family burden; through ‘goal setting’, set goals of behaviors and blood sugar control, and through writing diary to monitoring these activities. For enhancing of the social motivation, individual ‘education’, ‘encouragement’ for behavior change, and ‘persuasion’ for bad behavior are provided to patients in-personal communication; gain more social support and confidence through ‘encouragement’ and ‘vicarious experiences’ of others in peer communication.

Behavioral skill promotion: in order to enhance self-management skills of T2DM, patients should receive professional skill ‘education’. At the same time, patients strengthen their skills through ‘self-learning’ and ‘self-experience’, that is, participating in training and obtaining hands-on opportunities.

(2) The system of the program

Combined on group intervention, individual intervention and technology-based

intervention, the program includes five main phases of two in-person group sessions for one time each week, 90 minutes each; one phone call tailored intervention of 15 minutes for one week; and two WeChat app-based group intervention for one time each week, 40 minutes each. Run for a total of five weeks.

The themes of this program focus on three IMB model constructs. First, the information and motivation in-person education were set at first group session. Second, combine the survey data secondary analysis' results of having competence in T2DM care skills was significantly positively correlated with self-management level, the second in-person group session was full set to the theory and practice education of behavioral skills. Third, strengthen them at phases of phone call tailored intervention and WeChat app-based group intervention. The phone call intervention was focus on provide individual guidance in knowledge and skills of diet, exercise and blood glucose monitoring; at the same time, get to know the current situation of patients' self-management through individual communication, encourage patients' self-management behavior to strengthen motivation. Considering the situation of Bai people' s living places are scattered in vast areas in Yunnan Province (Xu, 2006), for the convenience of intervention, the program was set twice group intervention by WeChat app, and aim though providing learning materials, text messages tasks by and answering patients' questions by WeChat app to strengthening the three constructs.

3) Development

(1) Contents validity and contents revision

The content validity test based on the calculation method of the content validity index (CVI) (Lynn, 1986), consisting of a 4-point Likert scale (1 = not valid, 2 = somewhat valid, 3 = valid, 4 = very valid). If the number of experts is 6~8, and the

item percentage of 3 or 4 points calculated exceeds 83%, the content will be used. The results of calculating CVI showed that all tested items measured above 0.83 (Appendix 6-1, 6-2).

Finally, by experts' comments, the corresponding contents of IMB model-based strategies were revised (Appendix 6-3, 6-5). And corresponding contents for the system of program were revised (Appendix 6-4), the final version of the program system was determined (Table 1).

(2) Intervention materials

The 'lesson plan' helps a teacher to utilize time, resources, materials and techniques in an optimum level (Chickering & Ehrmann, 1996). Based on the system of program, the lesson plan was developed to guide the specific activities of the interventions and provide specific guidance for program executors. It was mainly developed around eight aspects: topics, goals, process, participants, specific contents, time planning, teaching aids, implementation methods (Appendix 7-1).

By analyzing previous studies, provide T2DM self-management education especially relevant basic theoretical and technical knowledge to patients by 'lectures' or 'teaching' (Osborn, Amico, et al., 2010; Gavgani, Poursharifi, & Aliasgarzadeh, 2010; Meunier et al., 2016; Yao et al., 2021; Kim et.al., 2022); 'skill demonstration' (Kasar et al., 2022) and 'patient participation' (Osborn, Amico, et al., 2010; Kasar et al., 2022) can effectively strengthen patient's operation ability of self-management skill; promoting peer experience exchange and encouragement through class 'discussion' (Osborn, Amico, et al., 2010; Kasar et al., 2022); through 'interviews' or 'communication' with patients to get to know personalized problems of patients, such as analyzing internal and external factors that lead to bad behavior, problems and

Table 1. The SMP Program for Bai T2DM Patients

Themes	Intervention contents	Time (min)	Goals
1st week Group session (at the hospital)			
Information Providing & Motivation enhancement	- Provide basic knowledge of T2DM self-management - Introduce the background, purpose, and significance of the project	10	Improve - T2DM related knowledge - SM knowledge - SM awareness
	- Provide knowledge related to T2DM: disease overview, clinical manifestations, treatment	20	
	- Provide patients with T2DM self-management handbook	5	
	- Introduce the prognosis and harm of T2DM: complications, emotions, social and family burden	30	Promote - Personal motivation - Social motivation
	- Percept the experience of T2DM complication	10	
	- Conduct class discussion: self-introduction, experience exchange, goal setting	15	
2nd week Group session (at the hospital)			
Behavioral skills improvement	- Provide basic knowledge on T2DM techniques: diet, exercise, blood sugar testing, medication, emotional management, foot care, and risk response	40	Improve - knowledge of T2DM self-management behavior skills
	- Apply of scientific dietary management: an example of Bai daily diet - Apply food simulation models to teach dietary nutrition and matching	10	Promote - Operational ability of T2DM self-management behavior skills
	- Demonstrate specific techniques - Conduct patients skill training and individual guidance	30	
	- Provide patients with SM diaries - Guide patients on SM diary recording methods - Assign tasks of SM monitoring	10	

(Table continued)

Table 1. (Continued)

Themes	Intervention contents	Time (min)	Goals
3rd week Phone call tailored intervention (at home)			
Constructs strengthening	Communicate over the phone call - Evaluate risk factors and analyze bad consequences - Persuading and encouraging changes in bad behavior	5	Strengthen - Motivation
	- Communicate the management status of patients' diet, exercise, and blood sugar testing - Provide individual guidance - Encourage patients to regularly test of blood sugar	10	Strengthen - Diet and exercise skills - Regular blood sugar testing
4th week WeChat app based group intervention (at home)			
Constructs strengthening	- Provide video learning materials related to T2DM basic knowledge and SM - Assign task of self-learning on diet, exercise, blood sugar testing, medication SM knowledge through the handbook	25	Strengthen - Information - Diet，exercise , blood sugar testing and medication
	- Conduct the Q&A: patients ask questions through text, answers and guidance	10	Strengthen - Motivation
	- Submit task: photos of recent SM diary	5	
5th week WeChat app based group intervention (at home)			
Constructs strengthening	- Provide video learning materials on T2DM related complications - Assign task: Self-learning on foot care, emotions, and risk response through the handbook	25	Strengthen - Foot care and emotion management - Risk response ability
	- Conduct the Q&A: patients ask questions through text, answers and guidance	10	Strengthen - Motivation
	- Submit task: photos of recent SM diary	5	

Q&A = Questions and Answers, SM = Self-Management, T2DM = Type 2 Diabetes Mellitus

obstacles in patients' self-management cognition and implementation (Davis et al., 2017; Jeon et al., 2019; Yao et al., 2021; Bakir et al., 2021); providing 'guidance' based on the actual situation of patients can form personalized plans and enhance their execution ability (Yao et al., 2021). Finally, the implementation methods was set to 'teaching', 'skill demonstrations', 'patients participation', 'communication', 'discussion' and 'guidance' in this study.

The 'PowerPoint teaching slides' was used to present in the twice group sessions. The draft of the material was revised after the comments of two nursing experts (Appendix 7-2). This material was combined with the theme of 'Information Providing and Motivation enhancement' in the first session, and includes 3 parts: the significance of T2DM self-management and this program, basic knowledge of T2DM, and understanding of the prognosis and hazards of T2DM; the theme of the second session is 'behavioral skills improvement', and includes theoretical knowledge related to T2DM self-management skills (Appendix 7-4). In order to adapt to participants with different education levels, the text of this PowerPoint slides were concise and easy to understand, combined with pictures related to the topic, which not only expands knowledge, increases interest, but also promotes the understanding of knowledge.

The 'T2DM self-management handbook' was used to provide T2DM self-management information to patients. The handbook was completed after reviewing a large amount of materials, and the corresponding contents were revised after two nursing experts' comments (Appendix 7-3). Handbook consists of total two parts and eight contents. The first part is introduction to basic knowledge and self-management of T2DM, the other parts focus on the seven aspects of T2DM self-management: knowledge of self-management in blood glucose monitoring, diet,

exercise, medication, foot care, emotion and risk response. Many contents of the handbook based on the perspective of Bai ethnicity characteristics, with pictures and brief words to enhance the learning interest and understanding of the patients, some knowledge can be viewed through QR codes scanned on WeChat applications to watch videos and it can provide patients with a rich self-learning experience and better effectiveness (Appendix 7-5).

The ‘T2DM self-management diary’ consists of self-management activity records and blood glucose test records. It aimed to provide patients with a simple way for monitoring of daily T2DM self-management activities. Based on the records, patients can review daily or weekly activities identify beneficial or risky behaviors. The diary was composed of two parts. The first part is ‘self-management activity record’, which include daily T2DM self-management activities such as ‘blood glucose testing (4 items), diet (8 items), exercise (5 items), medication (5 items), foot care (5 items), emotions (3 items), and prevention of hypoglycemia (2 items)’, a total of 32 structured options. And the second part is ‘blood glucose testing record’ (Appendix 7-6).

The ‘video learning materials’ is provide to patients through WeChat app in the technology-based group intervention. The videos are mainly used as supplementary materials for group session education, and are provided to participants for self-learning, and were strictly selected by researchers through the network platform. The videos are presented in the form of animation, vivid, interesting and easy for patients to understand, and production of this series of videos was guided by China’s authoritative endocrinologists. The video materials provided seven videos to the first WeChat-based intervention, include interpretation of T2DM, diagnosis of diabetes, self-blood glucose testing, medication, and basic knowledge of T2DM daily management. By watching videos, the main focus was on enhancing information and

behavioral skills. The second intervention were supplemented the knowledge about T2DM complications, four videos on prevention and treatment of diabetic foot, two on diabetes nephropathy, and three on diabetic retinopathy were provided. By watching the videos, mainly strengthened the information and motivation. Each video was about 4 minutes long (Appendix 7-7).

2. Evaluation of the SMP program for Bai ethnicity with T2DM

1) General and health-related characteristics of participants

There were no significant differences between two groups regarding general and health-related characteristics and dependent variables at baseline (Table 2).

In the experimental group, the mean age was 52.89 years; 63% were males; 59.3% resided in urban areas; 3.7% lived alone; 3.7% communicated exclusively in the Bai language; and 55.6% reported family economic burden due to T2DM. Similarly, the control group, the mean age was 56.76 years; 48% were males; 60% were urban residents. 8% lived alone; 8% communicated only in the Bai language; and 52% reported family economic burden due to T2DM.

For the health-related characteristics, the experimental group had an average BMI of 23.49; 44.4% reported a family history of T2DM; and 96.3% were received Western medical treatment. Similarly, the control group had an average BMI of 24.25; 44% had a family history of T2DM; and 88% were treated with Western medicine.

Table 2. Homogeneity Test of General and Health-related Characteristics of Participants

(N=52)

Characteristics	Categories	Exp. (n=27)	Con. (n=25)	χ^2 / Z	*p*
		n (%) or M±SD			
Age (year)		52.89±7.30	56.76±7.70	-1.927	.054*
Gender	Male	17 (63.0)	12 (48.0)	1.178	.278
	Female	10 (37.0)	13 (52.0)		
Education level	≤ Elementary school	4 (14.8)	6 (24.0)	1.836	.399
	Junior/high school	12 (44.5)	13(52.0)		
	≥ College	11 (40.7)	6 (24.0)		
Residence	Urban	16 (59.3)	15 (60.0)	0.003	.957
	Rural	11 (40.7)	10 (40.0)		
Work status	Employed/working	16 (59.3)	11 (44.0)	1.211	.271
	Retired/unemployed	11 (40.7)	14 (56.0)		
Monthly income (CNY)	< 2000	6 (22.3)	13 (52.0)	5.360	.115†
	2000-5000	9 (33.3)	6 (24.0)		
	5001-10000	11 (40.7)	5 (20.0)		
	> 10000	1 (3.7)	1 (4.0)		
Economic burden	No	12 (44.4)	12 (48.0)	0.066	.797
	Yes	15 (55.6)	13 (52.0)		
Living arrangement	Living alone	1 (3.7)	2 (8.0)	0.441	.603†
	Living with family	26 (96.3)	23 (92.0)		
Mandarin competence	No	1 (3.7)	2 (8.0)	0.441	.603†
	Yes	26 (96.3)	23 (92.0)		
BMI		23.49±3.34	24.25±2.97	-0.971	.392*
T2DM duration		5.28±5.27	4.74±5.74	-0.629	.529*

(Table continued)

Table 2. (Continued)

Characteristics	Categories	Exp. (n=27)	Con. (n=25)	χ^2 / Z	*p*
		n (%) or M±SD			
Family history of T2DM	No	15 (55.6)	14 (56.0)	0.001	.974
	Yes	12 (44.4)	11 (44.0)		
Type of treatment	Western medicine	26 (96.3)	22 (88.0)	1.258	.341†
	Both Western and Chinese medicine	1 (3.7)	3 (12.0)		
Medication	No medication	0 (0)	2 (8.0)	3.571	.393†
	OHA	7 (25.9)	5 (20.0)		
	Insulin	9 (33.3)	5 (20.0)		
	OHA and insulin	11 (40.7)	13 (52.0)		

*Mann-whitney U test, † Fisher's exact test
BMI = Body Mass Index, CNY = Chinese Yuan, Con. = Control Group, Exp. = Experimental Group, M = Mean, OHA= Oral Hypoglycemic Agent, SD = Standard Deviation, T2DM = Type 2 Diabetes Mellitus

2) Homogeneity test of dependent variables at baseline

There were no significant differences between two groups in dependent variables with diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, diabetes-specific quality of life, fasting blood sugar level, and HbA1c level among the participants, and ensuring the homogeneity of the baseline values for dependent variables (Table 3).

Table 3. Homogeneity Test of Dependent Variable at Baseline

(N=52)

Variables	Exp. (n=27)	Con. (n=25)	t / Z	*p*
	M±SD			
Diabetes knowledge	24.48±3.46	24.68±3.40	-0.018	.836*
Motivation	123.41±11.74	117.36±11.88	1.845	.071
Diabetes self-efficacy	136.89±21.93	127.40±25.24	1.450	.153
Self-management behavior	41.22±10.42	39.88±8.93	0.497	.621
Diabetes-specific quality of life	57.81±14.30	56.60±11.30	-0.248	.737*
Fasting blood sugar	9.56±3.61	8.92±3.93	-1.172	.545*
HbA1c	9.68±2.13	9.49±2.83	0.275	.784

*Mann-whitney U test
Con. = Control Group, Exp. = Experimental Group, HbA1c = Hemoglobin A1c, M = Mean, SD = Standard Deviation

3) Verification of the effects of SMP program for Bai T2DM patients

Hypothesis 1: Diabetes knowledge will be higher in the experimental group compared to the control group after intervention.

In the experimental group, diabetes knowledge scores increased from a baseline of 24.48 to 29.79 immediately post-intervention and to 30.04 four weeks post-intervention. In contrast, in the control group, the diabetes knowledge scores were 24.48 at baseline, 26.16 immediately post-intervention, and 24.76 at four weeks post-intervention (Table 4). The validation results showed that there was a significant difference in the changes over time between the two groups (χ^2 = 45.46, p < .001), thereby supporting the hypothesis 1.

Table 4. Comparison of Changes in Diabetes Knowledge between Two Groups

(N=52)

Group	Pre-test	Post-test I	Post-test II	Source	χ^2	*p*
	M±SD	M±SD	M±SD			
Exp. (n=27)	24.48±3.46	29.78±2.49	30.04±2.08	Group	17.77	<.001
				Time	98.89	<.001
Con. (n=25)	24.68±3.40	26.16±3.38	24.76±2.82	Group*Time	45.46	<.001

Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

Hypothesis 2: The motivation level will be higher in the experimental group compared to the control group after intervention.

In the experimental group, motivation scores increased from a baseline of 123.41 to 139.11 immediately post-intervention and to 140.19 four weeks post-intervention. In contrast, in the control group, the motivation scores were 117.36 at baseline, 122.16 immediately post-intervention, and 127.24 at four weeks post-intervention (Table 5). The validation results showed that there was a significant difference in the changes over time between the two groups (χ^2 = 38.46, p < .001), thereby supporting the hypothesis 2.

Table 5. Comparison of Changes in Motivation between Two Groups

(N=52)

Group	Pre-test	Post-test I	Post-test II	Source	χ^2	*p*
	M±SD	M±SD	M±SD			
Exp. (n=27)	123.41±11.74	139.11±11.11	140.19±8.83	Group	19.63	<.001
				Time	136.94	<.001
Con. (n=25)	117.36±11.88	122.16±11.66	127.24±10.05	Group *Time	38.46	<.001

Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

Hypothesis 3: The level of diabetes self-efficacy will be higher in the experimental group compared to the control group after intervention.

In the experimental group, diabetes self-efficacy scores increased from a baseline of 136.89 to 154.85 immediately post-intervention and to 155.48 four weeks post-intervention. In contrast, in the control group, the diabetes self-efficacy scores were 127.40 at baseline, 131.48 immediately post-intervention, and 139.72 at four weeks post-intervention (Table 6). The validation results showed that there was a significant difference in the changes over time between the two groups (χ^2 = 16.38, p < .001), thereby supporting the hypothesis 3.

Table 6. Comparison of Changes in Diabetes Self-efficacy between Two Groups

(N=52)

Group	Pre-test	Post-test I	Post-test II	Source	χ^2	p
	M±SD	M±SD	M±SD			
Exp. (n=27)	136.89±21.93	154.85±14.49	155.48±11.97	Group	9.21	.002
				Time	65.89	<.001
Con. (n=25)	127.40±25.24	131.48±27.82	139.72±20.06	Group *Time	16.38	<.001

Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

Hypothesis 4: The level of self-management behavior will be higher in the experimental group compared to the control group after intervention.

In the experimental group, self-management behavior scores increased from a baseline of 41.22 to 52.59 immediately post-intervention and to 51.37 four weeks post-intervention. In contrast, in the control group, the self-management behavior

scores were 39.88 at baseline, 42.80 immediately post-intervention, and 44.48 at four weeks post-intervention (Table 7). The validation results showed that there was a significant difference in the changes over time between the two groups (χ^2 = 20.11, p < .001), thereby supporting the hypothesis 4.

Table 7. Comparison of Changes in Self-management Behaviors between Two Groups

(N=52)

Group	Pre-test	Post-test I	Post-test II	Source	χ^2	p
	M±SD	M±SD	M±SD			
Exp. (n=27)	41.22±10.42	52.59±6.00	51.37±6.20	Group	14.78	<.001
				Time	47.75	<.001
Con. (n=25)	39.88±8.93	42.80±6.69	44.48±4.40	Group*Time	20.11	<.001

Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

Hypothesis 5: Fasting blood sugar levels will be lower in the experimental group compared to the control group after intervention.

In the experimental group, fasting blood sugar scores increased from a baseline of 9.56 to 7.47 immediately post-intervention and to 7.04 four weeks post-intervention. In contrast, in the control group, the fasting blood sugar scores were 8.92 at baseline, 7.84 immediately post-intervention, and 7.84 at four weeks post-intervention (Table 8). The validation results showed that there was no significant difference in the changes over time between the two groups (χ^2 = 3.19, p = .203), thereby not supporting the hypothesis 5.

Table 8. Comparison of Changes in Fasting Blood Sugar Level between Two Groups

(N=52)

Group	Pre-test	Post-test I	Post-test II	Source	χ^2	*p*
	M±SD	M±SD	M±SD			
Exp. (n=27)	9.56±3.61	7.47±2.21	7.04±1.45	Group	0.08	.773
				Time	21.51	<.001
Con. (n=25)	8.92±3.93	7.84±1.92	7.84±1.46	Group*Time	3.19	.203

Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

Hypothesis 6: HbA1c level will be lower in the experimental group compared to the control group after intervention.

In the experimental group, HbA1c scores increased from a baseline of 9.68 to 7.80 four weeks post-intervention. In contrast, in the control group, the HbA1c scores were 9.49 at baseline to 8.70 at four weeks post-intervention (Table 9). The validation results showed that there was a significant difference in the changes between the two groups after four weeks post-intervention (t = -3.32, *p* = .002), thereby supporting the hypothesis 6.

Table 9. Comparison of Changes in HbA1c Level between Two Groups

(N=52)

Group	Pre-test	Post-test II	*p*	Differences	t (*p*)
	M±SD	M±SD		M±SD	
Exp. (n=27)	9.68±2.13	7.80±1.67	.203*	-1.89±1.20	-3.32 (.002)
Con. (n=25)	9.49±2.83	8.70±1.98	.378*	-0.80±1.16	

*Levene's test
Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

Hypothesis 7: The diabetes-specific quality of life will be higher in the experimental group compared to the control group after intervention.

In the experimental group, diabetes-specific quality of life scores increased from a baseline of 57.81 to 48.15 immediately post-intervention and to 45.19 four weeks post-intervention. In contrast, in the control group, the diabetes-specific quality of life scores were 56.60 at baseline, 52.96 immediately post-intervention, and 49.76 at four weeks post-intervention (Table 10). The validation results showed that there was a significant difference in the changes over time between the two groups (χ^2 = 9.27, p = .010), thereby supporting the hypothesis 7.

Table 10. Comparison of Changes in Diabetes-specific Quality of Life between Two Groups

(N=52)

Group	Pre-test	Post-test I	Post-test II	Source	χ^2	p
	M±SD	M±SD	M±SD			
Exp. (n=27)	57.81±14.30	48.15±10.97	45.19±6.74	Group	1.19	.275
				Time	65.08	<.001
Con. (n=25)	56.60±11.30	52.96±9.47	49.76±5.49	Group*Time	9.27	.010

Con. = Control Group, Exp. = Experimental Group, M = Mean, SD = Standard Deviation

VI. Discussion

This study used the Information-motivation-Behavioral Skills (IMB) model as the theoretical basis to promote the self-management behavior of adult Bai T2DM patients through educational interventions. The Self-Management Promotion (SMP) program for Bai ethnicity with T2DM was developed and its effectiveness was verified.

1. Development of a SMP program for Bai ethnicity with T2DM

In the first phase of development, the IMB model-based education program was determined to develop the self-management behavior of Bai T2DM patients. Focus on the intervention strategies of the three constructs of the IMB model, and an intervention system for the SMP program was designed. This study adopted a system framework that combines group intervention (group session), tailored intervention (phone call intervention), and technology-based intervention (WeChat-based group intervention), and it is an unprecedented approach for promoting self-management in T2DM patients; at the same time, it is a minority program that integrated ethnic characteristics and languages. Except the combination of in-person and technology-based education has a definite effect on T2DM self-management (Davis et al., 2017; Yao et al., 2021; Bakir et al., 2021; Kim et al., 2022; Kasar et al., 2022), other main considerations were: in China, especially in border and ethnic minority areas, community health resources are scarce, but most health resources concentrated in large general hospitals (Zhang & Dong, 2010). In addition, Bai people' s living places are scattered in vast areas in Yunnan Province (Xu, 2006), intervention in large

general hospital has richer health and human resources, however, many patients came from other small cities or rural. Due to the distance issues, in-person intervention for several weeks can easily lead to large dropouts of participants.

The development of materials was based on the intervention system. Include lesson plan, PowerPoint teaching slides, T2DM self-management handbook and diary, and video learning materials.

The lesson plan was a more detailed explanation of the intervention process and contents of each step. It also guides time planning, preparation of teaching aids, and implementation methods. This study identified an implementation methods focuses on ‘teaching’, combines ‘skill demonstrations’, ‘patient participation’, ‘communication’, ‘discussion’ and ‘guidance’ to effectively strengthen patients' self-management skills and promote peer experience exchange and encouragement (Osborn, Amico, et al., 2010; Kasar et al., 2022), better understand and handle patients’ personal issues (Davis et al., 2019; Yao et al., 2021; Bakir et al., 2021), and form personalized self-management plan that is conducive to patient execution (Yao et al., 2019).

The PowerPoint teaching slides used at group sessions, which designed focuses on the topics of sessions. In the lecture, PowerPoint presentations combining text and contents related images are beneficial for students' learning (Bartsch & Cobern, 2003), therefore, we used concise text combined with vivid images to achieve the goal of patients from different educational levels, who were both easy to understand and interested in learning.

The most effective interventions incorporated multiple written materials and more contact hours (Malathy, Narmadha, Jose, Ramesh, & Babu, 2011; Megeid & El-Sayed, 2012). We developed the self-management handbook and diary so that to extend the learning duration of patients. The contents of this handbook were focus on seven

self-management behavior, especially from the cultural perspective, integrating diet, exercise, and emotional management with Bai characteristics. The most relatively new form of this handbook is patients can watch videos of knowledge after scanning QR code images on WeChat, especially videos of complex skills, which can be repeatedly learned by patients. In addition, to promote patient execution, the design of self-management diary was written in a simple form of selecting items, and focus on the seven themes of self-management behavior. This form of T2DM self-management diary has not found in other relevant studies.

In health educations, except printed materials, video interventions can more effectively improve short-term outcomes on knowledge, mental state and promote the recall of health-related information (Wilson et al., 2010; Dahodwala, Geransar, Babion, de Grood, & Sargious, 2018). In this study, video learning materials were mainly used as self-learning materials for WeChat group interventions. We provided interesting animated videos which were easy to understand and can greatly increase patients' opportunities to access health information and overcome reading and writing barriers in the dissemination of health information (Ahmed, Alike, & Keselman, 2015).

The intervention strategies and SMP program contents based on the IMB model developed for this study were reviewed and validated by experts, and revised with expert's comments; the developed materials also were revised with experts' comments before finally forming an SMP program for guiding the intervention implementation.

2. Effectiveness of the SMP program for Bai ethnicity with T2DM

This study focused on enhancing self-management behaviors among Bai T2DM patients using the IMB model. The results indicated that the SMP program was

significantly more effective than usual care in diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, HbA1c level and diabetes-specific quality of life.

First, the experimental group showed a significant improvement in diabetes knowledge compared to the control group after intervention. This aligns with findings from other IMB model-based interventions where both in-person group education (Kim et al., 2022) and individual education (Bakır et al., 2021) substantially raised patients' knowledge level. In this study, we provided the participants with basic knowledge and self-management knowledge of T2DM to promote information in the IMB model. Not only applied group and individual education, but also provided various forms of materials such as handbook and video. The combination of multiple methods can not only promote the short-term knowledge for patients, but also provide effective methods for long-term learning (Malathy et al., 2011; Megeid et al., 2012). Compared to the control group's routine oral education and simple written materials, it also increases patients' memory of knowledge and interest in self-learning.

Second, the experimental group showed a significant improvement in motivation compared to the control group after intervention. Within the IMB model, motivation is perceived as an individual's attitude towards healthy behavior, influenced by both social motivation and individual motivation (Fisher et al., 1996). Studies showed that IMB model-based interventions tend to enhance social motivation more effectively (Jeon et al., 2019; Kim et al., 2022), often employing strategies such as peer communication and professional support. A study suggested that patients' understanding of risk behaviors, as well as individual interviews or communication, can also help enhancing personal motivation (Bakır et al., 2021). Therefore, all of these methods on motivation to the participants in this study may effect to the positive

results.

Third, the experimental group showed a significant improvement in diabetes self-efficacy compared to the control group after intervention. This indicates that the intervention of implementing SMP program for Bai T2DM patients was superior to usual care in improving diabetes self-efficacy. This is consistent with the results of Davis and Kasar in similar studies (Davis et al., 2017; Kasar et al., 2022). Self-efficacy was definite to personal self-belief in behavior ability in IMB model (Fisher et al., 2002). In this study, although we did not find a suitable tool to test overall behavioral skill and techniques for T2DM, measuring confidence in implementing behavior through self-efficacy can also indirectly reflect changes in behavioral skills. Moreover, a high level of self-efficacy is the key to changing personal behavior and maintaining a healthy lifestyle (Bodenheimer, Lorig, Holman, & Grumbach, 2002). Therefore, from the result of this study, the SMP program can also effectively in enhance the self-efficacy, thereby further influencing self-management.

Fourth, the experimental group showed a significant improvement in self-management behavior compared to the control group after intervention. It indicates that the intervention of implementing SMP program for Bai T2DM patients had a significant effect on promoting self-management behavior, and was superior to usual care. In similar studies, most of them showed significant effects on self-management behavior change (Gavgani et al., 2010; Jeon et al., 2019; Kasar et al., 2022; Kim et al., 2022). This result seems to be consistent with the behavior change process of the IMB model, which is, providing relevant information and enhancing motivation for behavior change, at the same time, providing and promoting acceptable skills, when the information, motivation, and behavior skills reach a certain level, it

will ultimately lead to behavior change (Fisher et al., 1992). This result indicates that the SMP program in promoting self-management behavior in Bai T2DM patients is effective and applicable.

Fifth, the experimental group showed no significant improvement in FBS level compared to the control group after intervention, and the result consistent with a similar study by Guo (Guo et al., 2019). According to the suggestion of the previous study, it may take more time to determine whether the effect of SMP program on FBS superior to usual care. In addition, since we did not measure FBS uniformly, differences in test time, test method, fasting duration of participants and rapid response blood glucose meters were also important reasons for this result.

Sixth, the experimental group showed a significant improvement in HbA1c level compared to the control group after intervention, and it indicates that the intervention of implementing SMP program for Bai T2DM patients had a better effect on HbA1c control. Elevated HbA1c increases the risk of diabetic complications, and it requires patients to comprehensively improve self-management behaviors (Al-Khawaldeh, Al-Hassan, & Froelicher, 2012). About 85% of studies show that diabetes self-management education was effective in reducing HbA1c among T2DM patients (Bekele et al., 2021). As a T2DM self-management promotion program, our result also effectively improved HbA1c levels. Since similar studies' post-test time generally between 8~12 weeks after intervention, which was longer than 4 weeks of our study (Osborn & Egede, 2010; Bakır et al., 2021; Kasar et al., 2022; Kim et al., 2022), this SMP program seems to have a more significant effect in reducing HbA1c level in a short term.

Seventh, the experimental group showed a significant improvement in diabetes-specific quality of life compared to the control group after intervention. This

means that the implementation of SMP program intervention for Bai T2DM patients ultimately improved the diabetes-specific quality of life superior to usual care. And the result was consistent the study by Yao (Yao et al., 2021). Other studies also showed self-management intervention and training programs can prevent complications and have a positive impact on diabetes-specific quality of life (Heinrich, Schaper, & de Vries, 2010; Fadli, 2022). So diabetes self-management intervention studies should include important outcome of quality of life so that it can be further studied (Cochran & Conn, 2008).

Besides, the feedbacks were obtained through conversations with participants and nurses participating in the study. These feedbacks directly reflect the relevant role of the SMP program in improving self-management behavior of Bai T2DM patients (Appendix 9). Moreover, from the proportion of participant's dropouts, the experimental group had 33 cases and 6 dropouts, the dropouts accounting for 18%; in the control group, 34 cases and 9 dropouts, accounting for 26%. This also reflects that compared to usual care, participants were more proactive in the SMP program.

3. The implications and limitations of this study

This study was developed to promote the self-management behavior of Bai T2DM patients in China. First, from the above research process and results, it can be seen that the SMP program has executable and practical effects on promoting self-management behavior in Bai T2DM patients. And also has effects on the health-related outcomes, especially for HbA1c decrease, compared similar studies, it showed a superior effect in a shorter period of time. Second, compared with the usual care for Bai T2DM patients passively accept knowledge in the past, the design and development of this

program was based on the scientific behavioral theory model, and focuses on strengthening the self-management awareness of Bai T2DM patients, so as to enhance the leading role of patients in disease management, and enhance the initiative and ability of patients to participate in the long-term treatment process of T2DM. Third, we have made sufficient preparations before the development of this program, such as conducting a survey and analysis of the Bai ethnic group, analyzing a large amount of ethnic literatures, and collecting qualitative data (focus group interview). Due to the lack of previous research on this type, not just for the Bai ethnicity, this study has a certain enlightening effect on the health behavior research of chronic disease patients in ethnic minority concentrated areas in China.

However, this study also has certain limitations. The post-test II was only 4 weeks after the end of the intervention, making it difficult to confirm the long-term effect of the intervention. Due to some participants live far away from intervention place and some traveling during vacation, lead to a large number dropout in this study. Since the differences in rapid response blood glucose meters, fasting duration and participants' test methods, the FBS test results may be big deviation. Due to the lack of evaluation of the satisfaction of the participants, it cannot be used as a strong basis for further revisions to the SMP program.

Regarding the above limitations, there are several recommendations as follow: First, further application and repeated researches are needed in different region within the Bai ethnic communities to ascertain the effectiveness of this program. Second, future researches should consider adjusting the intervention duration based on the location (hospital or community). In community settings, the intervention duration can be extended and the post-test period extended to assess long-term effectiveness, also avoid too much dropouts. Third, implement unified standards for biochemical testing

such as FBS. Fourth, after the intervention, it is necessary to conduct a satisfaction survey of the participants to determine the shortcomings and as a basis for revising the program.

VII. Conclusion

This study developed and validated an intervention program to enhance self-management behaviors among Bai T2DM patients and confirmed its effectiveness through implementation and evaluation. To the best of our knowledge, this is the first study to develop and investigate a self-management promotion program specifically tailored for Bai ethnicity T2DM patients utilizing the IMB model. The research results will provide nurses with more scientific methods to implement health management education for adult T2DM patients of the Bai ethnicity, thereby more effectively improving patients' self-management ability and behavioral level and improving health-related outcomes.

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Appendix

Appendix 1. Study instructions and participant consent form

1) Study instructions and participant consent form - English version

Study Instructions and Participant Consent Form

Topic: Development and evaluation of a self-management promotion program for type 2 diabetes patient of the Bai ethnicity in China

Before deciding whether to participate in this study, please carefully read the research instructions and understand the reasons and methods for conducting this study. Show your intention to participate after reading the following. This study is limited to voluntary participants. If you have any questions, please consult the researchers.

1. Background and purpose of the study

Good self-management behaviors can improve chronic disease symptoms and quality of life, reduce the incidence of complications, reduce medical expenses, and reduce the use of health resources. Self-management among adults with T2DM in our country is generally at a moderate to low level. The prevalence of diabetes among ethnic minorities is also increasing rapidly, but there are few relevant studies. On the basis of respecting the customs, habits and religious beliefs of ethnic minorities, should pay attention in diabetes health education and lifestyle intervention, and to improve patients' self-management level, blood sugar control and quality of life. The T2DM prevalence in the Bai group is increasing, but the level of self-management is low. It is necessary to develop a program based on the characteristics of the Bai group to improve the self-management behavior of T2DM patients.

2. Participants

The study will take 67 Bai adults with T2DM as the participants, and will recruit in hospital outpatient department and inpatient department. The selection criteria is as follows: the age is from 40 to 65 years; diagnosed to T2DM more than 6months; have full cognitive and behavioral capacity, and voluntary participation; ability to use WeChat app independently or with assistance; never participated in other SMP programs for T2DM.

3. Procedures and methods of participating in the study

We will explain the relevant issues (including the risks of the study, precautions, and personal information protection countermeasures) to the patients who were interested in the study. If patients agree to participate, who will be reviewed by researchers in strict accordance with the participant's inclusion and exclusion criteria; after signing the participation consent form, participants will be randomly assigned to the experimental and control groups; two groups will received interventions and conducted pre-, post-test for 3 total times at the same time.

4. Risk factors in the study

In this study, the corresponding family tasks will consume the time of participants, both groups need to complete pre-, post I- and post II surveys, including 5 scales (knowledge, motivation, diabetes self-efficacy, self-management behavior, and diabetes-specific quality of life), which require about 30 minutes of time consumption, and the immersion in answering may bring inconvenience to participants. In addition, there is no possibility of loss or human rights violations due to participation in research. If you have any questions about the inconvenience or risk factors that may

occur during the survey, please consult the researcher immediately.

5. Benefits from participating in the research

If the research has the effect of promoting the self-management behavior and health-related outcomes for Bai T2DM patients, it can be applied in the Bai area and the Bai population; and the study will have certain-personal and social benefits for the treatment and health management of Bai diabetic patients, such as improving the quality of life, reducing the incidence of complications, reducing hospital admissions, controlling medical costs and the use of health resources.

6. Expenses for participating in the research

Participants do not have to bear the cost of the study. Even if not participate in this study, also not have any losing on participants.

7. Personal Information and Confidentiality

The private information of participants collected through the study will be kept strictly confidential; when analyzing the data, personal information will be coded and anonymized; the information collected will keep in a secure place; all data will be shredded and discarded upon completion of the research.

8. Matters concerning withdrawal of willingness to participate

Participation in the research is voluntary and you have the right and freedom not to participate, and there will be no adverse effects on you. In addition, if you want to give up during the participation process, you can withdraw at any time. If you decide to withdraw, please tell the research leader immediately. When you stop participating,

your data will no longer be used for research.

I have fully understood the information in the above description and have voluntarily participated in this research.

Participant name: Signature
Date:

Research Director: Signature
Date:

Program responsible organization: ****** and ******
Tel : ***-****-****
E-mail : 852593518@qq.com

2) Study instruction and participant consent form - Chinese version

研究说明及参与同意书

主题：白族 2 型糖尿病患者自我管理促进项目开发及效果验证

您在决定是否参与本研究之前，请慎重阅读说明书，并理解进行该研究的原因和方法。在阅读以下内容后表明参与意向。该研究仅限于对自愿参与的人进行，如果有任何疑问，请咨询研究人员。

1. 研究背景和目的

良好的自我管理行为可以改善慢性病症状和生活质量，减少并发症的发生，减少医疗费用，减少卫生资源的使用。我国成人 2 型糖尿病患者的自我管理水平普遍处于中低水平。 少数民族糖尿病患病率也在迅速上升，但相关研究却很少。在尊重少数民族风俗习惯和宗教信仰的基础上，应重视糖尿病健康教育和生活方式干预，提高患者的自我管理水平、血糖控制和生活质量。白族人群 2 型糖尿病患病率呈上升趋势，但自我管理水平较低。有必要针对民族的特点制定方案来改善 2 型糖尿病患者的自我管理行为。

2. 研究参与对象

研究将以白族成人 2 型糖尿病患者 67 名为参与对象。在医院门诊及住院部进行参与者的招募。选定标准是：年龄在 40 岁到 65 岁之间；确诊时间≥6 个月；具有完全的认知和行为能力并自愿参与；可以独立或在协助下使用微信；从未参

加过其他糖尿病的自我管理促进项目。

3. 参与研究的程序及方法

我们将对有意向的患者面对面对进行相关事项的说明（包括研究的风险、注意事项、个人信息保护对策）。如果患者同意参与该研究，将由研究人员严格按照参与者的纳入和排除标准进行审查；参与者在参与同意书上签名后随机分配到实验组和对照组；两组同时接受干预后并同时进行干预前、干预后共 3 次调查。

4. 研究中的风险因素

本研究中，项目的实施及相应的家庭任务将耗费参与者的时间，加之两组都需要完成实验前、实验后及后续的问卷调查，包括 5 份量表（知识、动机、自我效能感、自我管理、生活质量），需要耗费约 30 分钟的时间，加上回答的投入感可能会给参与者带来不便。除此之外，完全没有因参与研究而遭受损失或侵犯人权的可能性。如果对参与研究过程中可能发生的不便或风险因素有疑问，请立即咨询研究人员。

5. 参与研究带来的效益

如果该研究具有促进白族 2 型糖尿病患者自我管理行为和健康结果的效果，可在白族地区及白族人群中应用；对白族糖尿病患者的治疗及健康管理将具有一定的个人和社会效益，如改善患者的生活质量、减少并发症的发生率、降低入院率、控制医疗成本及卫生资源的使用。

6. 参与研究的费用

对于该研究，参与者不需要承担研究费用。即使不参与本研究，对参与者也不会造成任何利益的损失。

7. 个人信息和保密

通过研究收集到的参与者的私人信息，将非常严格的进行保密；分析问卷资料时，个人信息会被编码并匿名处理；收集的资料被保管在安全的地方；所有资料将在研究完成后被粉碎废弃。

8. 关于撤回参与意愿的事项

参与研究是自愿的，您有不参与本研究的权利和自由，并且对您不会有任何不利影响。另外，在参与过程中如果您想放弃，您随时都可以中途退出此研究，如果决定退出，请立即告诉研究负责人。停止参与时您的相关资料将不再用于研究。

对于以上说明中的信息我已经充分理解，并自愿参与本研究。

参与者：　　签名
日期：

负责人：　　签名
日期：

项目负责单位：****** 和 ******
联系电话：***-****-****
邮箱：852593518@qq.com

Appendix 2. Measurement tools

1) Demographic characteristics of patients - English version

Guidance: Please fill in the following questions carefully according to your actual situation and mark '√' on the correct serial number.

1. Your age: _____
2. Your height _____ cm, your weight _____ kg
3. You were diagnosed with type 2 diabetes for _____ years.
4. What is your gender?
   1) ☐Male 2) ☐Female
5. Where you live?
   1) ☐City 2) ☐Village
6. What is your education level?
   1) ☐Elementary school or below 2) ☐Junior/High School
   3) ☐University or above
7. What is your current occupation/work status?
   1) ☐In occupation / Labor 2) ☐Retirement/Rest
8. What is your income level?
   1) ☐Below 2000 2) ☐2000-5000 3) ☐5001-10000
   4) ☐Above 10000
9. What is your living arrangement?
   1) ☐Living alone 2) ☐Living with family
10. Can you fully understand and communicate in Dialect/ Mandarin?
    1) ☐No 2) ☐Yes
11. Are there other people with diabetes in your family (parents/children/siblings)?
    1) ☐No 2) ☐Yes
12. Do you have a heavy economic burden because of the treatment of T2DM?
    1) ☐No 2) ☐Yes
13. What is your current treatment method?
    1) ☐Western Medicine 2) ☐Traditional Chinese Medicine
    3) ☐Both of the above
14. What are your current medications?
    1) ☐Non-drug treatment 2) ☐Oral hypoglycemic agent (OHA)
    3) ☐Insulin injection 4) ☐OHA and Insulin

1) Demographic characteristics of patients - Chinese version

指导语：请根据您的实际情况认真填写以下问题，并在正确的序号上打“√”。

1. 您的年龄是_____岁
2. 您的身高_____厘米，体重_____公斤
3. 您被确诊为 2 型糖尿病_____年
4. 您的性别是？
   1）☐男　　2）☐女
5. 您住的地方是？
   1）☐城镇　　2）☐农村
6. 您的教育水平是？
   1）☐小学或以下　　2）☐中学（初中/高中/中专）
   3）☐大学及以上
7. 您现在的职业/工作状态？
   1）☐在职/劳作　　2）☐退休/休息
8. 您的经济收入水平是？
   1）☐低于 2000　　2）☐2000-5000　　3）☐5001-10000
   4）☐高于 10000
9. 您的生活方式是？
   1）☐独居　　2）☐与家人一起居住
10. 您是否能完全听懂汉语并用汉语交流？
   1）☐否　　2）☐是
11. 您的家族当中（父母/子女/兄弟姐妹）是否有其他糖尿病患者？
   1）☐否　　2）☐是
12. 因为该病的治疗，您的经济负担是否很重？
   1）☐否　　2）☐是
13. 您目前采用的治疗方法是？
   1）☐西医　　2）☐中医　　3）☐两者同时
14. 您目前的用药情况是？
   1）☐不用药物　　2）☐口服降糖药　　3）☐注射胰岛素
   4）☐口服药和胰岛素同时

2) The Knowledge Questionnaire for Patients with Type 2 Diabetes - English version

Introduction: Among the following 34 items, please tick '√' on the number that conforms to your own point of view.

Items		Right	Wrong	Not sure
1	Diabetes cannot be cured, but its progression can be controlled			
2	Diabetes is hereditary			
3	The fasting blood sugar standard is 4.4~6.0 mmol/L			
4	HAb1c reflects the average blood sugar level in the past 8~12 weeks			
5	The HAb1c target value stipulated in the Chinese diabetes guidelines is 6.5%.			
6	Emotional stress can affect blood sugar levels			
7	Oral medication can help lower blood sugar levels			
8	Oral medicines can sometimes cause hypoglycemia			
9	No need to take medicine every day			
10	When taking oral medication, stop taking the medication if blood sugar levels become too low			
11	Early application of insulin therapy is beneficial to control blood sugar			
12	When injecting insulin, in order to fully mix the insulin, shake vigorously			
13	When injecting insulin, the absorption of insulin is independent of the injection site			
14	Drink sugary drinks or eat sweets right away if hypoglycemia occurs			
15	Long-term adherence to blood sugar control can reduce the risk of damage to foot nerves, kidneys and eyes			
16	It harder to heal damaged skin than normal people of diabetics			
17	Diabetes can cause loss of feeling in hands, fingers and feet			
18	Diabetics need to be extra careful when cutting their toenails			
19	Diabetics with blisters on their feet should be treated in time			
20	Diabetics should monitor their weight regularly			
21	Diabetics should regularly test blood lipids, fundus			

22	Diabetics should test blood sugar regularly			
23	Diabetics should test HAb1c once every 3-6 months			
24	Diabetics should have their foot nerves checked regularly			
25	Proper exercise can lower blood sugar levels			
26	If the blood sugar level is high, cannot do exercise			
27	Diabetics should start exercise 1/2 hour to 1 hour after meals			
28	Aerobic activities, such as walking, jogging, cycling, Tai Chi, etc., should be preferred by diabetics for exercise			
29	Carry sugar (candies, sugar cubes) when exercising			
30	Can eat fruits that are low in sugar			
31	Starch -rich foods can affect blood sugar levels			
32	Protein-rich foods can affect blood sugar levels			
33	High-fat diets increase risk of chronic complications			
34	Nuts can be eaten in unlimited quantities			

2) The Knowledge Questionnaire for Patients with Type 2 Diabetes - Chinese version

指导语：以下 34 个条目中，请您在符合自身观点的数字上打“√”。

条目		对	错	不清楚
1	糖尿病虽然不能治愈，但能控制其进展			
2	糖尿病是可以遗传			
3	空腹血糖标准是 4.4～6.0 毫摩 / 升			
4	糖化血红蛋白反映过去 8～12 周的平均血糖值			
5	我国糖尿病指南规定糖化血红蛋白目标值为 6.5%			
6	情绪紧张可影响血糖水平			
7	口服药治疗能帮助降低血糖水平			
8	口服药有时会导致低血糖			
9	不需要每天都服药			
10	应用口服药治疗时，如果血糖水平过低应停止服药			
11	早期应用胰岛素治疗，有利于控制血糖			
12	注射胰岛素时，为使胰岛素充分混均匀可剧烈摇动			
13	注射胰岛素时，胰岛素的吸收与注射部位无关			
14	如果发生低血糖，立即喝含糖饮料或吃糖果			
15	长期坚持控制血糖可以降低对足部神经、肾脏和眼睛的损害风险			
16	糖尿病人皮肤破损后比常人难以愈合			
17	糖尿病会使手、手指及足部失去知觉			
18	糖尿病患者剪趾甲时，需特别小心			
19	糖尿病患者足部出现水疱、应及时进行治疗			
20	糖尿病患者应该定期监测体重			
21	糖尿病患者应该定期检查血脂、眼底			
22	糖尿病患者应该定期检查血糖			
23	糖尿病患者应该 3-6 个月监测 1 次糖化血红蛋白			
24	糖尿病患者应该定期检查足部神经			
25	适当的运动能降低血糖水平			
26	在运动前，血糖值较高时，不该进行运动			
27	糖尿病患者应在饭后半小时到 1 小时开始运动			
28	糖尿病患者进行锻炼首选有氧活动，如步行、慢跑 骑自行车、太极等			
29	运动时应随身携带糖类食品(糖果，方糖)			
30	可以吃含糖量低的水果			
31	含淀粉多的食物会影响血糖水平			
32	含蛋白质多的食物会影响血糖水平			
33	高脂肪食物会增加糖尿病患者慢性并发症发病风险			
34	坚果类食物可以不限量地食用			

3) The Chinese Third Version of the Diabetes Attitude Scale (C-DAS-3) - English version

Introduction: Among the following 33 items, please tick '√' on the number that conforms to your own point of view.

Items		Strong agree	Agree	Neutral	Disagree	Strong disagree
1	Health care professionals who treat people with diabetes should be trained to communicate well with their patients	1	2	3	4	5
2	People who do not need to take insulin to treat their diabetes have a pretty mild disease	1	2	3	4	5
3	There is not much use in trying to have good blood sugar control because the complications of diabetes will happen anyway.	1	2	3	4	5
4	Diabetes affects almost every part of a diabetic person's life.	1	2	3	4	5
5	The important decisions regarding daily diabetes care should be made by the person with diabetes	1	2	3	4	5
6	Health care professionals should be taught how daily diabetes care affects patients' lives	1	2	3	4	5
7	Older people with Type 2 diabetes do not usually get complications	1	2	3	4	5
8	Keeping the blood sugar close to normal can help to prevent the complications of diabetes	1	2	3	4	5
9	Health care professionals should help patients make informed choices about their care plans	1	2	3	4	5
10	It is important for the nurses and dietitians who teach people with diabetes to learn counseling skills	1	2	3	4	5
11	People whose diabetes is treated by just a diet do not have to worry about getting many long-term complications	1	2	3	4	5
12	Almost everyone with diabetes should do whatever it takes to keep their blood sugar close to normal	1	2	3	4	5

13	The emotional effects of diabetes are pretty small	1	2	3	4	5
14	People with diabetes should have the final say in setting their blood glucose goals	1	2	3	4	5
15	Blood sugar testing is not needed for people with Type 2 diabetes	1	2	3	4	5
16	Low blood sugar reactions make tight control too risky for most people	1	2	3	4	5
17	Health care professionals should learn how to set goals with patients, not just tell them what to do	1	2	3	4	5
18	Diabetes is hard because you never get a break from it	1	2	3	4	5
19	The person with diabetes is the most important member of the diabetes care team	1	2	3	4	5
20	To do a good job, diabetes educators should learn a lot about being teachers	1	2	3	4	5
21	Type 2 diabetes is a very serious disease	1	2	3	4	5
22	Having diabetes changes a person's outlook on life	1	2	3	4	5
23	People who have Type 2 diabetes will probably not get much payoff from tight control of their blood sugars.	1	2	3	4	5
24	People with diabetes should learn a lot about the disease so that they can be in charge of their own diabetes care	1	2	3	4	5
25	Type 2 diabetes is as serious as Type 1 diabetes	1	2	3	4	5
26	Tight control is too much work	1	2	3	4	5
27	What the patient does has more effect on the outcome of diabetes care than anything a health professional does	1	2	3	4	5
28	Tight control of blood sugar makes sense only for people with Type 1 diabetes	1	2	3	4	5

29	It is frustrating for people with diabetes to take care of their disease	1	2	3	4	5
30	People with diabetes have a right to decide how hard they will work to control their blood sugar	1	2	3	4	5
31	People who take diabetes pills should be as concerned about their blood sugar as people who take insulin	1	2	3	4	5
32	People with diabetes have the right not to take good care of their diabetes	1	2	3	4	5
33	Support from family and friends are important in dealing with diabetes	1	2	3	4	5

3) The Chinese Third Version of the Diabetes Attitude Scale (C-DAS-3) - Chinese version

导语：以下 33 个条目中，请您在符合自身观点的数字上打“√”。

条 目		完全不同意	不同意	一般	同意	完全同意
1	治疗糖尿病的医务人员应该接受交流方面的专业培训,以便与糖尿病患者进行良好的沟通	1	2	3	4	5
2	不需要胰岛素治疗的糖尿病病人病情较轻。	1	2	3	4	5
3	因为无论如何糖尿病慢性并发症都会发生,所以良好的血糖控制并不重要	1	2	3	4	5
4	糖尿病将影响病人生活的方方面面	1	2	3	4	5
5	糖尿病自我管理中的一些重要决定必须由患者本人来做	1	2	3	4	5
6	糖尿病医务人员必须了解糖尿病日常管理对病人生活影响	1	2	3	4	5
7	老年 2 型糖尿病病人不容易发生慢性并发症	1	2	3	4	5
8	保持血糖接近正常水平可以预防糖尿病慢性并发症	1	2	3	4	5
9	医务人员应该在给患者提供足够信息的基础上,帮助患者做出有关糖尿病治疗的决策	1	2	3	4	5
10	糖尿病教育者如护士和营养师等应学会咨询技巧	1	2	3	4	5
11	仅通过饮食治疗的糖尿病患者不必要担心会发生糖尿病慢性并发症	1	2	3	4	5
12	有糖尿病患者都应该尽其所能控制血糖接近正常	1	2	3	4	5
13	情绪对糖尿病的影响很小	1	2	3	4	5
14	血糖控制目标最终应该由患者来设定	1	2	3	4	5
15	2 型糖尿病不需要监测血糖	1	2	3	4	5
16	由于严格控制血糖容易发生低血糖，对于多数人来说，严格控制血糖风险太大	1	2	3	4	5
17	医务人员必须学会如何和患者一起设定目标,而不仅仅告诉患者怎么做	1	2	3	4	5
18	糖尿病很麻烦，因为一旦得糖尿病，就得一直围着它转	1	2	3	4	5

19	在糖尿病治疗小组中，糖尿病患者是最重要的成员	1	2	3	4	5
20	糖尿病教育者应该努力学习如何成为一位优秀的教师	1	2	3	4	5
21	2 型糖尿病是需要严肃认真对待的疾病	1	2	3	4	5
22	糖尿病将会改变一个人的对生活的看法	1	2	3	4	5
23	2 型糖尿病患者严格控制血糖并不一定带来良好的结果	1	2	3	4	5
24	糖尿病患者应该努力学习糖尿病相关知识,以便更好地承担起自我管理的责任	1	2	3	4	5
25	2 型糖尿病同 1 型糖尿病一样严重	1	2	3	4	5
26	严格控制血糖需要付出太多	1	2	3	4	5
27	对糖尿病治疗效果而言，患者的作用比医务人员作用更大	1	2	3	4	5
28	严格控制血糖仅对 1 型糖尿病患者有价值	1	2	3	4	5
29	自我管理糖尿病的过程中容易令人产生沮丧感	1	2	3	4	5
30	患者有权决定在自我管理中付出多少努力	1	2	3	4	5
31	服用降糖药物的患者应该和胰岛素治疗的患者一样,关注自己的血糖	1	2	3	4	5
32	选择不好好控制糖尿病也是患者的权利	1	2	3	4	5
33	在应对处理糖尿病的过程中，家庭和朋友的支持非常重要	1	2	3	4	5

4) The Chinese Version of the Diabetes Management Self-Efficacy Scale (C-DMSES)
- English version

Introduction: The following 20 items are about your opinion of yourself, please tick '√' on the number according to your actual feeling.

I have confidence to:		Can't do			Maybe can →maybe not					Can do		
1	I am able to check my blood sugar if necessary	0	1	2	3	4	5	6	7	8	9	10
2	I am able to decrease my blood sugar when the sugar level is too high (e.g., eat different foods)	0	1	2	3	4	5	6	7	8	9	10
3	I am able to increase my blood sugar when the sugar level is too low (e.g., eat different foods)	0	1	2	3	4	5	6	7	8	9	10
4	I am able to choose the foods that are best for my health	0	1	2	3	4	5	6	7	8	9	10
5	I am able to choose different foods and maintain a healthy eating plan	0	1	2	3	4	5	6	7	8	9	10
6	I am able to control my body weight and maintain it within the ideal weight range	0	1	2	3	4	5	6	7	8	9	10
7	I am able to examine both of my feet (e.g., for cuts or blisters)	0	1	2	3	4	5	6	7	8	9	10
8	I am able to do enough physical activity (e.g., walking, aerobic exercise, and stretching exercises)	0	1	2	3	4	5	6	7	8	9	10
9	I am able to maintain my eating plan when I am ill	0	1	2	3	4	5	6	7	8	9	10
10	I am able to follow a healthy eating plan most of the time	0	1	2	3	4	5	6	7	8	9	10
11	I am able to do more physical activity if the doctor advises me to do so	0	1	2	3	4	5	6	7	8	9	10
12	When doing more physical activity, I am able to adjust my eating plan	0	1	2	3	4	5	6	7	8	9	10
13	I am able to follow a healthy eating plan when I am away from home	0	1	2	3	4	5	6	7	8	9	10
14	I am able to choose different foods and maintain my eating plan when I am away from home	0	1	2	3	4	5	6	7	8	9	10
15	I am able to follow a healthy eating plan during traditional ceremonies	0	1	2	3	4	5	6	7	8	9	10

16	I am able to choose different foods and maintain a healthy eating plan when I am eating at a party	0	1	2	3	4	5	6	7	8	9	10
17	I am able to maintain my eating plan when I am feeling stressed or anxious	0	1	2	3	4	5	6	7	8	9	10
18	I am able to visit my doctor four times a year to monitor my diabetes	0	1	2	3	4	5	6	7	8	9	10
19	I am able to take my medication as prescribed	0	1	2	3	4	5	6	7	8	9	10
20	I am able to maintain my medication when I am ill	0	1	2	3	4	5	6	7	8	9	10

4) The Chinese Version of the Diabetes Management Self-Efficacy Scale (C-DMSES) - Chinese version

导语：以下 20 个条目关于您的看法，请根据您的实际感受在选择的数字上打“√”。

我有信心：		做不到			也许不可以→也许可以					可做到		
1	有需要时我有能力自行检测血糖	0	1	2	3	4	5	6	7	8	9	10
2	当我的血糖值太高时，我有能力自己调整我的血糖值（例如：食用不同种类的食物）	0	1	2	3	4	5	6	7	8	9	10
3	当我的血糖值太低时，我有能力自己调整我的血糖值（例如：食用不同种类的食物）	0	1	2	3	4	5	6	7	8	9	10
4	我有能力选择最有利于我的健康的食物	0	1	2	3	4	5	6	7	8	9	10
5	我有能力选择不同种类的食物来维持健康的饮食计划	0	1	2	3	4	5	6	7	8	9	10
6	我有能力将我的体重控制在理想范围内	0	1	2	3	4	5	6	7	8	9	10
7	我有能力自行检查我的脚（例如：伤口或起水泡）	0	1	2	3	4	5	6	7	8	9	10
8	我有能力做足够的身体活动，例如：遛狗、瑜伽、园艺或伸展运动等	0	1	2	3	4	5	6	7	8	9	10
9	当我生病时，我仍然能维持我的饮食计划	0	1	2	3	4	5	6	7	8	9	10
10	大部分的时间内，我都能确实遵从我的健康饮食计划	0	1	2	3	4	5	6	7	8	9	10
11	当医师建议我多做一些身体活动，我有能力确实做到	0	1	2	3	4	5	6	7	8	9	10
12	当我身体活动量增加时，我有能力自行调整我的饮食计划	0	1	2	3	4	5	6	7	8	9	10
13	当我外出时，我仍然能遵行健康的饮食计划	0	1	2	3	4	5	6	7	8	9	10
14	当我外出时，我有能力选择不同的食物种类，并维持我的饮食计划	0	1	2	3	4	5	6	7	8	9	10
15	在特殊节日时，我仍然能遵守健康饮食计划	0	1	2	3	4	5	6	7	8	9	10
16	当我在外用餐或参加聚会时，我有能力选择不同种类的食物并维持我的	0	1	2	3	4	5	6	7	8	9	10

	健康饮食计划											
17	当我面对压力或焦虑时，我仍然能维持我的饮食计划	0	1	2	3	4	5	6	7	8	9	10
18	我能每年至少去看医生四次，以监测我的糖尿病状况	0	1	2	3	4	5	6	7	8	9	10
19	我能够依医师处方按时服药	0	1	2	3	4	5	6	7	8	9	10
20	当我生病时，我仍然能维持我的糖尿病药物治疗	0	1	2	3	4	5	6	7	8	9	10

5) The Chinese Summary of Diabetes Self Care Activities (C-SDSCA) - English version

Introduction: In the following 11 questions, please tick '√' on the number (days) that conform to your actual situation.

Items		Days							
1	How many of the last SEVEN DAYS have you followed a healthful eating plan?	0	1	2	3	4	5	6	7
2	On average, over the past month, how many DAYS PER WEEK have you followed yours eating plan?	0	1	2	3	4	5	6	7
3	On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?	0	1	2	3	4	5	6	7
4	On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?	0	1	2	3	4	5	6	7
5	On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking)	0	1	2	3	4	5	6	7
6	On how many of the last SEVEN DAYS did you participate in a specific exercise session? (such as swimming, walking, biking)	0	1	2	3	4	5	6	7
7	Blood Sugar Testing On how many of the last SEVEN DAYS did you test your blood sugar?	0	1	2	3	4	5	6	7
8	On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider? (0) The number of blood sugar testing times that is not known to suit personal condition	0	1	2	3	4	5	6	7
9	Foot Care On how many of the last SEVEN DAYS did you check your feet?	0	1	2	3	4	5	6	7
10	On how many of the last SEVEN DAYS did you inspect the inside of your shoes?	0	1	2	3	4	5	6	7
11	On how many of the last SEVEN DAYS did your medicine or insulin was taken correctly as directed by the doctor?	0	1	2	3	4	5	6	7

5) The Chinese Summary of Diabetes Self Care Activities (C-SDSCA) - Chinese version

指导语：以下 11 个问题中，请您在符合自身实际情况的数字（天数）上打“√”。

条目		天数							
1	在过去 7 天内 按糖尿病饮食要求合理安排饮食的天数？	0	1	2	3	4	5	6	7
2	在过去 1 月内，每周 按糖尿病饮食要求合理安排饮食的平均天数？	0	1	2	3	4	5	6	7
3	在过去 7 天内 一天内摄入水果/蔬菜达 5 种或 5 种以上的天数？	0	1	2	3	4	5	6	7
4	在过去 7 天内 摄入油腻食物或全脂奶制品的天数？	0	1	2	3	4	5	6	7
5	在过去 7 天内 进行持续时间>30 分钟的运动情况（包括“散步”）？	0	1	2	3	4	5	6	7
6	在过去 7 天内 进行中等强度活动的情况（包括快走、游泳、骑车等）？	0	1	2	3	4	5	6	7
7	在过去 7 天内 进行了血糖监测的天数？	0	1	2	3	4	5	6	7
8	在过去 7 天内 完成适合自身状况的血糖监测次数的天数？ （0）为不清楚适合自身状况的血糖监测次数	0	1	2	3	4	5	6	7
9	在过去 7 天内 仔细检查自己脚部有无问题的天数？	0	1	2	3	4	5	6	7
10	在过去 7 天内 检查鞋子内部有无异物、平整、舒适情况的天数？	0	1	2	3	4	5	6	7
11	在过去 7 天内 按医生要求正确服用药物或注射胰岛素的天数？	0	1	2	3	4	5	6	7

6) The Diabetes-specific Quality of Life Scale (DSQL) - English version

Introduction: For the following questions, please tick '√' in the corresponding content based on your actual feelings in the past two weeks.

A. Physiological function

Item		Influence				
1	Overall, how damaging is diabetes to your health?	absolutely not	little	moderate	very	extremely
2	Do you often experience physical discomfort such as skin itching, numbness, and pain?	absolutely not	occasionally	about half the time	frequently	always
3	Do you find it increasingly difficult to see things?	absolutely not	occasionally	about half the time	frequently	always
4	How much has vision loss affected your daily life?	absolutely not	little	moderate	very	extremely
5	How much do feelings of physical discomfort interfere with your life?	absolutely not	little	moderate	very	extremely
6	Do you find it increasingly difficult to hear others speak clearly?	absolutely not	occasionally	about half the time	frequently	always
7	How much does hearing loss affect your daily life?	absolutely not	little	moderate	very	extremely
8	Do you often feel chest pain, chest tightness and heart palpitations?	absolutely not	occasionally	about half the time	frequently	always
9	Do you feel that your skin and feet are easily infected?	absolutely not	occasionally	about half the time	frequently	always
10	How much do skin and foot infections affect your life?	absolutely not	little	moderate	very	extremely
11	Do you feel less responsive to external events?	absolutely not	little	moderate	very	extremely
12	Do you often feel hungry?	absolutely not	occasionally	about half the time	frequently	always

B. Treatment influence

Items		Influence				
1	Have you ever had adverse reactions such as allergies and nausea after taking the medicine?	absolutely not	occasionally	about half the time	frequently	always
2	Do you have low blood sugar reactions such as heart palpitations, dizziness and sweating?	absolutely not	occasionally	about half the time	frequently	always
3	How much restriction does controlling diet have on your lifestyle or habits?	absolutely not	little	moderate	very	extremely

C. Psychology/Spirit

Items		Influence				
1	Does diabetes often bring trouble and inconvenience to your daily life?	absolutely not	occasionally	about half the time	frequently	always
2	Do you often think about what diabetes means to you?	absolutely not	occasionally	about half the time	frequently	always
3	Are you worried that you will die suddenly?	absolutely not	occasionally	about half the time	frequently	always
4	Does diet control bother you?	absolutely not	occasionally	about half the time	frequently	always
5	Does it bother you to test your urine sugar regularly or go to the hospital to check your blood sugar?	absolutely not	occasionally	about half the time	frequently	always
6	Are you nervous or cramped because of diabetes?	absolutely not	occasionally	about half the time	frequently	always
7	Are you satisfied with your current treatment results?	very satisfied	satisfied	moderately satisfied	very dissatisfied	extremely dissatisfied
8	Do you believe that you can overcome the troubles of disease?	believe very much	believe	moderately believe	somewhat believe	extremely unbelievable

D. Social relations

Items		Influence				
1	In general, does diabetes damage your interpersonal relationships?	absolutely not	little	moderate	very	extremely
2	Do you feel rejected because you have diabetes?	absolutely not	occasionally	about half the time	frequently	always
3	Does diabetes affect your status and role at home or work?	absolutely not	little	moderate	very	extremely
4	Do you often exchange experiences, problems and knowledge about diabetes with peers?	always	frequently	about half the time	occasionally	absolutely not

6) The Diabetes-specific Quality of Life Scale (DSQL) - Chinese version

指导语：以下问题，请您根据自己“最近两周”的实际感受，在相应的内容中“√”。

A. 生理功能

条目		影响				
1	总的来讲，糖尿病对您的健康损害有多大？	根本没有损害	有点损害	有损害（中度）	很损害	极度损害
2	您经常有皮肤瘙痒、肢体麻木、疼痛等身体不舒适的感受吗？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
3	您是否感觉看东西越来越困难？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
4	视力的下降对您的日常生活有多大影响？	根本没有影响	有点影响	有影响（中度）	很影响	极影响
5	身体不适的感觉对您的生活有多大干扰？	根本没有干扰	有点干扰	有干扰（中度）	很干扰	极干扰
6	你是否感觉听清别人讲话越来越困难？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
7	听力的下降对您的日常生活有多大影响？	根本没有影响	有点影响	有影响（中度）	很影响	极影响
8	您是否常感到胸痛，胸闷和心悸吗？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
9	您是否感到皮肤和脚很容易感染？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
10	皮肤和脚的感染对您的生活有多大影响？	根本没有影响	有点影响	有影响（中度）	很影响	极影响
11	您是否觉得对外界事物的反应能力下降了？	根本没有下降	有点下降	下降了（中度）	下降很大	下降极大
12	您是否常常感觉饥饿？	根本没有	偶尔有	有（约一半时间）	经常有	总是有

B. 治疗影响

条目		影响				
1	您用药后是否有过过敏、恶心等药物不良反应？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
2	您是否有心悸、头昏和出虚汗等低血糖反应？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
3	饮食控制对您的生活方式或生活习惯有多大限制？	根本没有限制	有点限制	有限制（中度）	很限制	极限制

C.心理/精神

条目		影响				
1	糖尿病经常给您的日常生活带来麻烦和不便吗？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
2	您是否经常想糖尿病对您意味着什么？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
3	您是否担忧您会突然死掉？	根本不担忧	偶尔担忧	担忧（一半时间）	经常担忧	总是担忧
4	饮食控制是否使您感到烦恼？	根本没烦恼	偶尔烦恼	烦恼（一半时间）	经常烦恼	总是烦恼
5	定期自测尿糖或到医院检查血糖使您感到麻烦吗？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
6	您是否因糖尿病而感到紧张或拘促不安？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
7	您对您目前的治疗效果满意吗？	极满意	很满意	满意（中度）	很不满意	极不满意
8	您是否相信您能战胜疾病的困扰？	极相信	很相信	相信（中度）	有点相信	极不相信

D.社会关系

条目		影响				
1	总的来说，糖尿病对您的人际关系是否损害？	根本没有损害	有点损害	有损害（中度）	很损害	极度损害
2	您是否感到因为患有糖尿病而被人嫌弃？	根本没有	偶尔有	有（约一半时间）	经常有	总是有
3	糖尿病对您在家里或单位上的地位和作用有影响吗？	根本没有影响	有点影响	有影响（中度）	很影响	极影响
4	您经常和周围的病友交流有关糖尿病的体验、问题和知识吗？	一直交流	经常交流	交流（约一半时间）	偶尔交流	不交流

7) Hemoglobin A1c (HbA1c) and Fasting blood sugar (FBS) inspection record sheet - English version

HbA1c Test Record Sheet

Case No: _____

☐ Pre-test ☐Post- test		
Test results (%)	HbA1c status	Normal value range (%)
	☐ Low	4 ~ 6
	☐ Normal	
	☐ High	

Date:

Researcher: signature

Fasting Blood Sugar Test Record Sheet

Case No: _____

☐Pre-test ☐Post-test I ☐Post-test II		
Test results (mmol/L)	Blood sugar status	Normal value range (mmol/L)
	☐ Low	4.4 ~ 6.5
	☐ Normal	
	☐ High	

Date:

Researcher: signature

7) Hemoglobin A1c (HbA1c) and Fasting blood sugar (FBS) inspection record sheet - Chinese version

糖化血红蛋白检测记录单

编号：_____

☐ 实验前检测 ☐ 实验后续检测		
检查结果（%）	HbA1c 状态	正常范围（%）
	☐ 偏低	4 ~ 6
	☐ 正常	
	☐ 偏高	

日 期：　　年　　月　　日
填写人：

空腹血糖检测记录单

编号：_____

☐实验前检测 ☐实验结束检测 ☐实验后续检测		
检查结果（mmol/L）	血糖状态	正常范围（mmol/L）
	☐ 偏低	4.4 ~ 6.5
	☐ 正常	
	☐ 偏高	

日 期：　　年　　月　　日
填写人：

Appendix 3-1. List of literature for systematic review

No.	Author (Year)	Title
A1	Sayin Kasar et al. (2022)	The effect of model-based telephone counseling on HbA1c and self-management for individuals with type 2 diabetes: A randomized controlled trial
A2	Kim et al. (2022)	Integrated diabetes self-management program using smartphone application: a randomized controlled trial
A3	Bakir et al. (2021)	Effects of the information - motivation - behavioral skills model on metabolic control of adolescents with type 1 diabetes in Turkey: Randomized controlled study
A4	Yao et al. (2021)	Effect of information - motivation - behavioral model based on protection motivation theory on the psychological resilience and quality of life of patients with type 2 DM
A5	Jeon et al. (2019)	Experiences of patients with a diabetes self-care app developed based on the information - motivation - behavioral skills model
A6	Davis et al. (2017)	Patient adoption of an internet based diabetes medication tool to improve adherence: A pilot study
A7	Meunier et al. (2016)	Longitudinal testing of the Information - Motivation - Behavioral Skills model of self-care among adults with type 2 diabetes
A8	Gavgani et al. (2010)	Effectiveness of Information - Motivation and Behavioral skill (IMB) model in improving self-care behaviors & Hba1c measure in adults with type2 diabetes in Iran-Tabriz
A9	Osborn et al. (2010)	An information - motivation - behavioral skills analysis of diet and exercise behavior in Puerto Ricans with diabetes

Appendix 3-2. Details of IMB model-based interventions and effectiveness

No.	First author / Country / Year	Study design	Participant		Intervention & duration / Follow-up time	Intervention based on IMB constructs	Measurements		Outcomes
			DM type (age / years)	Sample size			IMB constructs	Others	
A1	Sayin Kasarl; Turkey; 2022	RCT	Type 2 (18-65)	Exp. n=31 Cont. n=32	Individual training (45~60 m once) + SMS once a week + phone counselling (every 2 weeks, 6 times); PPT presentation, demonstration (role play), discussion, phone calls, SMS 12 weeks	**I:** during the individual training: general information, follow-up & treatment, complications, and the impact of medical control of DM **M:** during phone calls: talking about patients' problem, confirming target behavior, reinforcing the goals achieved, panning the next achievable and realistic goals, discussing barriers & benefits of behavior change, and Q&A; through SMS: motivation and support **B:** during the individual training: self-monitoring of blood glucose, carbohydrate portion sizes, weight and blood pressure, and foot care	None	**SE:** Self-efficacy scale for diabetes management **SMB:** DSMQ **GC:** HbA1c **SM:** perception: PDSMS	**Effect (+)** -self-efficacy -self-management -self-management perceptions -HbA1c -weight -systolic blood pressure **Effect (-)** -diastolic blood pressure
A2	Kim; Korea; 2022	RCT	Type 2 (Over 19)	Exp. n=32 Cont. n=36	In-person group education (90 m once, 2~5 subjects) using a booklet & PPT + smartphone app for 8 weeks + phone	**I:** during in-person education, diabetes SM including blood sugar control, exercise, medication compliance, hypoglycemia management, complications, foot care, stress management, and how to use the smartphone app	**I:** Brief Diabetes Knowledge Test **Mp:** DAS-3 **Ms:** DFBC-2 **B:** DSES	**SMB:** SDSCA **GC:** HbA1c, FBS **BMI** **Daily step count** **Diet**	**Effect (+)** -self-management behavior -knowledge -social motivation -HbA1c -FBS

					counselling (10 weekly, 8 times) 8 weeks	**M&B:** using Diabetes SM smartphone app (Doctor Diary, Inc.): set diabetes SM goals, engaged in SMB such as self-measuring blood sugar, taking medication, following a diabetic diet, and exercising. Chat and community functions for communication between participants and researchers. During phone counselling, resolve difficulties with SMB, feedback based on the app records			-diet **Effect (-)** -personal motivation -behavior skills -BMI -daily step count
A3	Bakir; Turkey; 2021	RCT	Type 1 adolescents	Exp. N=25 Cont. n=25	IMB model-based intervention 8 home visits & 5 phone interviews (2 to 15 min) by nurses who attended motivational interviewing techniques course / In-person 12 weeks	**I:** Individual education in accordance with participants' requirements **Mp:** motivational interview with raising participants' awareness of their risky behaviors **Ms:** cooperating with diabetes team (physician, nurse, dietician) **B:** Individual education	**I:** Diabetes Information Evaluation Form **Mp:** Child Attitude toward Illness Scale **Ms:** Multidimensional Scale of Perceived Social Support **B:** DSES for adolescents with T1DM	**SMB**: HbA1c	**Effect (+)** -knowledge -personal motivation -social motivation -behavioral skills -HbA1c
A4	Yao; China; 2021	Pretest-posttest nonequivalent control group	Type 2	Exp. n=64 Cont. n=53	Routine nursing & medical treatment + Individual guidance	**I:** purposeful interviews, knowledge manuals, regular health knowledge lectures **M:** active communication, targeted guidance **B:** guidance and personal plan	None	**blood glucose level** **Psychological resilience:** Psychological Resilience	**Effect (+)** -blood glucose level -depression -psychological resilience

		design			2 months			Scale **QOL**: DM Quality of **Life Scale** **Depression:** SDS	-quality of life
A5	Jeon; Korea; 2019	Single-group pre- and post-intervention study	Type 1 & 2	T1DM: n=8 T2MD: n=30	Diabetes self-care app for 4 weeks /Technology-based 4 weeks	**I:** EBE, personalized recommendations **Mp:** self-reflective diary writing, recording DM self-care, goal setting **Ms:** sharing with other patients and communicate with health care providers **B:** feedback and visualizing blood glucose trends **SCB:** Glucometer interface	**I:** Diabetes Knowledge Test (DKT) **Mp:** DAS-3 **Ms:** DFBC-2 **B:** A part of D-SMART (20 items)	**SMB**: D-SMART (39 items) **GC:** pre- & post-prandial blood glucose levels by a glucometer	**Effect (+)** -self-care behaviors -social motivation **Effect (-)** -information -personal motivation -behavioral skills -blood glucose level
A6	Davis; USA; 2017	Single-group pre- and post-intervention study	Type 2	51 participants	Managing Your Diabetes Medicines (MYDM); 9 internet-based video modules; 3 calls to assess progress at 1, 4, 8 weeks after baseline visit/Technology-based 3 months	Not stated	**Belief:** Beliefs About Medications Questionnaire **Self-efficacy:** 19-item diabetes medication self-efficacy scale	**SMB:** Morisky's 8-item measure of self-reported medication adherence **Health literacy:** REALM **Depression:** PHQ-2	**Effect (+)** -diet -medication adherence, -exercise -beliefs about medications -self-efficacy **Effect (-)** -patient-reported problems or barriers in using diabetes medications
A7	Meunie; Canada; 2016	Single-group longitud	Type 2	295 patients	Patient education course/In-person	Not stated	**I:** RIPQ **M:** TSRQ **B:** DSES	**SMB:** SDSCA **Self-care**	**Effect (+)** -general diet -exercise

		inal study			12 months			**behaviors:** -general diet - exercise -blood glucose testing -medication adherence	-blood glucose testing -Information **Effect (-)** -medication adherence -motivation -behavioral skills
A8	Gavgan; Iran; 2010	RCT	Type 1	Exp. n=16 Cont. n=14	In-person	Not stated	None	**SMB:** SDSCA **GC:** HbA1c **Weight**	**Effect (+)** -SMB(Diet, Exercise) -HbA1c **Effect (-):** -weight
A9	Osborn; USA; 2010	RCT	Type 2 Puerto Rican	Exp. n=48 Cont. n=43	90min educational sessions / In-person 3 months	**I:** teaching by professionals **M:** motivational interviewing technique **B:** discussion, teaching by professionals, role playing	None	**SMB:** -food label	**Effect (+)** -food label reading -diet adherence, -HbA1C **Effect (-)** -physical activity

Appendix 4-1. Secondary analysis of self-management status in Bai T2DM patients

Table 1. Scores of Self-management Behavior and Six Dimensions in Bai T2DM Patients

(N = 198)

Variables	Average score (M±SD)
Total T2DM Self-management behavior	51.12±12.02
Ordinary diet	4.12±5.21
Special diet	4.48±2.46
Exercise	4.49±4.32
Blood glucose monitoring	4.62±4.12
Foot care	5.14±4.60
Medications	5.79±1.84

T2DM = Type 2 Diabetes Mellitus

Table 2. Factors Influencing Self-management Behavior in Bai T2DM Patients

(N = 198)

Variable	B	SE	β	t	p	95% CI
Self-efficacy	0.26	0.06	0.28	4.18	<.001	0.14~0.38
Competency in T2DM care skills (Yes)*	9.53	2.34	0.27	4.08	<.001	4.92~14.14
T2DM knowledge from peer communication (Never) †	-5.97	2.40	-0.16	-2.49	.014	-10.71~-1.23
R^2_{adj} = .22; F = 19.01; p < .001						

* Reference = No, † Reference = Frequently
CI = Confidence Interval, SE = Standard Error, T2DM = Type 2 Diabetes Mellitus

Appendix 4-2. Secondary analysis results and response in the program

No.	Items	Variables	Results	Response in the SMP program	
				Target	Intervention
1	Self-management behavior and each dimensions level	Self-management behavior - Ordinary diet - Special diet - Exercise - Blood-glucose monitoring - Foot care - Medications	- The overall self-management behavior at a low level. - The levels of each dimension from low to high are ordinary diet, special diet, exercise, blood-glucose testing, foot care, medications. - The self-management behavior level score of diet, exercise, blood glucose monitoring are below average.	- Focus on improving the behavioral level of diet, exercise, and blood glucose monitoring	- Strengthening diet, exercise, and blood glucose monitoring
2	Crucial factors influencing self-management behavior of Bai T2DM patients	- Self-efficacy - Competency in T2DM care skills (Yes) - T2DM knowledge from peer communication (Never)	- Self efficacy, having competence in T2DM care skills is significantly positively correlated with self-management level. - Never communicate about the T2DM knowledge with peer is significantly negatively correlated with self-management level	Self-management behavior can be improved through the following ways - Improving self-efficacy - Improving behavioral skills - Peer communication	- Promoting self-efficacy through the enhancement of information, motivation, and skills - Promoting and strengthening self-management skills and abilities - Promote peer communication (such as class discussion)

Appendix 5-1. General characteristics of focus group interview participants

No.	Gender	Age	Duration of T2DM (year)
1	Male	46	2
2	Female	61	15
3	Male	53	7
4	Female	65	10
5	Female	55	1
6	Male	49	11

Appendix 5-2. Focus group interview procedure

Process	Contents
Introduction	Thank you for your participation. Over the years, T2DM may have an important impact on your life. Have you effectively adhered to self-management activities in order to reduce adverse impacts? Next, we will discuss the questions related T2DM and self-management, please state your real thoughts on the questions.
Opening questions	How many years have you been diagnosed with T2DM?
Main questions	1. What are the impacts of T2DM on your personal life?
	2. How is your self-management activity going?
	3. What causes you to fail to do self-management activities?
	4. What factors can promote your motivation or confidence in self-management?
Conclusion	Thank you for your cooperation. Let me briefly summarize today's interview. If there are any supplements or suggestions, please let me know.

Appendix 5-3. Focus group interview results and response in the program

No.	Questions	Summary of answers	Response in the SMP program	
			Target	Intervention
1	What are the impacts of T2DM on your personal life?	- Diabetes brings discomfort to the body - Diabetes causes anxiety, including concerns about prognosis, complications, treatment methods, and lifestyle effects - The treatment of diabetes brings more troubles to life - Diabetes leads to complications that affect life and work	- Improve patients' emotional problems related to diabetes - Promote motivation for self-management by recognizing the negative impact of T2DM (physical, psychological, etc.)	- Improve cognition and awareness through T2DM knowledge education - Emphasize the negative impact of T2DM and make patients perceive the threat of the disease
2	How is your self-management activity going?	- Irregular testing of blood sugar, or test blood sugar when uncomfortable - Inability to control diet or lack knowledge of a reasonable diet - Replacing exercise with labor - No scientific exercise plan - Take medication at will or change the dosage yourself - Peer supervision can promote regular medication use	- Strengthen the shortcomings of T2DM self-management skills and comprehensively improve self-management behavior skills - Drawing on effective experience to promote behavioral activities	- Provide diverse information on T2DM self-management skills (lectures, manuals, videos, images, text materials, etc.) - Correcting common erroneous behaviors of patients through explanation - Demonstrating and experiencing T2DM self-management related skills to effectively improve specific skill levels (diet, blood

		- Lack of awareness and cognition of diabetic foot - Can actively adjust the psychological state, but can bring psychological stress when blood sugar rises - Adjusting psychological state through hobbies or social activities - Unable to effectively quit smoking and limit alcohol		glucose measurement, insulin injection, etc.) - Promoting behavioral activities through peer communication and discussion - Adjusting emotional states by encouraging patients' interests, hobbies, or socializing - Promoting Patients' Psychological Coping Ability through Knowledge Teaching
3	What causes you to fail to do self-management activities well?	- The pressure and trouble of injecting insulin and testing blood sugar - Avoidance behavior caused by fear of insulin injection - Cannot give up the pleasure brought by bad behavior - Lack of knowledge about diabetes	- Overcoming obstacles and enhancing self-management motivation, knowledge, and skills	- Comprehensive improvement of knowledge level through information provision - Reducing patients' psychological concerns about insulin injection and blood glucose measurement through encouragement and participation - Urge patients to improve risk behaviors through individual communication and intervention
4	What factors can promote your confidence or motivation in self-management?	- Having a positive psychological state - Able to acquire more knowledge - The need for health and improved quality of life - Family care and support	- Adjusting emotions to promote motivation - Promote motivation for self-management by emphasizing the adverse consequences of T2DM (such as the consequences of	- Education on complications related knowledge in T2DM, experience of complications related feelings, and enable patients to perceive the serious threat of the disease - Emphasize the family, personal

		- Fear of adverse consequences such as complications - Reduce the burden and losses on family	complications, family and personal burdens, and losses) - Motivation to promote self-management by understanding the benefits of good self-management behavior (improving health and quality of life) - Motivation to promote self-management by providing patients with more knowledge	burden and economic loss caused by diabetes, so that patients can perceive the threat of disease - Enhance self-management awareness through lectures and T2DM self-management handbook, recognize the benefits of good self-management behavior, and stimulate patients' confidence and interest - Enhancing patient confidence through self-management related knowledge and skills education

Appendix 6-1. The item-level content validity index (ICVI) of the intervention strategies

Elements		Contents *(tested items)*	CVI
Information		Learn the basic knowledge and treatment knowledge of T2DM	0.83
		Learn the basics of SM	1
		Learn the knowledge by T2DM self-management handbook	1
		Learn the knowledge by various types of learning materials	1
Motivation	Personal	Recognize the hazards of T2DM (complications, psychological impact, family and personal burdens, economic losses, etc.)	1
		Learn the SM knowledge to enhance self-management awareness and confidence	1
		Goals of behaviors and blood sugar control; and activities monitoring (by self-management diary)	0.83
	Social	Communicate with patients and get to know the patient's issues and provide individual guidance. (professionals)	1
		Communicate with patients and get to know the risk behaviors of patients. (professionals)	1
		Get to know the obstacles to patients changing their behavior, and persuade them to change their bad behavior. (professionals)	1
		Enable patients to recognize the benefits of self-management and encourage them to adhere to good long-term self-management. (professionals)	1
		Peer communication and experience sharing	1
Behavioral skills		Learn knowledge related to SM behavioral skills	1
		Learn the specific skills by demonstrate	1
		Participate in skill operation training and individual guidance	1
		Receive individual guidance through personal interviews	1

Appendix 6-2. The item-level content validity index (ICVI) of the contents of SMP program

Topics	Intervention contents *(tested items)*	CVI
1st week	**Group session (at the hospital)**	
Information Providing & Motivation enhancement	**<Providing Information on T2DM and SM>** -Introduce the background, purpose, and significance of the SMP program -Basic knowledge of T2DM self-management: importance, concepts, content, and requirements -Basic knowledge of T2DM (basic knowledge of diseases; scientific treatment of traditional Chinese and western medicine) -Distribute T2DM self-management handbook to patients, and put forward self-learning tasks	1
	<Improvement of motivation for SM behavior> -The prognosis and hazard of T2DM: acute and chronic complications, impact on psychology and emotions, burden on families and individuals, economic losses to families and society, etc. -T2DM complication experience -Class communication and discussion: the necessity of enhancing self-management behavior; setting personal goals	1
2nd week	**Group session (at the hospital)**	
Behavioral skills improvement	**<Theoretical knowledge education on SM skills>** -Management of scientific diet, reasonable exercise t, blood glucose monitoring, medication (oral medication and insulin), foot care, risk response t, psychological and emotional	1
	<Application of SM behavioral skills> -Application of scientific dietary management: examples of daily diet (based on the dietary characteristics of the Bai ethnic group) -Demonstration of home blood glucose testing and insulin injection skills -Guidance on SM diary and blood glucose testing records; distribute SM diaries to patients and propose tasks	1
	<SM behavioral skills practice> -Patients participate in skill training and receive individual guidance (blood glucose testing and insulin injection)	1
3rd week	**Phone call tailored intervention (at home)**	
Constructs strengthening	**Telephone interviews** **<Strengthening the Motivation of SM Behavior>** -Get to know the daily behavior of patients and analyze	0.83

	individual risk factors -Persuade patients to change their bad behavior and encourage them to engage in good self-management behaviors	
	Telephone guidance **<Strengthening skills in diet, exercise, and blood sugar testing>** -Get to know the patient's dietary and exercise management status; provide individual dietary and exercise guidance -Get to know the patient's blood glucose testing status; provide individual blood glucose testing guidance and encourage patients to undergo regular blood glucose testing	1
4th week	**Mobile based group intervention (at home)**	
Constructs strengthening	**<Strengthening SM knowledge and skills>** Through the WeChat app group -Provide learning materials on basic knowledge of T2DM, basic knowledge of daily management, blood glucose monitoring, medication, etc. -Encourage patients to engage in self-learning: through learning materials and T2DM self-management handbook	1
	<Strengthening the motivation of SM behavior> Through the WeChat app group -Submit task: Patient's recent self-management diary and blood glucose test records; Confirm the patient's self-management behavior status -Q&A: Patients raise questions about diet, exercise, blood glucose monitoring, and medication management through text; answer patients' questions, provide guidance and advice	1
5th week	**Mobile based group intervention (at home)**	
Constructs strengthening	**<Strengthening SM knowledge and skills>** Through the WeChat app group -Provide video learning materials on diabetes foot and foot care, related complications, etc. -Encourage patients to engage in self-learning: through learning materials and T2DM self-management handbook	1
	< **Strengthening the motivation of SM behavior** > Through the WeChat app group -Submit task: Patient's recent self-management diary and blood glucose test records; Confirm the patient's self-management behavior status -Q&A: Patients raise relevant questions about foot care, complication response, and psychological and emotional management through text; Answer patients' questions, provide guidance and advice	1

Appendix 6-3. The experts' comments for the intervention strategies

Commentator	Advantage	Comments	Revision
Nursing professors	- IMB model is very suitable for self-management of diabetes patients	1. Record self-management activities (self-management diary) that involve multiple factors of patient behavior. Can the patient implement them? 2. Item 1 of the information: The basic knowledge of T2DM should already include treatment knowledge. 3. Items 3 and 4 of information: provide patients with T2DM self-management manuals and multiple forms of learning materials, and consider avoiding excessive duplication of materials. 4. Item 1 of personal motivation: understanding the hazards of T2DM (complications, psychological impact, family and personal burden, economic loss, etc.), suggest to revise 'economic loss' to 'economic burden'. 5. Behavioral skills: Receive individual guidance through personal 'interviews', revised to 'communication' for more accurate guidance.	1. Design a simple and easy to complete self-management diary and distribute it to patients, simplify the recording method, and guide patients in recording methods. 2. The item is revised to 'Learn the Basic Knowledge of T2DM'. 3. The self-management handbook will be designed to be concise in content; the provision of mobile app based materials is mainly in the reinforcement stage, with video learning materials as the main supplement to group education and handbook knowledge. 4. The item is revised to 'read cognitive T2DM hazards (complications, emotions, social and family burden) '. 5. Revise the item to 'Receive individual guidance through personal communication'.

Clinical experts	- The method is targeted, practical, and emphasizes the principle of individualization, focusing on solving the learning and improvement of patient self-management skills. - The method has a certain degree of scientific and practical significance, with comprehensive and specific contents	1. The disadvantage is that there is no classification of patients, such as proposing different intervention strategies for people of different age groups or cultural levels.	1. Due to the difficulty in recruiting subjects, the inclusion criteria were set for patients aged 40 to 65, with no restrictions on educational level. Screening will be conducted with sufficient recruitment of patients, with inclusion criteria for patients aged 40 to 60 years old and below university education level (adjusted according to the actual recruitment situation)
professional nurses	- The intervention methods are very detailed and comprehensive		

Appendix 6-4. The experts' comments for contents of the SMP program

Commentator	Advantage	Comments	Revision
Nursing professors		1. In the knowledge education of T2DM, it should be clear what the basic knowledge specifically includes 2. In the intervention of behavioral skills, exercise management should focus on guiding the degree of exercise achieved and the safety measures during exercise	1. The item is revised as 'Overview of T2DM incidence, current situation of Bai ethnic group incidence, typical clinical manifestations, and scientific treatment methods of traditional Chinese and Western medicine' 2. The PowerPoint slides in the group session and handbook materials will be specific and emphasize the control of exercise intensity and precautions
Clinical experts	- Intervention methods have specific divisions and descriptions of self-management knowledge and skills in T2DM, with various forms that meet the clinical needs of patients and are highly practical - The intervention measures are relatively	1. How to evaluate the 'persuasion to change bad behavior' in the third 'tailored intervention'? Insufficient objectivity 2. The patient's participation is not sufficient. For the first time in the hospital, group members should introduce and get to know each other. Setting up a specialized course that allows patients to express themselves through personal experiences can have	1. Revise the item to 'After analyzing the patient's risk factors, inform the patient of the negative consequences of their current behavior to persuade them to change their bad behavior and encourage them to engage in good self-management behavior' 2. At the beginning of the classroom discussion, add a section for patients to introduce themselves to promote communication and exchange with them experience

	comprehensive, covering all aspects of health education	unexpected effects on mutual communication between patients.	
professional nurses	- The development of intervention methods is very specific and comprehensive	1. Providing learning materials for patients through WeChat apps, allowing them to submit tasks, and other measures. As some elderly patients do not know how to use mobile phones or specific operating methods, it is recommended to develop personalized plans	1. Add an item in the inclusion criteria for subject recruitment that states ‘patients can operate WeChat apps or family members can help patients use WeChat app’

Appendix 6-5. Intervention strategies based on constructs of IMB model

Elements	Methods		Strategies						
			Education	Self-learning	Goal setting	Verbal persuasion	Encoura-gement	Vicarious experience	Self-experience
Information	- Learn the basics knowledge of T2DM by lecture - Learn the basics knowledge of SM by lecture		✓						
	- Learn the knowledge by T2DM self-management handbook - Learn the knowledge by video materials			✓					
Motivation	Personal	- Recognize the hazards of T2DM (complications and consequences, physical and psychological burden on individuals and families, economic burden on families and society)	✓					✓	✓
		- Learn the SM knowledge to enhance SM awareness and confidence	✓	✓					
		- Goals of behaviors and blood sugar control; and activities monitoring (by self-management diary)			✓				

	Social	(professional) Through individual communication to find out - The patient's issues and provide guidance - The risk behaviors of patients - The obstacles to patients changing their behavior and persuade them to change their bad behavior	✓			✓	✓		
		- (professional) Enable patients to recognize the benefits of SM and encourage them to adhere to good long-term self-management - Peer communication and experience sharing					✓	✓	
Behavioral skills	- Learn the knowledge related to SM behavioral skills - Learn the specific skills by demonstrate of professionals - Participate in skill training and receive individual guidance - Receive individual guidance through personal communication		✓	✓					✓

SM = Self-Management, T2DM = Type 2 Diabetes Mellitus

Appendix 7-1. The lesson plan of the SMP program

1) The first time: promoting education on information and motivation

<table>
<tr><td colspan="5">Theme: Education on promoting self-management information and motivation</td></tr>
<tr><td colspan="3">Week: The 1st week</td><td colspan="2">Total time: 90 minutes</td></tr>
<tr><td colspan="3">Form: Group session</td><td colspan="2">Place: Hospital</td></tr>
<tr><td colspan="5">Goal: Promoting patients' basic knowledge of T2DM and self-management
Promoting patients' T2DM self-management awareness and motivation</td></tr>
<tr><td colspan="5">Preparation: PowerPoint teaching slides, T2DM self-management handbook, diabetes complications experience supplies</td></tr>
<tr><td rowspan="6">Process</td><td>Topic</td><td>Content</td><td>Time</td><td>Method</td></tr>
<tr><td rowspan="3">Provide information</td><td>-Education on basic knowledge of self-management in T2DM: concepts, importance, contents, and requirements
-Background, purpose, and significance of the SMP program</td><td>10</td><td>Teaching</td></tr>
<tr><td>Education on T2DM related knowledge
-Overview of the incidence of T2DM and the current situation of the Bai ethnic group
-Typical clinical manifestations
-Scientific Traditional Chinese and Western Medicine Treatment methods</td><td>20</td><td>Teaching</td></tr>
<tr><td>-Provide Bai ethnicity T2DM self-management handbook to patients and introduce the contents</td><td>5</td><td>Teaching</td></tr>
<tr><td rowspan="2">Promote personal motivation</td><td>The prognosis and hazard of T2DM
-Common acute and chronic complications and clinical manifestations of T2DM
-The impact of T2DM on patients' psychology and emotions, and the current situation of emotional problems associated with T2DM in the Bai ethnic group
-The psychological burden caused by T2DM on families, as well as the economic burden on families and society</td><td>30</td><td>Teaching</td></tr>
<tr><td>-Experience of T2DM complications: blurred vision in eye lesions, numbness in extremities in peripheral neuropathy, vascular lesions, kidney lesions, etc.</td><td>10</td><td>Patient Participate</td></tr>
<tr><td>Promote social motivation</td><td>Class communication
-Self introduction of group members
-The necessity of enhancing SM behavior in T2DM
-Exchanging of daily SM experience
-Personal goal setting (blood sugar control and SM)</td><td>15</td><td>Discussion</td></tr>
<tr><td colspan="5">Class communicational questions setting:
1) What are the benefits of good T2DM self-management behavior in your opinion?
2) What SM activities do you do well in your daily life? Can you share your experience?
3) What are the goals you will set for yourself in the coming month? For example, in terms of SM activities and blood sugar control.</td></tr>
</table>

2) The second time: promoting education on behavioral skills

<table>
<tr><td colspan="5">Theme: Education on promoting self-management behavioral skills in T2DM patients</td></tr>
<tr><td colspan="3">Week: The 2nd week</td><td colspan="2">Total time: 90 minutes</td></tr>
<tr><td colspan="3">Form: Group session</td><td colspan="2">Place: Hospital</td></tr>
<tr><td colspan="5">Goal: Promoting patients' self-management skills in T2DM diet, exercise, blood glucose monitoring, medication, and foot care.
Promoting emotional management skills in T2DM patients.
Promoting patients' skills in coping with T2DM complications related risks.</td></tr>
<tr><td colspan="5">Preparation: PowerPoint teaching slides, simulated food models, rapid response blood glucose meter and test paper, 5th Novo Nordisk pen, needle, and insulin, other types of insulin pens, and T2DM self-management diary</td></tr>
<tr><td rowspan="5">Process</td><td>Topic</td><td>Content</td><td>Time</td><td>Method</td></tr>
<tr><td>Promoting knowledge related to behavioral skills</td><td>-Scientific dietary management
-Reasonable exercise management
-Correct blood glucose monitoring and management
-Correct medication management (oral medication and insulin)
-Foot care management
-Emotional management
-T2DM complication risk response management</td><td>40</td><td>Teaching</td></tr>
<tr><td rowspan="3">Promoting behavioral skills and operational abilities</td><td>-Scientific application of dietary management (based on the dietary characteristics of the Bai ethnic group)
-Example of a day's diet
-Applying food simulation models to distinguish dietary nutrients and learn dietary matching</td><td>10</td><td>- Teaching
- Skill demonstration
- Patient participation</td></tr>
<tr><td>Specific Skills Practice
-Demonstration of blood glucose testing and insulin injection skills
-Skill training on blood glucose testing and insulin injection for patients
-Provide individual guidance on patient operations</td><td>30</td><td>- Skill demonstration
- Patient participation</td></tr>
<tr><td>-Provide patients with a rapid response blood glucose meter and SM diary
-Writing methods for guiding patients to SM diaries (SM activities and blood glucose test records)
-Propose follow-up tasks: blood glucose testing and SM diary</td><td>10</td><td>- Teaching
- Patient participation</td></tr>
<tr><td colspan="5">Self-recording task settings:
1) Determine the frequency of weekly blood glucose monitoring and the timing of daily blood glucose testing based on one's blood glucose level (HAb1c) and medication use.
2) Activities' monitoring: fill out daily SM activity records and record blood sugar test values.</td></tr>
</table>

3) The third time: tailored intervention to strengthen motivation and behavioral skills

<table>
<tr><td colspan="5">Theme: Individual guidance on strengthening self-management motivation and dietary, exercise, and blood glucose testing skills</td></tr>
<tr><td colspan="3">Week: The 3rd week</td><td colspan="2">Total time: 15 minutes</td></tr>
<tr><td colspan="3">Form: Tailored intervention</td><td colspan="2">Place: Home</td></tr>
<tr><td colspan="5">Goal: Strengthen patients' motivation for SM in T2DM
Strengthen patients' self-management skills in diet, exercise, and blood sugar testing
Focus on improving SM skills in diet, exercise, and blood sugar testing</td></tr>
<tr><td colspan="5">Preparation: Participants’ basic information</td></tr>
<tr><td rowspan="3">Process</td><td>Topic</td><td>Content</td><td>Time</td><td>Method</td></tr>
<tr><td>Strengthening motivation</td><td>-Get to know the daily behavior of patients and evaluate risk factors
-Analyze and inform patients of the negative consequences of current risk behaviors
-Persuade patients to change their bad behavior and encourage them to engage in good SM behaviors</td><td>5</td><td>Communi cation</td></tr>
<tr><td>Strengthening skills</td><td>-Get to know the patient's dietary and exercise management status; Provide individual dietary and exercise guidance
-Knowing the patient's blood sugar testing status; Provide individual blood glucose testing guidance and encourage patients to undergo regular blood glucose testing</td><td>10</td><td>Guidance</td></tr>
<tr><td colspan="5">Phone call methods and questions settings:

Hello! I am *** of the SMP program for Bai ethnicity type 2 diabetes patients
I would like to know about your recent diabetes self-management situation.
Part 1:
1) Do you have anything you don't want to implement in your self-management activities?
2) Is there any activates that difficult to implement?
3) Are you continuing bad behaviors, such as smoking or drinking too much?
Part 2:
1) How about the implementation of diet and exercise plan? Is there any knowledge you can't understand? Are there any difficulties?
2) Did you check your feet after exercises?
3) Did you carry candies or biscuits when you go out and exercise?
4) How about your blood glucose control in the last week? Did you adhere to the blood glucose test that is suitable for you? Do you have any unclear knowledge on your blood glucose control objectives and test methods? Please test and record blood sugar regularly!
Part 3:
Hope you can adhere to the SM activities for a long time and control your blood sugar through personal efforts.</td></tr>
</table>

4) The fourth time: group intervention to strengthen motivation and behavior skills

<table>
<tr><td colspan="6">Theme: Group intervention to strengthen the motivation and behavior skills</td></tr>
<tr><td colspan="4">Week: The 4th week</td><td colspan="2">Total time: 40 min</td></tr>
<tr><td colspan="4">Form: Group intervention based on WeChat app</td><td colspan="2">Place: Home</td></tr>
<tr><td colspan="6">Goal: Strengthening patients' T2DM related knowledge; diet, exercise, and blood glucose monitoring and medication skills.
Strengthening patients' motivation.</td></tr>
<tr><td colspan="6">Preparation: Video learning materials, T2DM self-management handbook</td></tr>
<tr><td rowspan="3">Process</td><td>Topic</td><td colspan="2">Content</td><td>Time</td><td>Method</td></tr>
<tr><td>Strengthening knowledge and skills</td><td colspan="2">-Provides video materials through WeChat group (basic knowledge of T2DM, basic knowledge of daily self-management, blood glucose monitoring and medication), and encourage patients to watch and learn
-Encourage patients to learn diet, exercise, blood glucose testing and medication knowledge (through the T2DM self-management handbook)</td><td>25</td><td>Guidance</td></tr>
<tr><td rowspan="2">Strengthening motivation</td><td>Social</td><td>Q&A
-Patients ask questions in diet, exercise, blood glucose testing and medication SM in the form of text messages
-Answer patient's questions and give guidance and advice</td><td>10</td><td>- Communication
- Guidance</td></tr>
<tr><td>Personal</td><td>Submit task
-Guide patients to submit SM diaries and blood glucose test records in the past week in the form of photos to confirm the recent SM behavior of patients</td><td>5</td><td>Guidance</td></tr>
<tr><td colspan="6">Questions setting:
2) Did you have any difficulty in recent SM activities of diet, exercise, blood glucose monitoring and medication?
3) Is there any knowledge you can't understand? Please send it in text and we will answer you.</td></tr>
</table>

5) The fifth time: group intervention to strengthen motivation and behavior skills

<table>
<tr><td colspan="6">Theme: Group intervention to strengthen the motivation and behavior skills</td></tr>
<tr><td colspan="5">Week: The 5th week</td><td>Total time: 40 min</td></tr>
<tr><td colspan="5">Form: Group intervention based on WeChat app</td><td>Place: Home</td></tr>
<tr><td colspan="6">Goal: Strengthening the foot care, emotion management, complication risk coping skills.
Strengthening patients' motivation.</td></tr>
<tr><td colspan="6">Preparation: SM video learning materials, T2DM self-management handbook</td></tr>
<tr><td rowspan="4">Process</td><td>Topic</td><td colspan="2">Content</td><td>Time</td><td>Method</td></tr>
<tr><td>Strengthening knowledge and skills</td><td colspan="2">-Provides video materials through WeChat group (Knowledge of diabetic foot and foot care and other complications), and encourage patients to watch and learn
- Encourage patients to learn about foot care, emotion management and complication risk management (through the T2DM self-management handbook)</td><td>25</td><td>Guidance</td></tr>
<tr><td rowspan="2">Strengthening motivation</td><td>Social</td><td>Q&A
-Patients ask questions in foot care, emotion and complication prevention in the form of text messages
-Answer patient's questions and give guidance and advice</td><td>10</td><td>- Communication
- Guidance</td></tr>
<tr><td>Personal</td><td>Submit task
-Guide patients to submit SM diaries and blood glucose test records in the past week in the form of photos to confirm the recent SM behavior of patients</td><td>5</td><td>Guidance</td></tr>
<tr><td colspan="6">Questions setting:
1) Did you have any difficulty in recent SM activities of foot care, emotion and complication prevention?
2) Is there any knowledge you can't understand? Please send it in text and we will answer you.</td></tr>
</table>

Appendix 7-2. The experts' comments for PowerPoint teaching slides

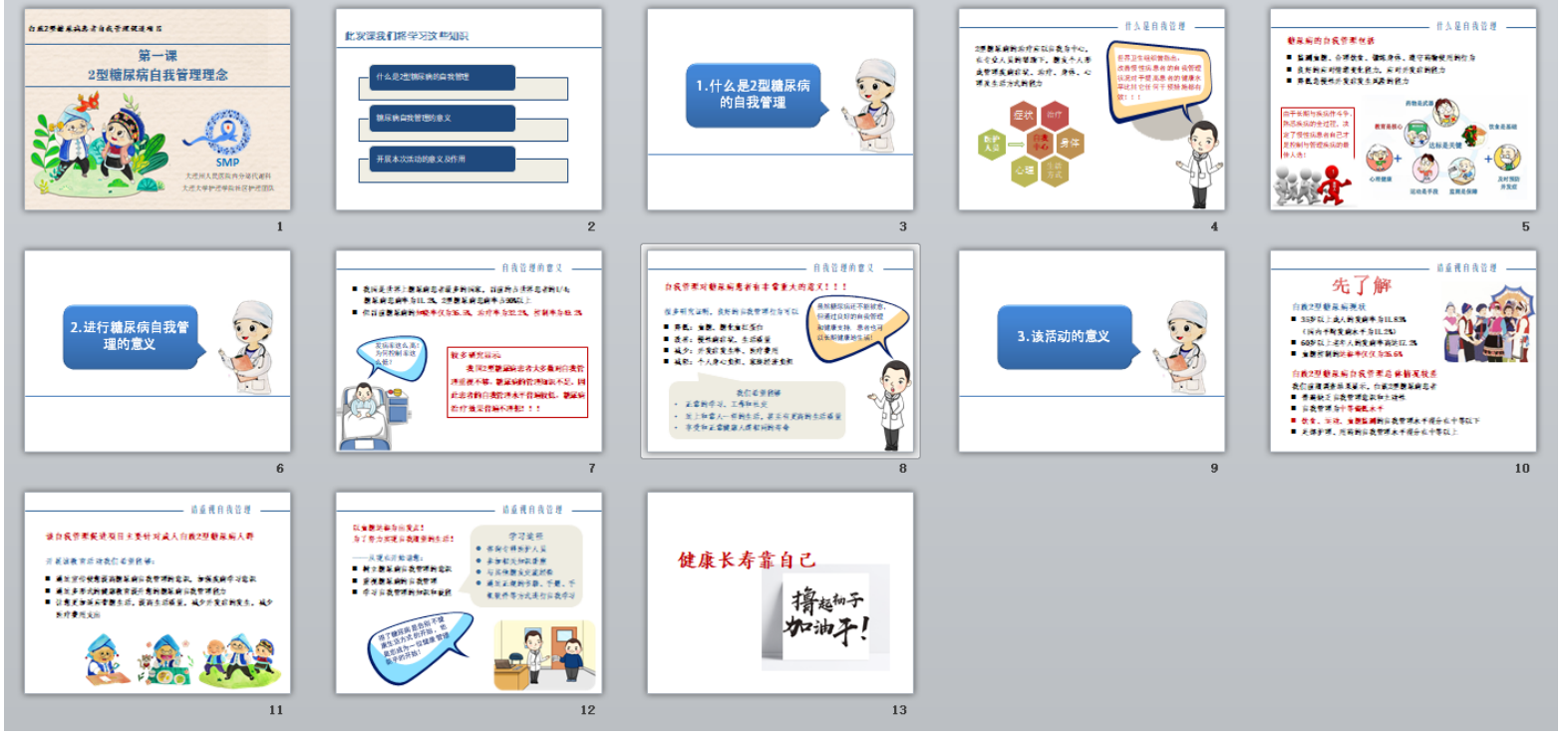
Comments	Revision
1. The first part of the first section is about 'Scientific Treatment of Traditional Chinese and Western Medicine'. Traditional Chinese medicine treatment is too complex and numerous, which is not conducive to patients' learning and understanding. 2. In the first part of the first section of the first section, 'five carriages' for diabetes treatment in diabetes only made a general simple statement, and each content should be simply supplemented, so that patients can have a further understanding of scientific treatment methods. 3. In the second section, only key points need to be provided in the theoretical teaching of blood glucose detection and insulin injection skills, and the content needs to be further specified in the operation demonstration and patient training, which is more conducive to the patient's understanding and memory.	1. Simplify the content of traditional Chinese medicine treatment for diabetes, so that patients can understand the current scientific basic methods of traditional Chinese medicine/Bai ethnicity medicine auxiliary treatment, and learn to judge the false advertising of traditional Chinese medicine treatment, so as to follow the scientific T2DM treatment and management methods. 2. Improved the content of each method in Western medicine treatment. 3. Simplified the theoretical teaching content of blood glucose testing and insulin injection skills, with a focus on highlighting precautions.

Appendix 7-3. The experts' comments for T2DM self-management handbook

Advantage	Comments	Revision
- The content revolves around the key points of self-management and is very complete. - It is illustrated and easy to understand, and incorporates scanning QR codes to watch videos, making it very interesting. Patients with different levels of education are easy to understand. - Combining the cultural characteristics of Bai patients, such as diet, exercise, and emotional management.	1. There is a lack of guidance on insulin use in drug self-management, and many patients have doubts about the injection time, which is also a problem that patients who use insulin are prone to making mistakes. 2. Some data should be based on the 'Chinese Guidelines for the Prevention and Treatment of Type 2 diabetes (2020)': - The formula for calculating the maximum pulse rate during exercise. - The blood pressure control target for T2DM patients is not 140/80mmHg - Guidelines add oral drug SGLT2 inhibitors.	1. This content has been supplemented in the 'Self-management of medication' section. Insulin was classified and summarized, and drug names and injection times were marked to facilitate patients to recognize the insulin they injected and compare it with the correct injection time. 2. Reviewed the Guidelines and revised the corresponding contents - Revised the maximum pulse rate during exercise to 170 minus age. - Revised the daily blood pressure control target for T2DM patients to 130/80 mmHg. - Added content related to oral drug SGLT2 inhibitors to the content of 'medication self-management'.

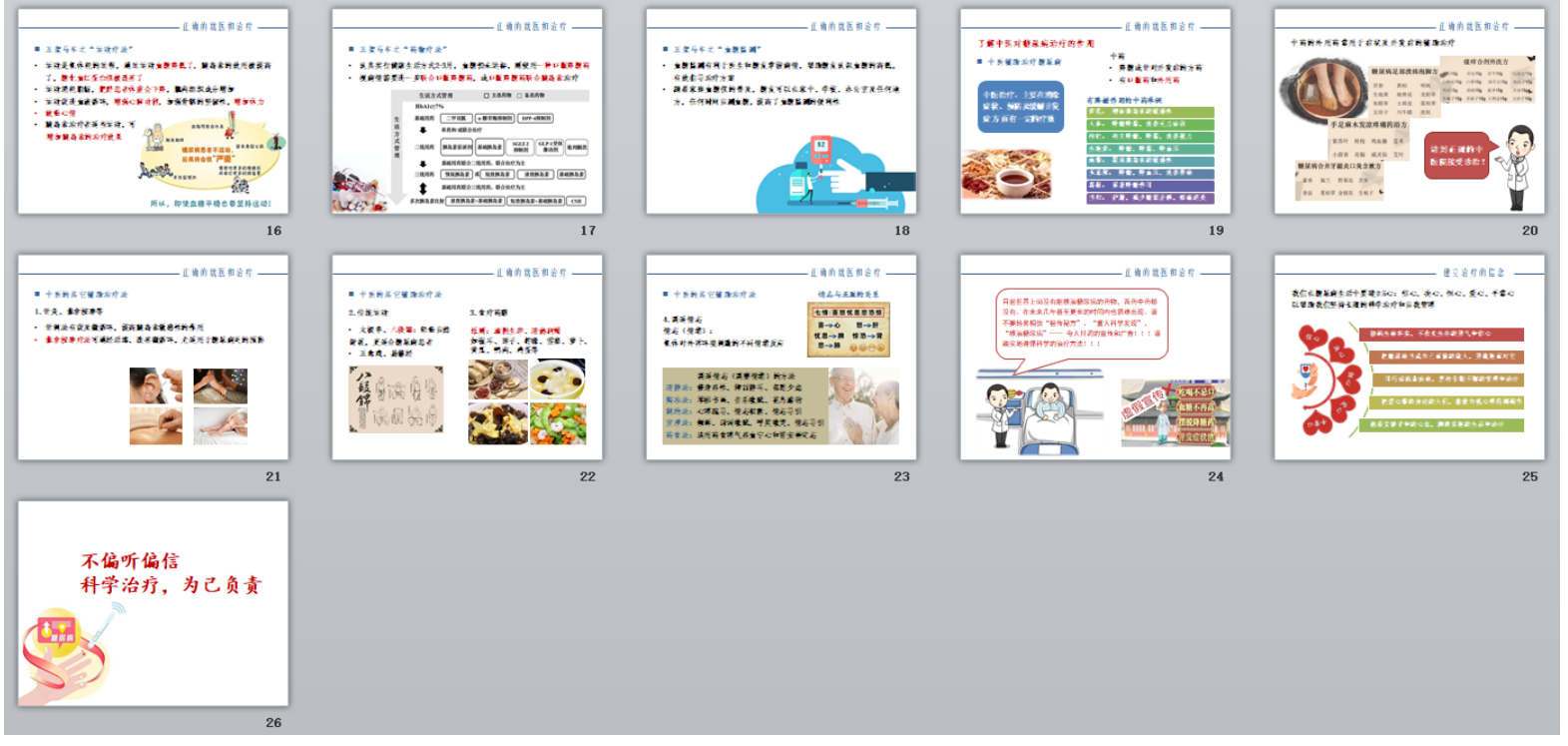
Appendix 7-4. The PowerPoint teaching slides

1) The first group session 1: Self-management awareness of T2DM

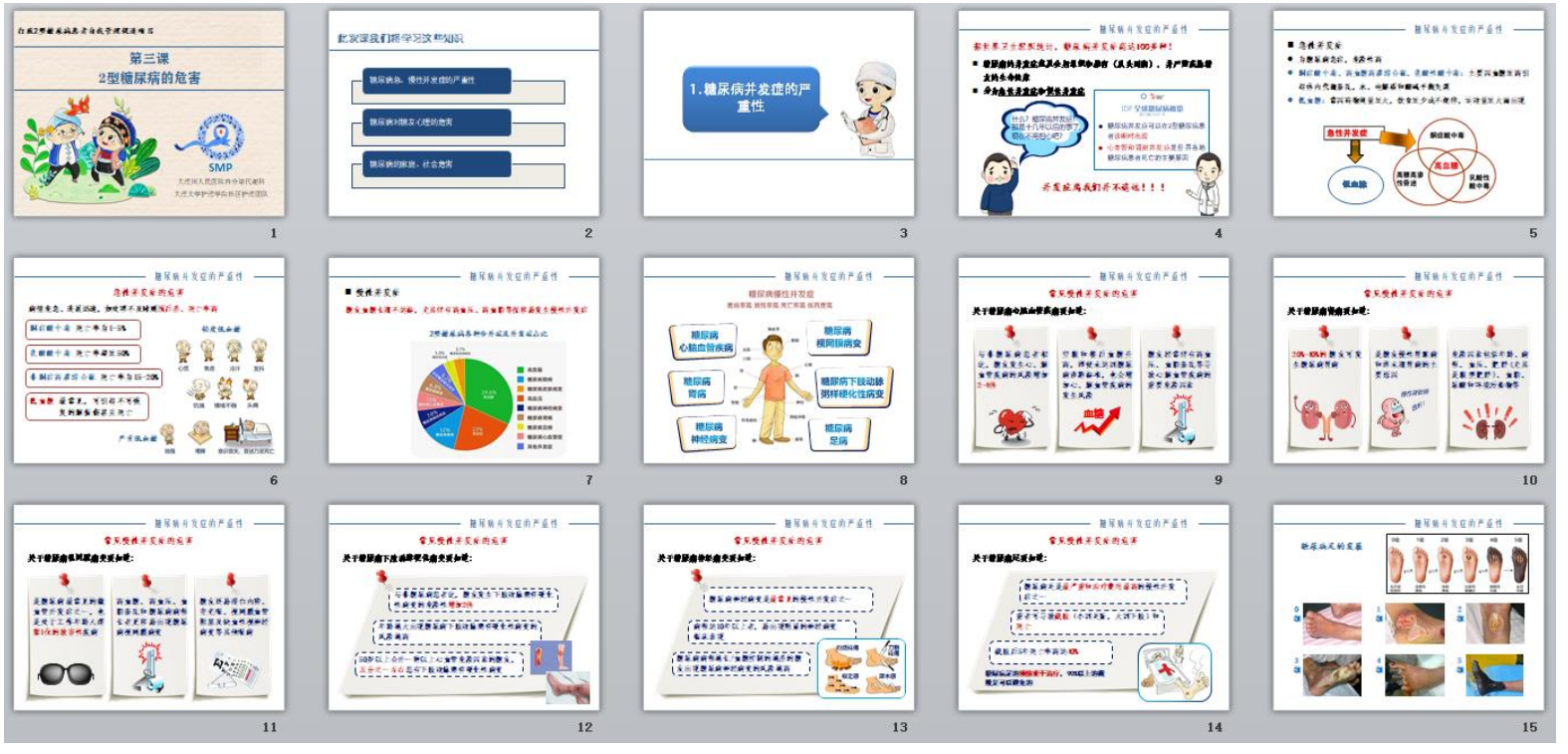


2) The first group session 2: Basic knowledge of T2DM

2) The first group session 2 (continued)



3) The first group session 3: Hazards of T2DM



3) The first group session 3 (continued)

4) The second group session 1: Self-management behavioral skills for T2DM

4) The second group session 1 (continued)

5) The second group session 2: Self-management behavioral skills for T2DM

5) The second group session 2 (continued)

5) The second group session 2 (continued)

Appendix 7-5. The T2DM self-management handbook

目 录

控糖之路漫长 做好自我管理

第一篇
“血糖监测”的自我管理

血糖监测极其重要

血糖监测是糖尿病自我管理的基础，规律监测血糖可以帮助我们

- 实时了解血糖水平，及时发现高血糖或低血糖
- 指导饮食运动等行为方式，优化药物治疗方案
- 帮助血糖达标，预防和延缓并发症的发生发展
- 提高疾病管理能力，改善生活质量，保持健康

坚持自我监测可降低微血管和大血管事件及死亡率

血糖监测其实不难

应同时注意其它的检查指标：
血压，血脂，体重，尿常规，尿白蛋白，眼底，肝肾功能，心电图，神经等。

重点关注以下血糖指标！

指 标	良好的标准		意 义	测 定
	一般成人	老年患者		
空腹血糖（晨起空腹，8-10 小时未进食）	4.4-6.1 毫摩/升	4.4-7.0 毫摩/升	反映基础胰岛素分泌功能	主要：家中快速血糖测定 其次：医院随诊
餐后 2 小时血糖（第一口饭开始计时）	小于 8.0 毫摩/升	小于 10.0 毫摩/升	胰岛β细胞储备功能重要指标	同上
随机血糖	小于 11.1 毫摩/升	小于 11.1 毫摩/升	反映特殊情况血糖值（低血糖，剧烈运动，劳累，生病，饮酒，多吃或少吃，情绪变化）	同上
糖化血红蛋白（HbA1c）	小于 6.5%	小于 7.0%	评估长期血糖控制的金标准（过去 2-3 个月的平均血糖浓度）	医院回访： -治疗初期 2-3 个月一次 -达标后 3-6 个月一次

让我们掌握好自我检测血糖的方法吧

一天当中什么时候测血糖，一周测血糖几天

一日多时点测血糖能更准确的反映血糖变化情况，是理想的血糖自我监测方式。

血糖状况	早餐前空腹	早餐后2小时	午餐前	午餐后2小时	晚餐前	晚餐后2小时	睡前	夜间3点	随机	频率 每周1-2天	频率 每周3-4天
使用胰岛素血糖未达标	✓	✓	✓	✓	✓	✓	✓				✓
使用胰岛素血糖达标	✓		✓		✓		✓			✓	
非胰岛素血糖未达标	✓	✓	✓	✓	✓	✓					✓
非胰岛素血糖达标	✓	✓		✓		✓				✓	
低血糖发作									✓		
怀疑夜间低血糖							✓	✓			✓

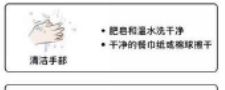
如何使用血糖仪

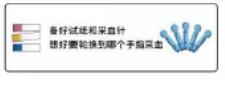
血糖自测的方法

（微信扫码观看视频）

测量血糖需要注意什么

测量前的准备





测量中的注意事项

-在指尖两侧采血疼痛轻，且血量足。
-采血部位要轮换，以防瘢痕形成。

-血糖试纸不是通用的，应核对血糖仪和试纸型号是否配对。
-试纸应放在干燥环境保存。

为何要坚持写血糖监测日记

进行规范的血糖记录，有助于

- 记录血糖动态，整理出现的问题
- 就诊时为治疗方案的调整提供依据

血糖日记这样写

日期	早餐前	早餐后	午餐前	午餐后	晚餐前	晚餐后	睡前	备注
4.10		7		7		16	9	晚上外出吃饭
4.14		9	2	14		9	5	早餐后打羽毛球
4.18	9	11	11	15	9	14		感冒发烧了
4.20	5	5		8		7	5	
4.26				7	3	12		下午忘记加餐

第二篇
“饮食”的自我管理

科学饮食益处多

合理饮食计划遵循健康饮食“标签”

01 控制热量，合理结构

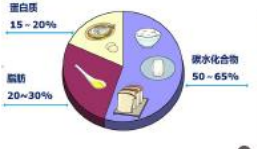
02 均衡营养，清淡少油

03 少食多餐，定时定量

04 满足喜好，戒烟限酒

饮食调节≠放弃喜爱的食物
控制病情+享受营养的美食

每日所需三大营养素如何均衡？



谷薯类 – 主要含碳水化合物，是每日能量的主要来源
肉蛋奶豆类 – 每日蛋白质的主要来源
动植物油 – 每日脂肪的主要来源
水果蔬菜 – 多水分低热量，补充每日所需维生素、矿物质、膳食纤维

合理的膳食结构是什么？

中国营养学会“中国居民膳食宝塔”提供了合理膳食结构的建议

让我们学习简易的糖尿病饮食方法吧

常食用的谷薯类有哪些？

谷类		薯类	
食物	每日摄入	食物	每日摄入
杂粮、米饭、米线、饵丝、饵块、粑粑、面条、馒头、花卷	250–400 克	土豆、红薯、芋头、山药	50–100 克

手掌法则

“手掌法则”是用手掌能够把握的量来衡量饮食量。虽然糖尿病患者的饮食具有一定的个体差异，但“手掌法则”可以作为实用的饮食参考指标，并依据个人身体情况、活动强度稍做增减。

主食应粗细搭配，“不吃或少吃主食可以更好地控制血糖”是错误的看法！

常食用的肉类有哪些？

选 择		少吃或不吃
种 类	每日摄入	
多吃白肉少吃红肉 低脂肪、低胆固醇 鱼、鸡、鸭、鹅、鸡蛋、瘦肉	水产类：40~75 克 畜禽肉类：40~75 克 蛋类：40~50g 克 平均总量 120~200g 克	火腿、腊肉、香肠、猪肝脏、牛干巴 内脏、猪蹄、蒸肉、红烧肉

建议：每日摄入一定量大豆制品，如豆浆、豆腐、豆干
每日喝奶 300 毫升，以新鲜牛奶或酸奶作为加餐

手掌法则

-火腿、腊肉、香肠、猪肝脏、牛干巴：高盐腌制食品，会间接导致血糖升高及加重疾病，尤其合并高血压的患者不宜食用。

-猪蹄、蒸肉、红烧肉：大多是肥肉，为高脂食品，不利于体重控制，尤其影响肥胖患者的血糖波动。

-煮鱼、肉也应少放盐。

建议食用的蔬菜有哪些？

种 类	次 数	每日摄入	少吃或不吃
餐餐有蔬菜 每日 5 种以上 -绿叶蔬菜（占一半量） -瓜果类 -菌类	三餐	300~500 克	腌菜、咸菜、豆腐乳

手掌法则

-菌类：鸡纵、香菇、木耳、灰树花等安全的菌类对血糖有较好的调节作用，且热量低。

-腌菜、咸菜、腐乳：同样是高盐腌制食品，尽量少吃或不吃。

怎么合理的摄入油脂？

建 议		不建议
不饱和脂肪酸类	每日摄入	饱和脂肪酸类
植物油（更换食用）： 菜籽油、玉米油、橄榄油、花生油、芝麻油	25~30 克	动物油： 猪油、牛油、鸡油

手掌法则

拇指第一指节体积大的油量（动/植物油）

坚果类：属于高油脂食物，每日可进食 10 克左右，包含在油脂摄入总量里。

葵花子、瓜子、花生、腰果、核桃、板栗、松子、杏仁、开心果、夏威夷果。

糖尿病能吃水果吗？

吃水果的时机	吃水果的时间	忌	种 类		
			适量食用 每 100 克含糖小于 10 克	谨慎食用 每 100 克含糖 11~20 克	不宜食用 每 100 克含糖大于 20 克
血糖控制较理想及病情稳定： 空腹血糖＜7.0 毫摩/升 餐后血糖＜10.0 毫摩/升 糖化血红蛋白＜7.5%	作为加餐 正餐之间： 上午 10 点 下午 3 点	餐前或餐后立即吃水果	番茄、草莓、柠檬、枇杷、李子、西瓜、青梅、柚子、猕猴桃	苹果、鸭梨、桃子、杏子、橘子、菠萝、樱桃、芒果、荔枝、葡萄、蓝莓、哈密瓜	山楂、鲜枣、香蕉、火龙果、椰子、百香果 话梅、果脯、干枣、桂圆干

手掌法则

这些情况要注意

吸烟对糖尿病的危害
（微信扫码观看视频）

少盐	限酒			戒烟	推荐
	啤酒	葡萄酒	白酒		茶饮/药饮
每日不超过6克 1啶酒瓶盖盐 ≈6克	350毫升 ≈15克酒精	150毫升 ≈15克酒精	45毫升 ≈15克酒精		绿茶、红茶、黑茶、普洱茶 具有降糖效果的药物：枸杞、西洋参、黄芪、玉米须、桔梗、罗汉果、栀子、玉竹、乌梅、荷叶、桑叶、葛根、马齿苋、茯苓、黄精、当归
同时限制腌肉、咸菜、酱、豆腐乳、酱油、味精等摄入； 可用醋、胡椒、花椒等香料提味。	饮酒量： 女性不超过15克/天，男性不超过25克/天； 每周不超过2次。 注意： 酒精可能诱发低血糖，避免空腹饮酒。			吸烟： 导致血脂异常；损伤血管内膜从而增加血管并发症的危险（如糖尿病足）。	具有一定的稳糖、降糖、调糖、提高糖耐量、促进胰岛素分泌、增加胰岛素敏感性等作用。 注意： 喝淡茶水；空腹不喝茶；晚间不喝茶；不用茶水服药。

饮食技巧学一学

烹调方法

推荐

蒸、炖、煮、煲、凉拌
特点：营养成分损失少，不增加脂肪，易消化，清淡爽口

不推荐

炸、煎、红烧
特点：破坏蛋白质和维生素，高热量，致癌

进食顺序

1 喝汤
餐前先喝汤，可提高饱腹感

2 吃蔬菜
其次吃蔬菜，蔬菜富含膳食纤维，可增加饱腹感，有助减少主食的摄入

3 吃豆类和肉
接着吃豆类和肉，可保证优质蛋白的充分摄入

4 吃主食
最后吃主食，粗细搭配；干食为主，少吃饵丝、米线、粥等流食

调整合适的进食顺序可延长碳水化合物的消化和吸收时间，减缓餐后血糖的升高速度和幅度。

第三篇
“运动”的自我管理

运动有强大的降糖效果

谨记不适合运动的情况

1. 急性并发症时（严重感染，酮症酸中毒，低血糖等）。
2. 严重并发症时（严重的糖尿病足，肾病，神经病变，冠心病等）。
3. 老年糖尿病患者伴有各种严重身体疾病。
4. 腹泻、呕吐或禁食期间。
5. 血糖控制不佳，病情不稳定者，容易发生低血糖者。

适量运动有什么好处

运动方式可以个性化

每位患者的年龄、性别、体质、生活方式不同，运动应因人而异，因时因地制宜，选择自己容易坚持下去的运动方式最重要！

不常运动者	经常运动者	运动类型	
		首选	其它
利用 1-2 个月进行调整： 5-10 分钟 运动要简单；运动量少些 ⇩ 30-40 分钟 逐步增加强度	根据喜好选择运动方式； 运动强度合理	有氧运动： 运动强度稍小 保证充分呼吸 全身肌肉活动 时间持续较长	力量运动（腹肌锻炼、俯卧撑、哑铃等）： 增肌减脂 配合有氧运动 拉伸运动： 随处可做 有氧运动前热身
每日持续运动时间：累计不少于 30 分钟；运动频次：每周 3-5 天			

定期评估，适时调整运动计划！

运动方式不是最重要的，关键是自己所喜欢的运动并做到

一一 循序渐进 量力而行 持之以恒

看看什么运动适合您吧

有氧运动有哪些

分类	举例	持续时间	消耗热量
最低强度运动	散步、园艺、钓鱼、家务	30 分钟	90 千卡
低强度运动	舞蹈、慢骑自行车	20 分钟	
中强度运动	划船、骑马、爬山（爬楼梯）、慢跑、太极拳、羽毛球	10 分钟	
高强度运动	游泳、篮球、足球	5 分钟	

"有氧运动"

在氧气充足的情况下进行的可使人体微出汗的运动，可促进糖代谢，促使体内碳水化合物和脂肪分解较完全。

常做的有氧运动如何进行

散 步

有效降低血糖，同时放松身心

步速：
微微出汗，呼吸略微急促，说话自如为宜
持续时间：
每次 30 分钟，每天 1 次，每周至少 5 次
适宜人群：
适合老年患者或体质较差的糖尿病患者

跳 舞

在运动的同时加入音乐元素，让人心情愉悦

持续时间：
每次 20 分钟
适宜人群：
老少皆宜
种类：
交谊舞/广场舞/霸王鞭或其它白族舞蹈

常做的有氧运动如何进行

八段锦 / 太极拳

宜于提高糖尿病患者的免疫功能，降低胰岛素抵抗，有效降低血糖

锻炼时间：
早晚各两遍，或早中晚各一遍，时隔不超过 3 天
适宜人群：
推荐简单易学的八段锦；
太极拳体质弱者可做半套或练习几个基本动作，体质较好者可做全套

八段锦教程

（微信扫码观看视频）

慢 跑

消耗热量，控制体重，促进心肺功能，保护心血管系统

持续时间：
20 分钟左右，每天 1 次，每周 3-4 次
适宜人群：
较年轻、身体条件好、无心血管疾病且有一定锻炼基础的糖尿病患者
注意事项：
慢跑前应做充分的热身运动

常做的有氧运动如何进行？

爬 山

促进血液循环，增强新陈代谢，增加胰岛素敏感性

特点：
耗氧量较大，应根据病情尝试，控制好时间和路程，途中适当休息
注意事项：
当运动量较大或持续时间较长时，适量加餐；
应有伙伴或家人同行；
骨关节病患者不宜选择爬山

游 泳

增强各器官和系统功能，改善胰岛素抵抗，保护膝关节，控糖减脂

锻炼次数：
每周不超过 2 次
适宜人群：
体质较好的各年龄段糖尿病患者
注意事项：
-游泳前温水擦身适应水温
-做好充分的拉伸运动

游泳是高强度运动，且环境具有危险性，易导致意外发生。
-尤其应避免低血糖反应的发生：餐后 0.5~1 小时才能游泳；酒后不宜游泳。
-根据脉搏次数判断运动量，即游泳后脉搏率为：
轻壮年 120~140 次/分
中年 90~100 次/分
老年 70~80 次/分

运动强度如何把握？

运动强度依据：脉搏次数（脉搏率）

运动强度上限（脉搏次数）= 170 - 自己的年龄
合适的运动强度（脉搏次数）=（220-年龄）×0.6 ~（220-年龄）×0.7

请参考

年龄	不常运动者	经常运动者
20~39 岁	110 次左右	120~125 次
40~59 岁	100 次左右	110~115 次
60~69 岁	90 次左右	100 次左右
70 岁以上	根据自身情况，做一些简单、平静的运动（如：散步、太极拳）	

通过手动或电子设备测量脉搏

注意事项要牢记

运动前的 2 准备		运动时的 3 携带		
适量准备活动	服装准备	糖果饼干等	糖尿病患者卡	其它用品
目的：提高心血管系统的适应性；避免肌肉韧带的拉伤。 方式：伸展运动、踢腿、慢走。 时间：5-10 分钟。	服装：根据季节、气候、运动方式选择舒适的服装。 鞋：合脚的运动鞋，无挤压感，鞋底可减震。 袜：纯棉松口袜，易吸汗，不勒腿。	目的：预防低血糖（运动前进餐少并注射了胰岛素，由于运动比静止消耗更多热量，易发生低血糖反应）。 食用：当出现头晕时可立即食用糖果、饼干或巧克力；口服白糖或葡萄糖。	目的：（可根据自己情况制作）意外情况下可得到旁人的帮助并脱离危险。 我有糖尿病 如果您发现我有异常不清话行为异常的情况，可能是低血糖发作。请尽快送我到医院抢救，同时请告诉我的地址和电话通知紧急联系人。 感谢您的帮助！ 正反面 姓名：_____ 出点医院：_____ 家庭住址：_____ 紧急联系人：_____ 联系电话：_____	必备用品：水、毛巾。 慢跑或快走时：携带计步器、或使用手机计步功能。 其它：运动智能手环。

运动后的 4 注意			
做好放松运动	做好血糖监测	不要马上洗澡	不要马上进食
目的：促进血液回流，消除疲劳，预防肢体淤血、晕厥、乏力、恶心、心律失常等。 方式：不要突然停止运动，主要运动完成后继续做放松运动（如：踏步、慢走、踢腿、按摩）。 时间：5-10 分钟。	目的：了解运动对血糖的影响，对用药的调整及血糖稳定有很大意义。 其它：监测运动后的食欲睡眠等。 如出现异常状况应停止运动并接受医生的专业指导	原因：导致毛孔迅速收缩和关闭，阻碍体内热量散发。 方法：运动后用毛巾擦干汗，呼吸心跳恢复正常后洗澡。 注意：洗澡水温不宜过高或过低，以免发生头晕恶心。	餐后不宜立即运动，运动后不宜立即进食 原因：加重消化器官负担，引起消化功能失常。 方法：运动后 30-60 分钟再进食。

切忌空腹运动

避免进餐时运动及餐后立即做中强度运动

避免睡醒后立即运动

避免服药或打胰岛素后立即运动

3 "运动"自我管理

日常小技巧学着做一做

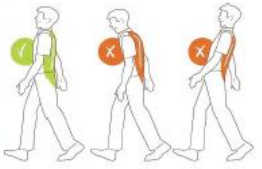
日常生活的好习惯也可达到一定锻炼效果

走路时提高速度

"快步走"能消耗更多热量，快速行走 10 分钟能消耗 40 千卡左右热量。

在外吃饭尽量走路

在外吃饭摄取的能量往往更高，吃完饭走路回家可以消耗更多能量。



正确的走路姿势有助于提升锻炼效果

每天至少外出一次

外出购物或即便是 10 分钟的散步也可以增加消耗热量的机会。

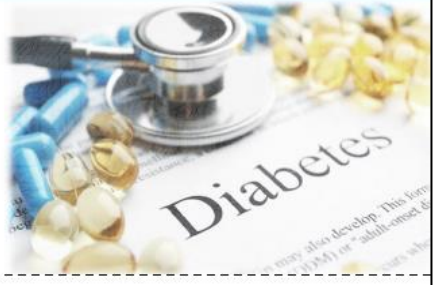
能站着就不坐着

站着消耗的热量更多，并能起到肌肉锻炼的作用。

上下楼多爬楼梯

能爬楼梯就尽量不坐电梯，爬楼梯还可以锻炼腿部肌肉。上下楼梯 10 分钟可消耗约 50 千卡左右热量。

第四篇
"用药"的自我管理



4 "用药"自我管理

正确用药获益大

降糖药物分为口服药、GLP-1 受体激动剂、胰岛素三类

不同种类口服降糖药的作用机制有差别，不要擅自调整或改换药物

根据病情需要适时启动胰岛素治疗，正确用药可助您早达标、早获益

了解降糖药物的分类

遵从医生建议用药非常重要

4 "用药"自我管理

口服降糖药有哪些类型

作用方式	分 类	代表药物	作用特点
促胰岛素分泌剂	磺脲类	格列本脲、格列美脲、格列齐特、格列吡嗪、格列喹酮	-可使糖化血红蛋白降低 1.0-1.5% -可导致低血糖及体重增加
	格列奈类	瑞格列奈、那格列奈、米格列奈	-可使糖化血红蛋白降低 0.5-1.5% -可导致低血糖及体重增加
	DPP-4 抑制剂	沙格列汀、维格列汀、利格列汀、阿格列汀	-可使糖化血红蛋白降低 0.5-0.9% -对体重的作用为中性 -可导致头痛、皮疹、上呼吸道感染
其它	双胍类	盐酸二甲双胍	-可使糖化血红蛋白下降 1.0-1.5% -使体重下降，减少肥胖患者心血管事件和死亡率 -可导致胃肠道反应
	α-糖苷酶抑制剂	阿卡波糖、伏格列波糖、米格列醇	-可使糖化血红蛋白降低 0.5% -可使体重下降，导致胃肠道反应
	噻唑烷二酮类	罗格列酮、吡格列酮	-可使糖化血红蛋白下降 1-1.5% -可使体重增加及水肿，增加骨折和心衰的风险
	SGLT2 抑制剂	达格列净、恩格列净、卡格列净、艾托格列净	-可使糖化血红蛋白下降 0.5-1.2% -有一定减轻体重和降压作用 -可导致泌尿系统感染

降糖首选口服药——二甲双胍

服用时间	肠溶型-饭前 20 分钟 普通型/缓释型-饭中或饭后
用量	最小有效剂量：0.5 克/日 最佳有效剂量：2 克/日 最大推荐剂量：2.55 克/日 （请根据医嘱服用）

当偶尔漏服二甲双胍时，根据漏服时间，血糖水平等，可参考以下方法进行补救

1
如漏服在 1 小时内，立即原剂量补服

2
如漏服时间大于 1 小时，平时只服用二甲双胍，可原剂量补服

3
如平时同时服用二甲双胍和其它降糖药，只漏服了二甲双胍，且血糖＜12.9 毫摩/升，可不补服，适当增加运动量；如血糖≥13.9 毫摩/升，可原剂量补服

长期服用二甲双胍会影响维生素 B_{12} 的吸收，可能造成巨幼细胞贫血，建议：

-每年检测维生素 B_{12} 的水平。
-可补充鱼、蛋、肉类含维生素 B_{12} 的食物。
-在医生的指导下适量服用维生素 B_{12}。

注射型降糖药有哪些

种 类	代表药物	作用特点
GLP-1 受体激动剂	利拉鲁肽、艾塞那肽	-利拉鲁肽可使糖化血红蛋白下降 1.0-1.5%；体重下降 1.8-2.4kg；收缩压下降约 3mmHg -艾塞那肽可使糖化血红蛋白下降 0.8%；体重下降 1.6-3.6kg -常见副作用：初始治疗时胃肠道反应（恶心、呕吐） -胰炎病史患者禁用
胰岛素	第一代-动物胰岛素 第二代-人胰岛素 第三代-胰岛素类似物	-机体内唯一直接降低血糖的激素，同时促进糖原、脂肪、蛋白质合成 -葡萄糖"搬运工"：把血中的葡萄糖转运到身体的细胞内提供能量

虚假广告要警惕!!!

目前没有根治糖尿病的方法，许多保健药中可能添加了低价的降糖药物，可能会导致患者出现严重的低血糖反应。

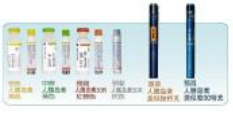
医生会为您定制最佳的治疗方案，请遵医嘱科学用药。

胰岛素是降糖的有力武器

您对使用胰岛素有顾虑吗

在需要时尽早启动胰岛素治疗的好处

- 纠正高血糖状态
- 保护胰岛素分泌功能
- 促进身体更好的利用胰岛素



启用胰岛素治疗的情况

您对胰岛素有误解吗

误 解	事 实
打胰岛素会引起很多问题，如失明	胰岛素可以很好的控制血糖，保护眼睛，降低发生失明的风险
打胰岛素会限制我的生活，不能工作，不能外出	胰岛素笔随身携带很方便，注射简单，既不影响外出，对日常生活影响更小
打胰岛素太疼了，我不敢尝试，也坚持不了	胰岛素注射针头非常细，且有润滑剂，正确注射几乎感觉不到疼痛
打胰岛素会引起严重的低血糖	只要做好血糖自我监测，选择低血糖发生风险低的胰岛素，一般不会发生严重的低血糖

请正确认识胰岛素的作用及对糖尿病的意义！

在需要的时候尽早接受胰岛素治疗！

坚持胰岛素治疗能有效预防并发症！

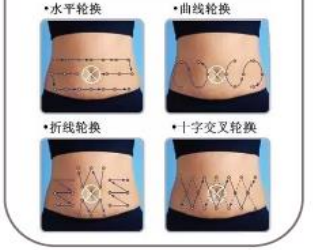
注射胰岛素其实很简单

选择合适注射部位

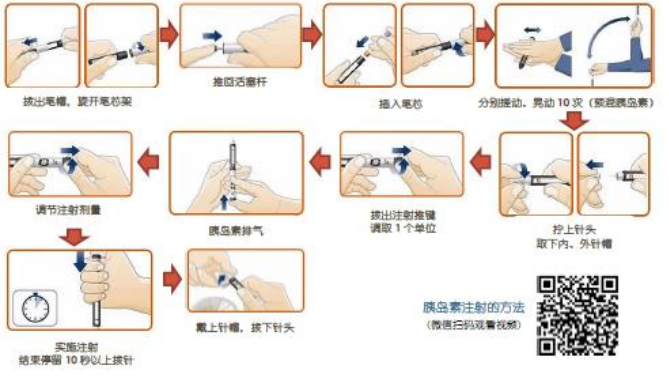
胰岛素注射一般选择腹壁、大腿前外侧、手臂外上侧和臀部上侧 1/4 处，这些部位下都有一层皮下脂肪组织，易于胰岛素吸收。

学会轮换注射方式

每个注射区域每次注射点间隔大于 1 公分，如选择腹部注射时，应以肚脐 5 公分外（约为食指、中指、无名指并齐的宽度）按顺序进行轮替注射，同一部位的注射间隔应在 8 周以上。



注射步骤



胰岛素注射的方法
（微信扫码观看视频）

注射胰岛素的时间别弄错

种 类	名 称	注射时间（仅供参考）
长效胰岛素（基础胰岛素）L	甘精胰岛素（来得时），重组甘精胰岛素（长秀霖），地特胰岛素（诺和平），德谷胰岛素（诺和达）	每天定时注射一次：睡前或早起时
中效胰岛素（基础胰岛素）N	中性低精蛋白生物合成人胰岛素（诺和灵 N） 精蛋白锌重组人胰岛素（优泌林 N） 低精蛋白重组人胰岛素（重和林 N）	早、晚餐前 1 小时
短效胰岛素（餐时胰岛素）R	生物合成人胰岛素（诺和灵 R） 重组人胰岛素（优泌林 R、重和林 R） 常规重组人胰岛素（甘舒霖 R）	三餐前 15–30 分钟
速效胰岛素（餐时胰岛素）S	赖脯胰岛素（优泌乐），谷赖胰岛素（艾倍德），门冬胰岛素（诺和锐）	注射后立即进餐或进餐后立即注射
预混胰岛素	精蛋白生物合成人胰岛素（诺和灵 30R） 精蛋白锌重组人胰岛素（优泌林 70/30） 精蛋白重组人胰岛素（重和林 M30） 30/70 混合重组人胰岛素（甘舒霖 30R）	三餐前 15–30 分钟
	精蛋白锌重组赖脯胰岛素（优泌乐 25R、优泌乐 50R）	注射后立即进餐或进餐后立即注射

以下事项要注意

注射不疼的技巧

注射前
- 新开启胰岛素放置到室温时使用
- 用酒精消毒皮肤，等挥发完再注射
- 每次注射更换新针头

注射时
- 肌肉放松
- 进针要快
- 进针拔针角度要一致

选择合适注射部位
- 避免在硬结部位注射
- 避免在毛发根部注射
- 每次更换注射部位

胰岛素的保存需重视

未拆封的胰岛素
- 在家放在冰箱冷藏室
- 外出时放在胰岛素专用冷藏包或冷藏便携盒里

已拆封的胰岛素
- 在家避免太阳直射，避开电器热源
- 外出随身携带，避免阳光照射

针头不能重复使用

针头重复使用危害大
- 针头中残留药液影响剂量准确性
- 针头中残留胰岛素结晶堵塞针头
- 针头钝化，注射更疼
- 引起皮下脂肪增生，影响药物吸收

第五篇
“足部护理”的自我管理

足部护理要重视

什么是糖尿病足

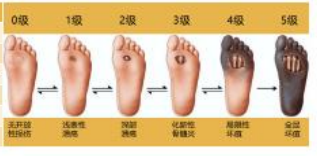
糖尿病足俗称“烂脚”：糖尿病患者由于合并**神经病变**及各种不同程度**末梢血管病变**而导致下肢感染、溃疡形成，甚至造成深部骨骼肌肉组织的破坏而导致患者截肢。

- 全球每 20 秒就有人因糖尿病足截肢!!
- 早期正确的预防和治疗，45–85%患者可免于截肢!!!

糖尿病足危害大

瓦格纳分级——糖尿病足的自然病程

分级	表 现
0 级	有发生溃疡的危险因素，目前尚无溃疡
1 级	表面溃疡，临床无感染
2 级	较深溃疡常合并软组织感染，无脓肿或骨组织感染
3 级	深度感染，伴骨组织病变或脓肿
4 级	局限性坏疽（趾、脚跟或前脚背）
5 级	全脚坏疽



如何识别糖尿病足的危险因素及诱因

整体危险因素	局部危险因素	其它常见诱因
-性别：男性较女性更高发 -吸烟：周围动脉疾病的重要危险因素 -病程：10 年以上病史患者更易发 -视力障碍：糖尿病足独立危险因素 -糖尿病肾病：足溃疡及截肢的高危因素 -血管病变及其它合并症	-周围神经病变 -下肢血管病变 -脚部畸形或变形 -有溃疡或截肢（趾）史 -下肢静脉功能不全	-鞋过紧或鞋底袜底不平：脚趾挤压及脚底磨擦 -用热水袋暖脚或洗脚水温过高：脚部烫伤 -脚癣没及时发现和治疗：感染扩散及加重 -脚部干燥、皲裂没用润肤霜护理：皮肤裂伤 -修脚、剪指甲或鸡眼处理不当：脚部组织损伤 -没及时发现或正规处理脚部小伤口：继发感染 -没及时处理脚部老茧：脚底受压损伤

让我们学习如何预防糖尿病足吧

检查很重要

每天养成自我检查的习惯

重点检查部位：脚底、趾间、关节或脚部变形的部位

检查是否出现：
- 各种损伤、擦伤、水泡
- 皮肤干燥、皲裂
- 鸡眼和老茧
- 皮肤温度、颜色
- 肿胀、溃疡、感染
- 指甲异常

如有相关危险因素需要进行糖尿病足的早期筛查

感觉评估

周围血管评估

足部形态功能评估

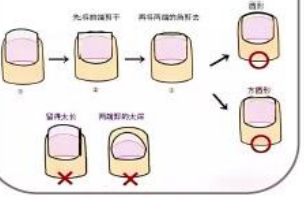
足部自我护理方法有哪些

正确的洗脚方式

- 不要过长时间泡脚
- 使用手感受水温，或用水温计测量水温
- 注意脚部卫生，清洁脚部时使用中性肥皂
- 用浅色毛巾擦脚，以便观察是否有渗液或出血
- 保持脚趾间的干爽

小心修剪趾甲

- 确保在看清楚的情况下修剪趾甲
- 保留一点指甲边缘，边缘留 1 毫米左右
- 减去尖锐的部分，用锉刀将边缘轻轻磨光滑
- 不要剪破老茧和鸡眼
- 不在外面场所接受修剪指/趾甲的服务
- 如剪趾甲造成脚部破损应及时找医生处理



足部自我护理方法有哪些

保持足部皮肤健康

- 平时使用皮肤护理霜涂抹脚部保持皮肤滋润，涂抹时注意避开脚趾间或伤口。
- 如果脚跟干裂，尤其冬季较干燥，可使用含尿素的特殊皲裂霜。
- 不能用手撕去脚皮。
- 感染脚藓时，不用手抓止痒，可涂抹药膏或用中药外洗。
- 多做脚部按摩。下肢及脚底按摩可促进血液循环，改善脚部营养状况，增加脚部抗病能力。

选择合适的鞋袜

	选择	注意
鞋子	-有足够的空间 -透气性良好 -鞋底稍厚而硬，鞋内较柔软 -少穿皮鞋、不穿尖头鞋、高跟鞋 -少穿拖鞋、凉鞋等露趾鞋	-穿鞋前，检查鞋里是否有异物 -下午买鞋(下午脚会有些肿胀) -买鞋时需穿袜子试鞋；站立，两脚同时试穿 -穿新鞋 20 分钟应检查双脚是否有摩擦痕迹
袜子	-选择纯棉浅色袜子，袜口松软有弹性 -每天更换清洗袜子 -不穿高过膝盖的袜子	

可购买：
糖尿病人专用鞋
糖尿病人保健袜

每日锻炼做一做

促进下肢血液循环的锻炼

踮脚尖 脚尖提起、放下，重复 20 次，试着以单脚承受全身力量做。抓紧椅子，踮起脚尖、放下，然后脚尖围椅子走数圈。

弯　膝 手扶椅子，做 10 次弯膝运动，越低越好，背部保持挺直。

上楼梯 踮起脚尖并快速走上楼梯。

座椅运动 双臂交叉胸前，坐下、起立重复 10 次。

抗阻运动 面向墙，双手抵墙，双手的高度不宜超过肩膀高度，双脚伸直在后，双臂弯曲，身体挺直，身体向前靠，重复做 10 次。

踝泵运动 首先脚尖用力向前伸到最大限度时维持 10～30 秒，然后脚尖向头部方位勾到最大的限度位置维持 10～30 秒；之后踝关节做顺时针旋转运动 3 次，逆时针运动 3 次。每天 3 次，每次 20~30 组。

"踝泵运动"可预防糖尿病足，控制感染，并促进糖尿病足溃疡的愈合。

踝泵运动
（微信扫码观看视频）

抗阻运动

第六篇
“情绪”的自我管理

情绪问题要重视

糖尿病引起的情绪问题有哪些？

患病初期

拒绝、愤怒、恐惧、抑郁、接受

治疗期间

盲目乐观、过分紧张、抑郁、恐惧、担忧

不良情绪会导致血糖升高！！！

不良情绪→机体发生系列反应→
儿茶酚胺、肾上腺皮质激素、皮质醇、生长激素等分泌增多→
拮抗胰岛素→血糖升高

如何自我识别糖尿病“抑郁情绪”？

- 情绪低落，有晨重晚轻的特点，占 100%。
- 思维迟缓，即记忆力减退、大脑反应慢等，占 86%。
- 兴趣事淡，生活空虚，不愿意参加社交活动，常常个人独处，占 85%。
- 伴有焦虑，占 82%。
- 睡眠障碍，早醒为其典型表现，占 80%。
- 性欲减退，占 66%。
- 疲乏、心悸、胸闷、胃肠不适、便秘等躯体症状，占 61%。

当您出现以上这些状况时，应引起警惕，并寻求家人及医护人员的帮助！

长期疾病！！！

急慢性并发症！！！

医疗费用与经济负担！！！

糖尿病患者的抑郁情绪是正常人的 3 倍，糖尿病患者焦虑、抑郁与以下因素相关：

性别因素：女性患者更容易产生焦虑情绪。
并发症因素：合并的并发症越多，发生焦虑的可能性越高。
病程因素：随着病程的加长，患焦虑的风险有上升趋势。

正确的状态是什么？

积极乐观

既来之则安之，乐观平静，主动就医及学习，健康的生活方式

过度关注：悲天尤人，悲观失望
满不在乎：听之任之，得过且过

家庭的力量

您担心
您是否会成为家庭负担？
您生病是否给家庭生活带来不便？

其实
您是家庭不可或缺的一员，家人关爱并需要您！
您的积极和自信也会影响家人的态度和信心！

我们会一起努力，共同克服！

定下目标 努力执行

目标选择 “我要健康” → 自我监测 “关注自己情绪变化” → 信息评估 “分析情绪变化原因” → 做出决策 “选择适合自己的调节方式” → 付诸行动 “想好就努力去做” → 自我奖励 “我很棒！继续保持”

正确的状态是什么？

表达自我需要

您觉得
您的需要没有得到满足？
别人根本不了解您需要什么？

您要做
让周围的人明白您需要什么！
了解他人到底能为您提供什么！

实现自我价值
建立生活信心

保持正常的人际交往，享受生活的美好。
维持自己的兴趣爱好，建立生活的乐趣。
劳动有助于降低血糖，减轻体重。
积极管理疾病，减轻个人和家庭的经济负担。

"带糖"生活成常态

对于大多数患者而言，糖尿病是一种"良性"疾病，它在提醒您关注自己的身体，坚持健康的生活方式。

一定要相信，只要观念正确、行动力强、方法科学、持之以恒，糖尿病患者可以让身体"带病延年"。

做自己的情绪管理者

学会调节情绪的方法！

克制和冷静 应用意识控制法

愤怒时提醒自己"息怒"；
情绪激动时告诫自己"冷静"；
遇到紧急情况时告诉自己"别着急，慢慢来"；
情绪控制后，要鼓励自己"我很棒，要保持，继续努力"。

宣泄不良情绪 遇到不顺心的事应避免压抑

痛快的哭 痛苦或愤怒时哭泣可已经压力释放出来并排出压力产生的有害物质。
找人倾诉 遇到烦心事可和家人沟通，以寻求解决方法；心有不平之事可和朋友倾诉以宣泄情感。
运动性疏泄 进行自己喜欢的有氧运动，如到公园和阳光下散步；进行其他身体活动，如走路时挺起胸膛、迈开大步、甩开手臂以释放身体的"负能量"；
兴趣式放松 听听音乐以舒缓情绪；做做兴趣爱好的事情以转移注意力。

一些调节情绪的活动建议

到大自然中运动，享受阳光、蓝天、青山、绿树、碧水。		通过电话、视频、短信和家人及朋友聊天倾诉。		积极参与各种感兴趣的民族节日活动、民俗活动、文化活动。		回忆曾经拥有的快乐时光或自己的荣光时刻，并与人分享。	
	做一些放松活动，如种花、听音乐、唱歌、看书、书法、遛鸟。		参与一些社交活动，如聚会、聊天、打牌、下棋、集体舞、广场舞。		试着做一些自己愿望中的事情。		把不想倾诉的事写下来，帮助更好的了解自己的状态。

第七篇
自我风险应对

糖尿病更可怕的是并发症带来的风险

糖尿病会发生什么并发症

糖尿病并发症是糖尿病代谢紊乱所导致的、涉及全身的急性或慢性病变，分为**急性并发症**和**慢性并发症**。

据世界卫生组织统计，糖尿病并发症高达 100 多种，是已知并发症最多的一种疾病。

急性并发症有哪些

常见的慢性并发症有哪些

急性并发症识别应对很重要

酮症酸中毒

症状	早期	口干舌燥、小便频繁、乏力、视物模糊
	中晚期	食欲不振、恶心呕吐、心跳加快、脉搏细速、血压下降、四肢发冷、呼吸深大烂苹果味、头晕头痛、烦躁、嗜睡、昏迷、脱水
诱因	血糖过高、漏用降糖药、生病、感染	
预防	长期严格控制血糖，坚持运动、预防感染；补足充分水分，多喝无糖流质如水、茶、肉汤；经常监测血糖，关注尿量、体重变化	
自我处理	监测血糖，一般为 16.7~33.3 毫摩/升；如持续呕吐、不能喝流质或持续腹泻并伴进行性虚弱，应立即就医	

非酮症高血糖高渗状态

症状	早期	多尿、口渴、多饮、倦怠、乏力加重、反应迟钝、表情淡漠
	晚期	逐渐出现脱水和精神症状，烦躁、嗜睡、昏迷、抽搐、少尿或无尿
诱因	生病或感染；应激状态；漏用降糖药；高糖摄入；活动减少；饮水不足或式水过多（腹泻、呕吐、大量出汗）	
预防	严格控制血糖，预防感染；规律生活起居，补充足够水分；任何不适时要加强血糖监测	
自我处理	监测血糖，一般大于 33.3 毫摩/升；感到不适时要积极就医（尤其老年人）	

乳酸性酸中毒

症状	原因不明深大呼吸伴口唇紫绀、乏力、恶心呕吐、血压及体温下降、神志模糊、面色潮红、昏迷或休克
易发人群	长期或过量服用苯乙双胍（降糖灵）者；伴有心、肝、肾疾病的患者；老年患者
预防	严格掌握苯乙双胍服用剂量；如需双胍类药物治疗者，尽可能选用二甲双胍
自我处理	发生急症时，应暂停该药物治疗，尽快就医；长期使用双胍类药物者，多留意心、肝、肺、肾功能，如有异常及时就医

低血糖反应

症状	轻度	饥饿感、心慌、焦虑、出冷汗、发抖、面色苍白、急躁易怒、头痛
	重度	抽搐、嗜睡、意识丧失、昏迷乃至死亡
诱因	过量胰岛素、进食减少、运动过多，喝酒过多	
易发人群	老年患者及肝肾功能减退者；有严重微血管和大血管并发症者；使用胰岛素治疗患者	
预防	日常加强血糖监测，规范用药；生活规律，科学运动，限制饮酒；如睡前血糖＜5.6 毫摩/升，建议进食（如一杯牛奶）以预防夜间低血糖；随身携带预防低血糖食物及糖尿病急救卡	
自我处理	“两个 15”原则：意识清楚时立即补充 15 克含糖食物；等待 15 分钟后复测血糖	
家庭处理	如呼吸通畅并有吞咽功能，可给患者喂一些糖水可迅速改善症状；如丧失吞咽功能应为患者清理呼吸道保证呼吸，同时拨打 120 急救	

15 克含糖食物推荐：
4 块苏打饼干，1 片面包，12~15 颗葡萄，1 个小苹果，1 碗蒸麦粥，3~5 颗硬糖，半杯果汁，250 毫升脱脂牛奶，4 茶匙白糖，150 毫升可乐

慢性并发症要重视

糖尿病发病 10 年后，30%~40%的患者至少会发生一种并发症！
2 型糖尿病的慢性并发症多是“心脑血管疾病”，然而不仅仅局限于高血压、脑梗、冠心病等，其破坏力渗透在身体从头到脚的每一个部位！

糖尿病合并心脑血管疾病

心血管疾病	静息状态下心率加快，通常＞90 次/分； 体位性低血压：起床和下蹲时出现头晕、黑蒙、晕厥； 胸闷、胸痛等心绞痛的表现
脑血管疾病	视物模糊、复视或伴有眩晕； 活动受限或伴肢体无力； 说话口齿变得不清； 突然跌倒或伴有短暂意识散失
预防	血糖达标，控制血压及血脂； 改变不良生活方式：科学饮食、合理运动、戒烟限酒、保持正常体重； 定期监测：体重、腰围、血压、血脂、心电图等； 保持情绪稳定可减少心脑血管事件的发生
处理	尽早就诊，遵医嘱使用药物治疗

血压控制目标

一般控制在 130/80 mmHg 以下

血脂控制目标

指标		控制目标
总胆固醇		＜4.5 毫摩/升
高密度脂蛋白	男性	＞1.0 毫摩/升
	女性	＞1.3 毫摩/升
甘油三酯		＜1.7 毫摩/升
低密度脂蛋白	未合并冠心病	＜2.6 毫摩/升
	合并冠心病	＜1.8 毫摩/升

糖尿病肾病

我国 2 型糖尿病患者中约 40%患者会发展为慢性肾病

症状	小便频繁、小便时有疼痛或烧灼感、尿液浑浊、泡沫尿、尿中带血、腰背疼痛、发烧； 常伴有视网膜病变； 严重者可发展为肾功能衰竭
预防	血糖达标，控制血压及血脂； 改变不良生活方式利于保护肾功能； 定期筛查：尿常规、肾功能、尿蛋白定量等
处理	低蛋白饮食； 选择优质蛋白（鸡蛋、牛奶、鱼肉、虾、鸡肉）； 尽早就医

如积极干预，肾病发展可以被阻止或延缓，在早期甚至可以逆转

糖尿病眼部并发症

视网膜病变、青光眼、白内障、缺血性视神经病变

视网膜病变	5~10%糖尿病患者会发生； 可致视力减退至失明，是糖尿病患者失明的主要原因
症状	视力下降、复视，眼前有黑影遮挡感，视野缩小； 眼部肿胀、阅读障碍
预防	血糖达标，控制血压及血脂； 改变不良生活方式； 常规眼底检查； 运动时避免跳水、举重等方式； 注意用眼卫生，尤其看手机、电视、电脑
处理	控制血糖：对早期病变有促进逆转作用 尽早就医，进行药物、激光或手术治疗

识别		预防	处理
周围神经病变	四肢末端麻木、刺痛、烧灼等感觉异常； 痛觉等感觉减退或消失； 皮肤色泽暗淡、皮温低或泌汗异常； 肌肉无力或萎缩； 上腹饱胀、消化不良、便秘与腹泻； 排尿障碍； 性欲减退、月经紊乱； 静息心率快，体位性低血压	血糖达标，控制血压及血脂； 定期进行周围神经检查； 病程较长者 3~6 个月进行一次复查	早期病变具有可逆性 从早期严格控糖； 使用药物进行神经修复； 症状较重患者应进行对症治疗
下肢血管病变	间歇性跛行； 足背动脉减弱或消失； 下肢皮肤色素沉着，弹性差，皮肤干燥，皮温低； 肌肉组织萎缩，趾甲变脆变薄	血糖达标，控制血压及血脂； 限制酒精摄入； 戒烟	适当的运动锻炼； 吸烟者必须戒烟； 使用药物治疗以改善微循环

加强自我管理
享受健康生活

制作：大理大学护理学院社区护理团队
大理州人民医院内分泌代谢科（0872-2191026）
封面设计及插图：大理市花花田文化艺术培训学校（13987250425）

Appendix 7-6. The T2DM self-management diary

第一项

自我管理活动记录

“自我管理活动记录”可以帮助您了解每天及每周进行糖尿病自我管理的基本情况。根据记录您可以清楚的掌握自己在糖尿病的管理中做得好的地方和做得不足的地方，以此鼓励和督促自己改变不良的行为习惯。

一周的自我管理情况

请在符合您实际情况的框内打"✓"，没做到的不填。

日期 / 条目	星 期		一	二	三	四	五	六	日
	月/日								
我今天的血糖检测情况	晨起空腹								
	餐前								
	餐后								
	随机								
我今天的饮食情况	控制了进食量	早餐							
		午餐							
		晚餐							
	总共吃了 5 种以上蔬菜								
	定时加餐（酸奶、牛奶、水果等）								
	吃了高油脂食物或较咸的食物								
	吸烟								
	过量饮酒								
我今天的运动情况	散步或跑步								
	跳舞								
	其它方式的运动								
	运动时监测了脉搏								
	没有做运动								
我今天的用药情况	口服药或胰岛素	定时定量用药							
		有剂量错误							
		有时间错误							
		有用药遗漏							
	不用（非）药物治疗								
我今天的足部护理情况	穿了合脚舒适的鞋子								
	穿了吸汗柔软的棉袜								
	认真的检查了脚部								
	进行了脚部的按摩								
	做了促进脚部血液循环的锻炼								
我今天的情绪状况	总体情绪较好								
	因疾病产生了情绪问题	进行有效调整							
		无法调整							
预防低血糖	外出携带了糖尿病人急救卡								
	外出携带了糖果、饼干等含糖食物								

第二项

血糖检测记录

进行规范的“血糖检测”记录，有助于记录您日常的血糖动态，及时发现和整理出现的问题，并在就诊时为治疗方案的调整提供依据。

请参考以下内容，并根据实际情况判断您的“血糖目标值”、“血糖检测时间点和频率”

1.血糖目标值

指 标	控制标准		意 义
	一般成人	老年患者	
空腹血糖 （晨起空腹，8~10 小时未进食）	4.4~6.1 毫摩/升	4.4~7.0 毫摩/升	反映基础胰岛素分泌功能
餐后 2 小时血糖 （第一口饭开始计时）	小于 8.0 毫摩/升	小于 10.0 毫摩/升	胰岛β细胞储备功能重要指标
随机血糖	小于 11.1 毫摩/升	小于 11.1 毫摩/升	反映特殊情况血糖值（低血糖，剧烈运动，劳累，生病，饮酒，多吃或少吃，情绪变化）

2. 血糖检测时间点和频率

血糖状况	晨起空腹	早餐后 2 小时	午餐前	午餐后 2 小时	晚餐前	晚餐后 2 小时	睡前	夜间	随机	频率（每周）	
										1~2 天	3~4 天
使用胰岛素血糖未达标	✓	✓	✓	✓	✓	✓	✓				✓
使用胰岛素血糖达标	✓		✓		✓		✓			✓	
非胰岛素治疗血糖未达标	✓	✓	✓	✓	✓	✓					✓
非胰岛素治疗血糖达标	✓	✓		✓		✓				✓	
低血糖发作									✓		
怀疑夜间低血糖							✓	✓			✓

自我血糖检测记录

请按实际情况在对应框内填写您的血糖检测数值，如有特殊情况请在备注内填写。

日期	早餐前空腹	早餐后2小时	午餐前	午餐后2小时	晚餐前	晚餐后2小时	睡前	夜间或随机	备注（饮食、运动、生病等特殊情况记录）

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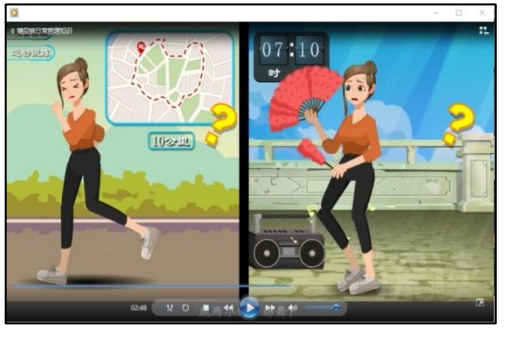
Appendix 7-7. The video learning materials

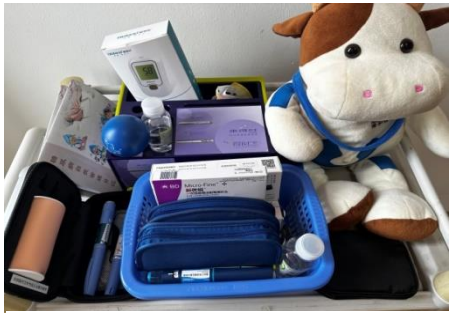
1) Videos materials for the first WeChat-based group intervention



2) Videos materials for the second WeChat-based group intervention

Appendix 8. Other intervention supplies

Simulated food
models



Insulin pens and
Rapid response blood glucose

Diabetes complications
experience supplies

HbA1c
Dry fluorescence
immunoassay analyzer

Gifts given to
participants

Learning materials for control
group

Appendix 9. Feedbacks from participants and nurses

Group	Feedbacks
Participants of experimental group	- This is a thoughtful job by professionals that helped a lot of patients. Especially for our Bai T2DM patients, we are very grateful. - Before this, I didn't know about "self-management" and only followed the instructions of professionals. - We learned a lot of knowledge by education, and began to pay attention on blood sugar monitoring, and started to test it every day. - We have started our daily exercise. - When I learned about so many complications, I started to choose the right food, eat less and walking 2 kilometers every day, which I had never done before. - I often suffer from hypoglycemia, and I was hospitalized due to severe hypoglycemia. Now I understand how to control it. - I was hospitalized because of diabetic foot. I didn't know about this complication before. Now I not only pay attention to it, but also understand how to care of it.
Participating study nurses	- This is an unprecedented education program for T2DM patients here, and the education carried out in the past was only a simple lecture. And this is a program for minority patients that have never been done before. - The intervention combines a variety of methods. WeChat-based intervention facilitates patients' participation and improves the enthusiasm. - The Lesson plan is so detailed and very instructive for implementation. - The self-management handbook and diary developed for the Bai T2DM patients are novel and practical, and make up for the lack of health education materials. - We hope to continue to get cooperation opportunities to do such programs.

Development and Evaluation of a Self-Management Promotion Program for Type 2 Diabetes Patients of the Bai Ethnicity in China

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(Supervised by Professor Jun, Sangeun)

(Abstract)

Effective self-management is crucial for mitigating symptoms, reducing complications, and optimizing resource use in chronic diseases like type 2 diabetes mellitus (T2DM). However, ethnic minorities in China's border regions, including the Bai ethnicity, often lack targeted diabetes self-management education and awareness. This study aimed to develop and evaluate a Self-Management Promotion (SMP) program for Bai adults with T2DM, based on the Information-Motivation-Behavioral (IMB) Skills Model and guided by the ADDIE instructional model.

The research comprised two stages: program development and effectiveness verification. The SMP program was formulated through literature review, secondary data analysis, focus group interviews, material development, and expert validation. A

randomized controlled trial assessed the 5-week SMP program's impact on self-management behaviors and health outcomes. Of the 67 participants, 52 completed the study, with the experimental group (n=27) receiving the SMP intervention and the control group (n=25) receiving usual care. Data analysis was conducted using SPSS 26.0, employing descriptive statistics, Shapiro-wilk test, Independent sample t-test, Chi-square test, Fisher's exact test, Mann-whitney U test, Levene’s test and Generalized estimating equation.

Results revealed significant improvements in the experimental group's diabetes knowledge, motivation, diabetes self-efficacy, self-management behavior, and diabetes-specific quality of life, alongside reduced HbA1c levels compared to the control group. These findings suggest the short-term effectiveness of the IMB model-based SMP program in enhancing T2DM self-management and health outcomes among Bai adults.

중국 백족(白族) 2형 당뇨병 환자를 위한 자기관리증진 프로그램 개발 및 효과 검정

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(초록)

효과적인 자기관리는 제2형 당뇨병(T2DM) 과 같은 만성 질환의 증상을 완화시켜주고 합병증을 줄이는 최적화된 자원으로 중요한 역할을 한다. 그럼에도 불구하고 백족(白族)을 포함한 중국 국경지역 다수의 소수민족은 당뇨병에 대한 인식과 교육이 많이 부족한 상황이다. 본 연구는 Information-Motivation-Behavioral (IMB) Skills 모델을 기반으로 한 ADDIE 교육모델을 통해 제2형 당뇨병 앓고 있는 백족(白族) 성인을 위한 자기관리 증진 (self-management promotion, SMP) 프로그램을 개발하고 효과 검정을 목적으로 하였다.

프로그램은 문헌검색, 2차 데이터 분석, 포커스 그룹 인터뷰, 교육자료 개발 및 전문가의 검증을 통해 개발되었다. 무작위적 대조 실험은 5주

동안의 SMP 프로그램을 통해 자기관리 행동 및 건강 결과에 미치는 영향을 검정하였다. 67명의 참가자 중 52명에 대한 연구를 진행하였으며 여기서 실험군(n=27)은 SMP 의 통한 관리를 받았고 대조군(n=25)은 일상적인 관리를 받았다. 데이터 분석은 SPSS 26.0프로그램을 사용하여 기술 통계, Shapiro-wilk test, Independent sample t-test, Chi-square test, Fisher's exact test, Mann-whitney U test, Levene's test 및 Generalized estimating equation test를 실시하였다.

연구결과는 실험군의 당뇨병 지식, 동기, 당뇨병 자기 효능 감, 자기관리행위, 삶의 질이 대조군에 비해 현저하게 개선이 되었고 동시에, HbA1c수준는 감소했다는 것을 볼 수 있었다. 이러한 결과는 IMB 모델 기반의 SMP 프로그램은 백족(白族)의 T2DM 자기관리와 건강 결과를 촉진하는데 단기적으로 유효성이 있다는 것을 입증하였다.