FACTORS INFLUENCING DIABETES SELF-MANAGEMENT AMONG ADULTS WITH TYPE 2 DIABETES MELLITUS IN WENZHOU, CHINA

NI YANG

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE MASTER DEGREE OF NURSING SCIENCE
(INTERNATIONAL PROGRAM)
IN ADULT NURSING PATHWAY
FACULTY OF NURSING
BURAPHA UNIVERSITY
2022

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The prevalence of type 2 diabetes in China continues to rise and diabetes self-management is generally suboptimal. The aims of this study were to ascertain diabetes self-management among adults with T2DM and to examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with T2DM. A simple random sampling method was used to recruit the sample of 108 adults with T2DM in the diabetes outpatient department (OPD) at the First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China. Research instruments included the demographic questionnaire, the Chinese version of the Diabetes Self-Management Questionnaire (DSMQ), the Diabetes Knowledge (DKN) scale, the Self-efficacy Scale for Patients with Type 2 Diabetes Mellitus (SE-Type 2 scale), the Fatalism Scale, and the Perceived Social Support scale (PSSS). Data were analyzed by descriptive statistics and standard multiple linear regression.

The results revealed that 62% of adults with T2DM had poor control blood sugar (HbA1c $\geq$ 8.0%) with suboptimal diabetes self-management (M = 4.85 out of 10, SD = 1.42). Considering the DSM subscales, medication adherence subscale had the highest mean score of 6.31 (SD = 2.85), followed by physician contact (M = 6.20, SD = 1.66), dietary control (M = 5.32, SD = 2.09) and physical activity (M = 4.50, SD = 2.88). Glucose monitoring subscale (M = 2.40, SD = 1.95) had the lowest mean scores. The regression analysis showed that diabetes knowledge, perceived self-efficacy, and social support could explain 38.2% of the variance in diabetes self-management among adults with T2DM ($F_{3, 104}$ = 23.021, p < .001). However, only diabetes knowledge (β = .468, p < .001) and perceived self-efficacy (β = .184, p = .039) could significantly predict diabetes self-management.

The findings suggested that increased diabetes knowledge and perceived self-efficacy can help improve diabetes self-management in T2DM to ascertain the ultimate treatment outcomes.

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CHAPTER 1

INTRODUCTION

Significance of the problem

Diabetes Mellitus (DM) is a global public health epidemic that cannot be ignored particularly in developing countries and has emerged as one of the 21st century's fastest-growing health challenges (International Diabetes Federation [IDF], 2021; Zheng, Ley, & Hu, 2018). As one of the types of that, type 2 diabetes mellitus (T2DM) results from impaired insulin secretion, insulin resistance, or a combination of both conditions, and is far more common than other types of DM (DeFronzo et al., 2015). T2DM has unknown origins, but it is strongly linked to overweight and obesity, aging, ethnicity, and family history (IDF, 2019). It is reported that T2DM accounts for more than 90% of all diabetic cases (IDF, 2021).

In 2021, around 537 million 20-79 years old adults worldwide suffer from type 2 diabetes (an average of 1 in 10 people with diabetes), according to statistics (IDF, 2021). China has the highest number of individuals with diabetes (140.9 million), accounting for a quarter of all adults with diabetes in the world, and there has been a significant rise in the prevalence of T2DM (IDF, 2021; Y. Z. Li et al., 2020). In Wenzhou, China, a survey in 2017 showed that 1,488 adults with type 2 diabetes mellitus were detected among 11,765 adult residents, with a detection rate of 12.6% (Zhang et al., 2017).

The incidence was statistically significant for adults over 20 years of age in the 2007-2017 survey in Zhejiang Province, with an average annual growth of 4.01% (in particular, 12.89% for 20-29 years and 8.72% for 30-39 years), indicating a clear trend towards a younger incidence of T2DM (Wang et al., 2020). There's strong evidence that the declining age of onset of T2DM is due to a rise in obesity rates among young people, owing to unhealthy dietary habits and sedentary lifestyles

(Haddad & Haddad, 2018). As a result, facilitating diabetes care is critical for nurses and other providers of primary care (Luo et al., 2015).

The manifestations of type 2 diabetes are usually milder and it might even be completely asymptomatic at times. The exact development of type 2 diabetes is frequently unpredictable (IDF, 2021). As a result, there is usually a long pre-diagnostic period, and up to one-third to one-half of people with T2DM may get undiagnosed (IDF, 2021). Complications such as retinopathy or lower limb ulcers may already be evident at the time of diagnosis if the disease has gone unnoticed for a long time (Gregg et al., 2014). Young-onset T2DM (aged < 40 years), in particular, is linked to a higher risk of complications than late-onset T2DM, owing to the disease's longer course (Magliano et al., 2020).

Many studies confirm that the development of diabetic complications always accompanies diabetic patients, which is closely related to a higher risk of mental problems and disability, poorer quality of life, greater medical costs, and increased risk of mortality (Beck et al., 2017; Jing et al., 2018; Lee, Piette, Heisler, Janevic, & Rosland, 2019). Diabetes-related mortality in adults (aged 20-79 years) reach roughly 6.7 million in 2021, accounting for 12.2% of all deaths in this age group globally, excluding the risk of death connected with the covid-19 pandemic (IDF, 2021). About a third (32.6%) of these deaths occur among people under the age of 60, which equates to 11.8% of all deaths of people under 60 years worldwide (IDF, 2021). The mortality data for China is equally large (about 1.4 million) (IDF, 2021). According to statistics, the reported mortality rate is 15.50 per 100,000 in Wenzhou (of these, T2DM has the highest mortality rate; 91.34%), and diabetes mellitus has become the seventh cause of death in Wenzhou, China (Y. Q. Shao, Chen, & Xue, 2012).

Its impact not only characterized by premature mortality and lower quality of life due to diabetes-related complications, but also imposes a significant economic impact on individuals with diabetes and their families (O'Connell & Manson, 2019; Peters, Huisman, Schoonen, & Wolffenbuttel, 2017; W. Yang et al., 2012). IDF

estimates that total diabetes-related health expenditure reaches USD 966 billion, with a 316% increase over 15 years, and there is no doubt that the impact will be long-lasting (IDF, 2021). China's overall health expenditure due to diabetes (20-79 years) is USD 165.3 billion, putting it in second place (IDF, 2021). Diabetes has an unfair economic impact since it is a disease that disproportionately affects working-age adults (under 60 years) (IDF, 2021).

Over the past decade, integrated strategies have been used for diabetes treatment, including patient education and diabetes self-management (DSM), which has been emphasized (Sturt, Whitlock, & Hearnshaw, 2006). The cornerstone of type 2 diabetes management is self-management (SM), including a healthy diet, regular physical activity, monitoring blood glucose, maintaining a healthy weight and so on (American Diabetes Association [ADA], 2021e; IDF, 2019). As an essential element of diabetes care, self-management is significant for maintaining cardiometabolic control and avoiding complications for people with diabetes (Luo et al., 2015; Rosland et al., 2014). Self-management is identified as a dynamic process in which individuals manage the illness actively, and it also stresses the individual's involvement in defining health (Lubkins, 2019; Schulman-Green et al., 2012). Ryan & Sawin also clarified that SM is intentional and "it involves the use of specific processes, can be affected by specific programs and interventions, and results in specific types of outcomes" (P. Ryan & Sawin, 2009, p. 218).

Type 2 diabetes mellitus, as a common chronic disease, brings a serious burden of self-management to the affected individuals and families (Gonzalez, Tanenbaum, & Commissariat, 2016). Diabetes self-management is identified as activities that adults with T2DM actively participate in recommended behavioral activities, including dietary control, glucose monitoring, medication adherence, physical activity, and physician contact (C. Q. Li, Jing, Liu, & Ma, 2018). Its regimens are often complex and it is very difficult for many patients to achieve the goal (Rosland et al., 2014). DSM is time-consuming, which requires joint efforts of

patients, health care providers, and other relevant personnel, and it comes with a financial drain (Gonzalez et al., 2016). Also, specific behaviors in the process of DSM tend to increase the patient's distress, such as regular blood glucose measurements and insulin injections (Gonzalez et al., 2016). Thus, in standards of medical care for diabetes, the performance of adults' DSM is recommended to monitor as the part of routine clinical nursing, including its influence on clinical outcomes, health status, and quality of life, as well as the psychosocial factors affecting diabetic patients' self-management (ADA, 2019). A position statement is developed on psychosocial care for patients with diabetes, providing evidence and support to examine psychosocial factors in self and family management, and to integrate facilitators and barriers into clinical care (ADA, 2021a).

Much evidence has shown that improving DSM is important to achieve better health outcomes, including better glycemic control, improved quality of life, and reduced incidence of complications (Beck et al., 2017; Cochran & Conn, 2008; Hildebrand et al., 2020). An ideal DSM program has been shown to be effective in reducing HbA1c levels (Lee et al., 2019). The concept of financial and social resources shows the effectiveness of people with diabetes in self-and family management (Weaver, Lemonde, Payman, & Goodman, 2014). Conversely, suboptimal DSM is related to worse glycemic control, an increased risk of hospitalization, complications, and even mortality, as well as loss in social, and psychological health (Currie et al., 2012; Feldman et al., 2014; Ho et al., 2006; Schectman, Nadkarni, & Voss, 2002). Therefore, the outcomes of poor DSM may be serious (Gonzalez et al., 2016).

Although DSM is valued, many existing studies have shown that DSM of adults with T2DM from all over the world is not ideal (Joseph, Berry, & Jessup, 2015; Kurnia, Amatayakul, & Karuncharernpanit, 2017; Portillo et al., 2017; Rogers et al., 2015). For example, the level of DSM examined by Al-Qahtani (2020) in Saudi Arabia was not high and the mean score of DSM was 5.04 out of 10 (measured by

DSMQ). Due to cultural influences, DSM among diabetic adults is always done in the context of family (T. Liu, 2012). Some previous studies have consistently shown that DSM is suboptimal among Chinese adults with type 2 diabetes (Cui, Chang, & Zhang, 2020; Ji, Ren, Dunbar-Jacob, Gary-Webb, & Erlen, 2020; Yao et al., 2019). Yu, Xiao, Wang, and Wang (2013) investigate 211 adults with type 2 diabetes in the community of Hunan and found that only 20.5% of the participants have optimal DSM (The score indicators for each dimension: dietary management, exercise management, medication management, glycemic control, foot care, prevention and management of hyperglycemia are 68.30%, 66.15%, 80.53%, 61.00%, 66.76% and 69.55%, respectively), which is similar to the result of the study conducted in Beijing (Lin et al., 2017). Also, the study in Shandong confirmed that the situation about DSM is not optimistic, because only 54.8% of patients actively participate in DSM and the rates of good performance on DSM in medication adherence, dietary control, physical activity, and self-monitoring is 75.8%, 74.5%, 61.0%, and 25.8% respectively (Yao et al., 2019). In Zhejiang province, C. R. Chen and Huang (2019) indicated that percentage of good levels of DSM was only 21%. Besides, several studies have been conducted to investigate practices of DSM and potential influencing factors in urban areas (Cui et al., 2020; Huang, Zhao, Li, & Jiang, 2014), while the popularization of DSM is not enough (Le, Rong, Dingyun, & Wenlong, 2016).

Diabetes self-management is often ineffective because of many complex factors, like many challenges that adults may face in daily work or life (Y. Wang, Xue, Huang, Huang, & Zhang, 2017). Based on the Individual and family self-management theory (IFSMT), P. Ryan and Sawin (2009) clarify that different factors under three different dimensions such as individual and family characteristics, disease conditions, perspective, self-efficacy, knowledge and social support may influence the self-management outcomes. Several studies have found that diabetes knowledge, perceived self-efficacy, and social support are some of the common factors that may influence DSM (Adu, Malabu, Malau-Aduli, & Malau-Aduli, 2019; Frier, Devine,

Barnett, & Dunning, 2020; Gonzalez-Zacarias, Mavarez-Martinez, Arias-Morales, Stoicea, & Rogers, 2016; Hu, Gruber, Liu, Zhao, & Garcia, 2012). As a psychological factor, fatalism may influence self-management directly or indirectly (Asuzu, Walker, Williams, & Egede, 2017; Osborn, Bains, & Egede, 2010). According to the IFSMT and literature review, these factors may influence the outcome of self-management (P. Ryan & Sawin, 2009) and previous studies have found that they have varying degrees of connection with DSM or can predict DSM (Gunggu, Thon, & Whye Lian, 2016; Ji et al., 2020; Joseph et al., 2015; Kueh, Morris, & Ismail, 2017; Kurnia et al., 2017; Yao et al., 2019). Thus, the effect of four variables (diabetes knowledge, perceived self-efficacy, fatalism and social support) on the DSM among patients with T2DM were studied.

Diabetes knowledge is defined as the patient's understanding of information about the physiological aspects of diabetes and the understanding of the principles of diabetes treatment (X. Yin, Savage, Toobert, Wei, & Whitmer, 2008). It is an important part of DSM, and determining adults' diabetes knowledge can promote to solve the disease condition (Hu et al., 2012). Lack of diabetes knowledge can partly hinder DSM, especially for diet and physical exercise (Adu et al., 2019). Some studies confirmed the correlation between diabetes knowledge and DSM, like the cross-sectional study conducted in Malaysia, clarified a strong relationship between diabetes knowledge and DSM (β = .15, p < .05) (Kueh et al., 2017). M. Shi et al. (2016) divided the participants into the family-involved group (FIG, n = 60) and single-involved group (SIG, n = 60) to investigate the effect of the FIG from the aspect of knowledge and found that diabetes knowledge highly correlated with DSM outcomes (FIG: OR = 1.95, p < .001; SIG: OR = 8.55, p < .001). Luo et al. (2015) summarized in the systematic review that diabetes knowledge is not only positively related to overall DSM practice, but also positively related to certain specific DSM behaviors, such as medication management, foot care, self-monitoring, and healthy lifestyle behaviors, which showed diabetes knowledge was a predictor for DSM.

However, Kurnia et al. (2017) indicated that diabetes knowledge was only relevant to DSM (r = .26, p = .03) but could not predict it in the stepwise regression model. Similarly in China, Ji et al. (2020) found that there was only the correlation between diabetes knowledge and DSM (r = .16, p < .01). Some studies investigated the older adults with diabetes in Beijing and also found that there was no significant correlation between diabetes knowledge and DSM (r = .06, p = .60) (Hu et al., 2012). Studies of diabetes knowledge and DSM have yielded inconsistent results.

Perceived self-efficacy refers to the degree of confidence in a person's ability to act successfully under normal and stressful situations (P. Ryan & Sawin, 2009). For adults with T2DM, it is the confidence in their abilities and is involved in DSM. A good level of perceived self-efficacy affects positive evaluations about the use of the information and skills in DSM, and it also can help diabetic patients remove obstacles in the DSM process and adhere to long-term health improvements (Adu et al., 2019). Joseph et al. (2015) made a summary in the review that there was a strong association between diabetes self-efficacy and DSM, which was confirmed and further inferred as a predictor (β = .217, p < .001) by Kurnia et al. (2017). Wichit, Mnatzaganian, Courtney, Schulz, and Johnson (2017) also indicated that there was a predictive link between self-efficacy and DSM (β = .40, p < .001). In Beijing of China, the study about the effect of perceived self-efficacy on patients with T2DM showed an indirect effect on DSM (β = .33, p < .001) (Lin et al., 2017). In many studies, the degree of the association between perceived self-efficacy and DSM is different.

Fatalism is described as the belief that each event and situation is predetermined and is beyond one's power to change the course of these events (Rustveld et al., 2009; Sukkarieh-Haraty, Egede, Abi Kharma, & Bassil, 2018). It includes the concepts of predestination, luck, and pessimism (Shen, Condit, & Wright, 2009). Fatalism as a psychosocial factor has a negative impact on self-management outcomes (P. Ryan & Sawin, 2009; Unantenne, Warren, Canaway, & Manderson,

2013). It can contribute to poor medication adherence, poor blood glucose levels, and reduced quality of life (Egede & Ellis, 2010; Walker et al., 2012). Osborn et al. (2010) found that less fatalism (r = - .22, p < .05), more diabetes knowledge (r = .22, p < .05) and more social support (r = - .27, p < .01) are independent and direct predictors of DSM. Walker et al. (2012) described in more detail that fatalism was significantly associated with medication adherence (β = .029, p < .001), dietary (β = - .063, p < .001), exercise (β = - .055, p < .001) and blood sugar testing (β = - .055, p = .001), but there was no significant correlation between diabetes fatalism and foot care (r = - .107, p = .057). The review by Gonzalez-Zacarias et al. (2016) confirmed there was a relationship between fatalism and DSM, and emphasized the effect of ethnic differences in this regard as well. The finding of qualitative research in 2003 showed that fatalism was associated with DSM in African Americans (Egede & Bonadonna, 2003). Nevertheless, the study by Asuzu et al. (2017) presented that there was no significant direct association between fatalism and DSM. In China, studies about the association between fatalism and DSM are rarely found.

Social support refers to the individual's perception that if a person needs assistance, he or she can get assistance at any time (Ahola & Groop, 2013). Provided support may be emotional, informational, appraisal or others, which may be obtained from various approaches, including friends, family, medical workers, and so on (Tang, Brown, Funnell, & Anderson, 2008). It is relevant to barriers encountered, self-efficacy, level of DSM, and blood glucose control (Gonzalez-Zacarias et al., 2016). Gunggu et al. (2016) clarified that family support was considered to be an important factor influencing DSM (β = .198, p = .007). In studying the association between social support and DSM, King et al. (2010) found social support was independently associated with healthy lifestyle behaviors (β = .25, p < .0001), but not medication management (β = - .009, p = .84). The study of Ji et al. (2020) showed that social support was only correlated with DSM (r = .30, p < .01). But the study by Kurnia et al. (2017) confirmed that social support did not present any significant

effects on DSM among adults with T2DM in Malang City (r = .314, p < .01). It is stated in a review of China that there was little data on the relationship between socioeconomic factors and DSM (Le et al., 2016). The other study also put forward a similar point of view and mentioned that social support was always divided into direct support and indirect support, according to the mode of provision, which affected different dimensions of DSM (Zhang et al., 2017).

Although there are many existing studies on the relationship between these four factors and DSM can be searched, there are still gaps in the research. There are inconsistent results in the study of diabetes knowledge and social support factors, and numerous studies show varying degrees of the association between perceived self-efficacy and DSM, and there is limited research on the association between fatalism (a psychosocial factor) and DSM in China. By several studies, diabetes knowledge alone did not ensure better adherence to DSM if other barriers still exist (Gonzalez-Zacarias et al., 2016; Gonzalez et al., 2016; Nam, Chesla, Stotts, Kroon, & Janson, 2011), implying that other factors are needed to achieve optimal DSM. For fatalism, Berardi et al. (2016) also demonstrate that religious beliefs may confuse the relevance of fatalism to DSM. Some studies have revealed that the reasons for poor adherence to DSM among Chinese adults are still inadequate and warrant further investigations. It's crucial to identify related factors that can assist patients adhere to DSM regimens (Luo et al., 2015; Rosland et al., 2014). Furthermore, strong family bonds are highly valued in Chinese culture (T. Liu, 2012). For many diabetes adults, family is the environment for DSM, and family support is closely related to successful self-management behavior of T2DM, which must be taken account for DSM (Rintala, Jaatinen, Paavilainen, & Astedt-Kurki, 2013).

The prevalence of diabetes in Wenzhou was reported to be 15.50% in 2015, compared to 12.27% and 12.44% in 2010 and 2013, respectively (Y. Q. Shao, Fan, Li, Zhang, & Weng, 2015). T2DM complications are complex and time-consuming, and there is a high mortality rate from diabetes in Wenzhou (15.50 per 100,000),

especially for T2DM (91.34%) (Y. Q. Shao et al., 2012). However, DSM as an important tool for T2DM is not ideal throughout China, including Wenzhou. Thus, the researcher conducted this study to ascertain the situation of DSM among Chinese adults with T2DM, and to examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict DSM among Chinese adults with T2DM in Wenzhou, China. The information obtained from this study could be provided for nurses and other primary health care workers to better understand the situation of DSM among T2DM adults in Wenzhou and further determine relevant factors, which can help them to make a better diabetes self-management plan and intervention for adults with T2DM to promote health.

Research purpose

1. To ascertain diabetes self-management among adults with type 2 diabetes mellitus in Wenzhou, China.

2. To examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with type 2 diabetes mellitus in Wenzhou, China.

Research hypotheses

Diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with type 2 diabetes mellitus.

Scope of the study

The aims of this study are to ascertain diabetes self-management among adults with T2DM and to examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with T2DM. This study was conducted with adults with T2DM who visited the

diabetes outpatient department (OPD) at the First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China. Data were collected from June to July, 2021.

Conceptual framework

This study was based on Ryan and Sawin' s (2009) the individual and family self-management theory (IFSMT). The IFSMT stated that self-management is a "complex dynamic phenomenon" and that it consists of 3 dimensions: context, process, and outcomes (P. Ryan & Sawin, 2009). According to this theory, self-management is conducted in the context of risk and protective factors specific to the condition, physical and social environment, and individual and family (P. Ryan, 2009). Also, the outcomes of self-management are divided into proximal outcomes and distal outcomes (P. Ryan & Sawin, 2009). The factors in the dimension of context affect the participation of individuals and families in the process of self-management, and can directly affect the outcomes dimension as well. Promoting the self-management process of individuals and families can bring more positive outcomes, which includes proximal outcomes and distal outcomes (P. Ryan & Sawin, 2009). Also, improvements in individual and family outcomes can translate into improvements in health practitioners and system outcomes (P. Ryan, 2009).

In the context dimension (risk and protective factors), the condition-specific factors are the physiological, structural or functional characteristics of the conditions, treatment or prevention conditions, which can affect the number, type and nature of the behaviors required for self-management (De Geest, von Renteln-Kruse, Steeman, Degraeve, & Abraham, 1998; A. A. Ryan, 1999; Simons & Blount, 2007). Environmental factors are physical or social, including access to healthcare, transition or setting to another, transportation, neighborhood, work, school, culture, or social capital (Aday, 1994; Danziger & Lin, 2000; Schilling, Grey, & Knafl, 2002; Williams, 1999). Individual and family factors are the direct characteristics of

individuals and families, like literacy, learning ability, family structure and so on (P. Ryan, 2009).

In the process dimension (the self-management process), knowledge and beliefs affect self-efficacy, outcome expectancy, and goal congruence of specific behaviors (P. Ryan & Sawin, 2009). Self-regulation is a process to change health behavior, including goal setting, self-monitoring and reflective thinking, decision-making, planning and participation, self-evaluation, and management of physical, emotional, and cognitive responses associated with changes in health behavior (P. Ryan & Sawin, 2009). Social facilitation includes the concepts of social influence, social support, and negotiated collaboration among individuals, families and health care professionals (P. Ryan & Sawin, 2009).

Proximal outcomes are individual and family self-management behaviors and cost of health care services, and distal outcomes are health status, quality of life, and cost of health (P. Ryan & Sawin, 2009).

According to IFSMT, diabetes knowledge, perceived self-efficacy, social support that are set in this study, are viewed as the influencing factors respectively from knowledge, belief, and social facilitation. Fatalism is viewed as the context in the theory. It is showed that the above four factors including diabetes knowledge, perceived self-efficacy, fatalism and social support are presented as the independent variables and may predict the dependent variable, diabetes self-management, all of which are shown in Figure 1.

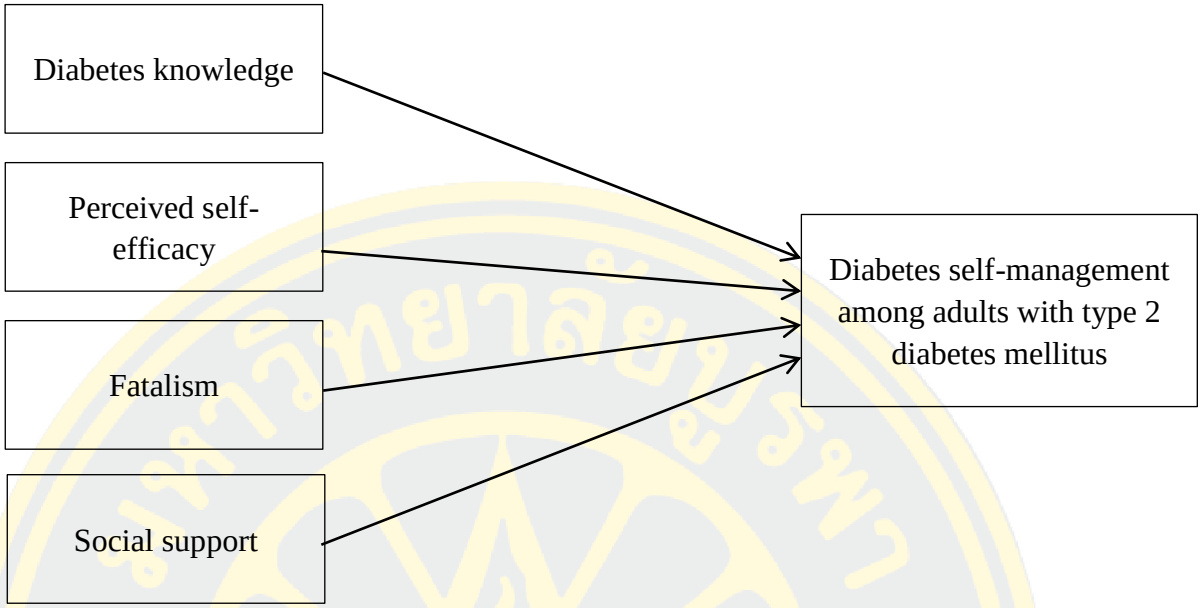

Figure 1 Research framework

Operation definition

Adults with type 2 diabetes mellitus refer to adults who have been diagnosed as T2DM for at least six months and come to the diabetes outpatient department at the First Affiliated Hospital of Wenzhou Medical University in Wenzhou, China for regular follow up.

Diabetes self-management refers to recommended behavioral activities that adults with T2DM actively participate in, including dietary control, glucose monitoring, medication adherence, physical activity, and physician contact. The Chinese version of The Diabetes Self-Management Questionnaire (DSMQ) was used to measure diabetes self-management, which was translated and modified by C. Q. Li et al. (2018).

Diabetes knowledge is defined as the understanding of adults with T2DM about diabetes and its management, including basic physiology of diabetes, food choices, general diabetes care, and sick day management. It was measured by the

Chinese version of the Diabetes Knowledge (DKN) scales that was translated and modified by X. Yin et al. (2008).

Perceived self-efficacy is the confidence of individuals with T2DM in their abilities to perform DSM activities, such as getting sufficient physical activities and checking blood glucose. It was measured by the Chinese version of the Self-efficacy Scale for Patients with Type 2 Diabetes Mellitus (SE-Type 2 scale) that was translated and modified by X. Yin et al. (2008).

Fatalism is defined as the individuals' perception of what they encounter during coping with the disease, including pre-determination, luck, and pessimism. It was measured by the Chinese version of Fatalism Scale that was translated and modified by X. Zhang, Zuo, and Zhao (2018).

Social support is defined as perception of adults with T2DM about the assistance and encourage that individuals receive to cope with the difficulties in the process of diabetes self-management. It was measured by the perceived social support scale translated by Jiang (1996).

CHAPTER 2

LITERATURE REVIEWS

This chapter presents an overview of T2DM, diabetes self-management among adults with T2DM, and factors related to diabetes self-management among adults with T2DM.

Type 2 diabetes mellitus (T2DM)

Diabetes mellitus has become one of the fastest-growing health challenges of the 21st century and become a global public health crisis (IDF, 2021). As one of the types of that, T2DM, described as “noninsulin-dependent diabetes” or “adult-onset diabetes” before, which accounts for 90-95% of all diabetes (ADA, 2021b). Approximately 537 million adults (20-79 years old) worldwide suffer from type 2 diabetes in 2021 (an average of 1 in 10 people with diabetes), and there is a rapid increase in the prevalence of T2DM (IDF, 2021; Y. Z. Li et al., 2020). In Wenzhou, it is reported that the prevalence of diabetes in Wenzhou is 15.50% in 2015, compared to 12.27% and 12.44% in 2010 and 2013, respectively (Y. Q. Shao et al., 2015). A survey in 2017 for adult residents shows that 1,488 adults with type 2 diabetes were detected among 11,765, with a detection rate of 12.6% (Zhang et al., 2017). The incidence was statistically significant for adults over 20 years of age in the 2007-2017 survey in Zhejiang Province, with an average annual growth of 4.01% (in particular, 12.89% for 20-29 years and 8.72% for 30-39 years), indicating a clear trend towards a younger incidence of T2DM (Wang et al., 2020).

Definition of diabetes mellitus

Diabetes mellitus is a heterogeneous group of disorders, which is viewed as a serious, long-term condition that occurs when the body cannot produce any or enough insulin or cannot effectively use the insulin it produces (IDF, 2019). It is a

kind of complex and chronic illness that requires continuous medical care and multifactorial risk-reduction strategies in addition to blood glucose control (ADA, 2021k). Also, continuous diabetes self-management education and support (DSMES) for diabetes are essential to prevent acute complications and reduce the risk of long-term complications (ADA, 2021k).

Classification of diabetes mellitus

According to American Diabetes Association [ADA] (2021b), diabetes can be classified into the following four categories:

1. Type 1 diabetes mellitus (T1DM): due to autoimmune β-cell destruction, usually leading to absolute insulin deficiency.

2. Type 2 diabetes mellitus (T2DM): due to a progressive loss of adequate β-cell insulin secretion frequently on the background of insulin resistance.

3. Specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young), diseases of the exocrine pancreas (such as cystic fibrosis and pancreatitis), and drug- or chemical-induced diabetes (such as with glucocorticoid use, in the treatment of HIV/AIDS, or after organ transplantation).

4. Gestational diabetes mellitus: diabetes diagnosed in the second or third trimester of pregnancy that was not overt diabetes before gestation.

Diagnostic criteria of diabetes mellitus

Diabetes may be diagnosed based on plasma glucose criteria, either the fasting plasma glucose (FPG) value or the 2-h plasma glucose (2-h PG) value during a 75-g oral glucose tolerance test (OGTT) or A1C criteria (International Expert Committee, 2009). The diagnostic criteria in ADA are as follows (ADA, 2021b):

1. Fasting plasma glucose (FPG) ≥ 126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.

2. Two-hour (2-h) plasma glucose (PG) ≥ 200 mg/dL (11.1 mmol/L) during oral glucose tolerance test (OGTT). The test should be performed as described by the

World Health Organization (WHO), using a glucose load containing the equivalent of 75g anhydrous glucose dissolved in water.

3. A1C ≥ 6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is National Glycohemoglobin Standardization Program (NGSP) certified and standardized to the Diabetes Control and Complications Trial (DCCT) assay. In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.

4. In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥ 200 mg/dL (11.1 mmol/L).

Signs and symptoms of type 2 diabetes mellitus

T2DM symptoms can be comparable to T1DM symptoms, although in general, the presentation of T2DM is less visible, and even can be asymptomatic (IDF, 2021). Therefore, 1/3 to half of adults with T2DM may be undiagnosed (IDF, 2021). The classic symptoms of T2DM include unintended weight loss, polydipsia (increased thirst), polyphagia (increased hunger), and polyuria (increased urination) (Awuchi, Echeta, & Victory, 2020).

Complications of type 2 diabetes mellitus

Complications from T2DM can be divided traditionally into macrovascular and microvascular (Zheng et al., 2018). Macrovascular complications are due to damage to larger blood vessels, including cardiovascular diseases such as heart attacks, stroke, and peripheral vascular disease (ADA, 2021i; Zheng et al., 2018). Microvascular complications are due to damage to small blood vessels, including neuropathy, nephropathy, and retinopathy (ADA, 2021j; Zheng et al., 2018). Complications of type 2 diabetes mellitus are very common. The manifestations of T2DM tend to be less strong generally, which most likely leads to a failure to be diagnosed promptly, and when it is not identified for long periods, complications such as retinopathy or lower extremity ulcers may already be present at the time of diagnosis, which are also long-term (Gregg et al., 2014; IDF, 2021).

It is confirmed that for cardiovascular disease alone, the incidence of adults with diabetes in high-and middle-income countries is as high as 32% (IDF, 2019). In China, most individuals with T2DM have at least one complication, of which cardiovascular complications in particular are the leading cause of morbidity and mortality in these patients (Zheng et al., 2018). For one of the microvascular complications, diabetic retinopathy, the incidence among patients with T2DM is from 28.5% to 40.3% in the United States, and the incidence is about 25.4% in China, which has a great socio-economic impact (IDF, 2019). Besides, Patients with T2DM are at higher risk for hepatitis B infection and are more likely to develop complications from influenza and pneumococcal disease (ADA, 2021d). The complications of T2DM lead to significantly increased costs directly and indirectly influence T2DM reduced quality of life and increased risk of early death as well (ADA, 2021h; ADA, 2021i; IDF, 2021).

In some developed countries, management mainly through glycemic control and cardiovascular risk management has produced good outcomes, but for the rest of the world, it is rare (Gregg, Sattar, & Ali, 2016). Internationally, DSM is considered an effective means of glucose control and has been identified as a significant component of successfully preventing or delaying the complications of diabetes (IDF, 2019).

Treatment of type 2 diabetes mellitus

The goal of treatment for T2DM is to control blood glucose by achieving an HbA1c level of less than 7% (53 mmol/mol) in the absence of significant hypoglycemia or other adverse effects of treatment, whereas the less stringent A1C target (8% [64 mmol/mol]) may be appropriate for patients with limited life expectancy or where the harms of treatment outweigh the benefits (ADA, 2021f). The treatment of T2DM is always divided into pharmacological treatment and non-pharmacological treatment (Pfeiffer & Klein, 2014).

For pharmacological approach, many different treatments are available for glycemic control (Pfeiffer & Klein, 2014). In oral medications, metformin is considered as the first choice for the treatment of T2DM, which should be continued as long as it is tolerated and not contraindicated, once starting (ADA, 2021h). It is particularly suitable for obese, insulin-resistant patients and is also effective in skinny patients and has beneficial effects in reducing the risk of cardiovascular events and death (ADA, 2021h; Pfeiffer & Klein, 2014). If metformin is contraindicated or poorly tolerated, alternative drugs are selected, including sulfonylurea, DPP-4 inhibitors, SGLT-2 inhibitors, thiazolidinedione, α -Glucosidase inhibitors, meglitinides and so on (ADA, 2021h). One anti-hyperglycemic drug (monotherapy) is usually sufficient initially, but only maintains targets of blood glucose for a few years, later it is often necessary to add drugs with a different second mechanism of action (combination therapy) (Pfeiffer & Klein, 2014).

If catabolism (weight loss) or hyperglycemia occurs, or when A1C level (> 10% [86 mmol/mol]) or blood glucose level is very high (≥ 300mg/dL [16.7 mmol/L]), adding insulin should be considered as early as possible (ADA, 2021h). Insulin can be classified into rapid-acting insulin (like Lispro, Aspart), short-acting insulin (human regular), intermediate-acting insulin (human NPH), long-acting insulin (like Glargine, Detemir), and premixed insulin products (ADA, 2021h). If basal insulin has been titrated to an acceptable fasting blood glucose level (or a dose of .5 units/kg/day with signs of the need for additional therapy) and A1C remains above target, advancing co-injection therapy needs to be considered (ADA, 2021h). It is crucial to use insulin appropriately and to avoid hypoglycemia episodes. American Diabetes Association [ADA] (2021h) recommends that pharmacological selection should be patient-centered, taking into account factors including effects on cardiovascular and renal complications, efficacy, risk of hypoglycemia, impact on weight, cost, risk of side effects, and patient preferences, and suggests that medication

regimens and medication-taking behavior should be reassessed regularly (every 3-6 months) and adjusted.

Expect for pharmacological treatment, effective behavioral management and mental health are viewed as the basis for achieving treatment goals for patients with diabetes, including DSMES, medical nutrition treatment (MNT), routine physical activities, smoking cessation counseling and psychosocial care if necessary (ADA, 2021d; Pfeiffer & Klein, 2014). American Diabetes Association [ADA] (2021d) encourages patients, their families and care providers to engage in person-centered collaborative care.

The common treatment of T2DM is mainly through western medicine (M. Liu, Liu, Xu, Zhang, & Cai, 2016). However, due to the serious side effects of drugs, complementary and alternative treatments have attracted more attention among patients and physicians, especially in China, including herbal medicine, acupuncture and other traditional Chinese medicine (TCM) (M. Liu et al., 2016; Nahas & Moher, 2009).

Diabetes self-management among adults with type 2 diabetes mellitus

Definitions of self-management

World Health Organization (WHO) describes self-management as one of the key components of improving chronic care (WHO, 2005). Importantly, behavioral skills to support the management of chronic condition at home, including the necessary knowledge of medication, the use of self-monitoring tools and the acquisition of self-management skills, has become the part of integrated care (Nuño, Coleman, Bengoa, & Sauto, 2012).

Besides, researchers have different understandings of self-management. For this research, the elements of individuals and families and the integration of these are emphasized in the whole process of self-management. As Ryan and Sawin said, self-management is “a multidimensional, complex phenomenon that can be conceptualized

as affecting individuals, dyads, or families across all developmental stages" (P. Ryan & Sawin, 2009, p. 218).

The individual and family self-management theory (IFSMT)

As a new mid-range descriptive theory, this theory draws lessons from and synthesizes the viewpoints of previous theories, and is presented from a different perspective (P. Ryan & Sawin, 2009). This theory provides a new conceptual basis for development and practice for self-management.

IFSMT means integrating health-related behaviors into the daily functions of individuals or families. Individuals or families assume responsibility for chronic diseases or healthy behaviors by purposefully carrying out a series of acquired behaviors. Living with a chronic disease or engaging in healthy behavior is complex, and it is necessary to integrate self-management behavior into the lifestyle of individuals and families (P. Ryan, 2009).

IFSMT presents that SM is a complex, dynamic, multidimensional phenomenon consisting of 3 dimensions, including context, process, and outcomes (P. Ryan & Sawin, 2009). The factors in the contextual dimension affect the participation of individuals and families in the process of self-management and directly affect the outcomes. Strengthening the individual's and families' self-management process can produce more positive outcomes. The outcomes include proximal or distal. Although the outcomes are related to individuals and families, improvements in personal and family outcomes translate into improvements in health care practitioners, and system outcomes.

Context (Risk and protective factors)

The context dimension consists of condition-specific factors, physical and social environment, and individual and family factors (P. Ryan & Sawin, 2009). Condition-specific is defined as a physiological, structural, or functional characteristic of the conditions, its treatment, or prevention of the conditions that impact the amount, type, and critical nature of behaviors needed for SM. The physical and social

environment is defined as physical or social factors, for example, access to health care, transition in health care providers or setting, transportation, neighborhoods, school, work, culture, and social capital, which can be risk and protective factors for individual and family SM. The Individual and family factors are defined as characteristics of the individual and family that increase or remove barriers to SM, including learning ability, developmental stages, literacy, family structure and function, and capacity to SM.

Process (The self-management process)

In this dimension of IFSMT, the process is based on the dynamic interaction among condition-specific knowledge and beliefs, self-regulation skills and abilities, and social facilitation (P. Ryan & Sawin, 2009). In the concept of this theory, having information about and embracing health beliefs, developing self-regulation abilities, experiencing social facilitation that supports them to participate in health behavior, which all can promote people's SM (P. Ryan, 2009).

Among them, knowledge and beliefs are defined as factual information and perceptions about health conditions or health behaviors, including self-efficacy, outcome expectancy, and goal congruence. Self-regulation is defined as the activities to change health behaviors to promote SM including goal-setting, self-monitoring and reflective thinking, decision-making, planning, and action for health behavior, self-evaluation, and emotional control. Social facilitation includes social influence, support, and negotiated collaboration. Social influence is some expert knowledge that advises and encourages individuals and families to engage in specific health behaviors to enhance SM. These persons may be friends, relatives, neighbors, peers, health care providers, work colleagues, and members of community groups or electronic media like magazines, television, or the internet. Social support has consisted of emotional, instrumental, or informational support that is provided by a person or family to assist or promote SM of patients (P. Ryan & Sawin, 2009).

Proximal and distal outcome

This dimension includes proximal and distal outcomes. Proximal outcomes include engagement in SM behaviors related to treatment regimens, symptom management, use of recommended pharmacological therapies, or others (P. Ryan & Sawin, 2009). Participation in SM behaviors may or may not affect the cost of health care services (P. Ryan, 2009). Distal outcomes include health status, quality of life, or perceived well-being and cost of health (P. Ryan & Sawin, 2009).

Among the above three dimensions, the factors in the dimension of context affect the ability of individuals and families to participate in the process, which also has a direct impact on the outcome dimension. Also, the contents in the dimension of the process are internally related to each other, which are connected to the contents in the dimension of context, and affect the dimension of outcome. The construction of the outcome dimension is affected by the dimensions of context and process, and the achievement of proximal outcomes at least partially affects and even leads to distal outcomes (P. Ryan & Sawin, 2009).

Diabetes self-management among adults with type 2 diabetes mellitus

Many prior studies have demonstrated that diabetes self-management is critical for overall diabetic treatment and control, and the current nursing concept for this population emphasizes self-management as well (Gunggu et al., 2016; Vas et al., 2017). DSM is defined as activities that adults with T2DM actively participate in recommended behavioral activities, including dietary control, glucose monitoring, medication adherence, physical activity, and physician contact (C. Q. Li et al., 2018). Effective DSM can promote adults with T2DM to obtain adequate metabolic control, to prevent or delay the complications successfully, and to achieve a satisfactory quality of life (IDF, 2019; Vas et al., 2017). However, DSM is complex and multidimensional. In the process of DSM, adults with T2DM need to take care of their health problems and adapt to changing needs or demands, which also means that DSM depends to a large extent on changes in health behavior (Cochran & Conn,

2008; Narayan, Ali, & Koplan, 2010; Vas et al., 2017). It is a difficult effort for most diabetic people and is still one of the greatest challenges in modern life (Narayan et al., 2010).

The previous study in Saudi Arabia demonstrated that the mean score of DSM was 5.04 out of 10 (measured by DSMQ), which means that the level of DSM was not high (Al-Qahtani, 2020). In Europe, it was confirmed that DSM did not seem ideal, whether in relatively rich areas or relatively poor areas (Penn et al., 2015; Portillo et al., 2017; Rogers et al., 2015). For example, in Norway, although diabetic patients strive to improve their health through DSM, only 55% of people with T2DM maintained DSM and achieved their long-term blood glucose treatment goals (Mouland, 2014). Compare the situation of Europeans with T2DM, McElduff et al. (2005) found the outcomes of DSM were worse for South Asians, especially for glucose management (HbA1c: European 8.5% vs. South Asian 9.0%, $p < .01$). From the review by Joseph et al. (2015), they stated that Asian Indians relied more on local traditional medicine and herbs to cope with T2DM and had a quite different diet. They were culturally influenced and always had different exercise choices, like Yoga (Joseph et al., 2015). In Southeast Asia, a cross-sectional study of 127 adults with type 2 diabetes mellitus in Indonesia showed that more than half of the participants had a poor level in DSM (Kurnia et al., 2017).

From the review on DSM, in many studies examining the self-management of T2DM, the sample sizes are always small, which limits confidence in the findings (Joseph et al., 2015). Also, Joseph et al. (2015) add that study design, length of intervention, and outcomes measured are varied, which makes it difficult to examine similarities across studies. DSM is inherently a complex concept, and patients' understanding of it may differ from the views of policymakers or medical professionals (Atkin, Stapley, & Easton, 2010). Thus, there is a need to increase understanding of the comprehensive demand for DSM, like considering the culture and belief in DSM (Foss et al., 2016; Joseph et al., 2015).

Components of diabetes self-management

Diabetes self-management is considered as activities that adults with T2DM actively participate in recommended behavioral activities, including dietary control, glucose monitoring, medication adherence, physical activity, and physician contact (C. Q. Li et al., 2018). In this study, these activities are considered as components of DSM to explore the situation about DSM among T2DM adults in Wenzhou, China.

1. Dietary control

There is no single ideal dietary distribution of calories from carbohydrates, fats, and proteins in the diet, for diabetic patients (ADA, 2021d). Therefore, the diet is tailored and individualized, while achieving total calorie and metabolic goals (ADA, 2021d). Therefore, the diet is tailored and individualized to the individual, while achieving total calorie and metabolic goals. Dietary control can save money and improve health outcomes, including A1C reduction, weight loss and cholesterol reduction (ADA, 2021d).

The diet should emphasize non-starchy vegetables, minimal added sugars, fruits, whole grains, and dairy products (ADA, 2021d). Reducing total carbohydrate intake in individuals with diabetes has been strongly shown to improve blood glucose and can be used in a range of dietary patterns to meet individual needs and preferences (ADA, 2021d). For diabetics on a fixed insulin dose, it is recommended that carbohydrate intake should be maintained over time and in quantity, while taking into account the duration of insulin action, which can improve blood glucose and reduce the risk of hypoglycemia (ADA, 2021d). People with diabetes are also encouraged to replace sugary drinks with water to control their blood sugar and weight and reduce their risk of cardiovascular disease and fatty liver disease, as well as to minimize their consumption of added sugars in place of healthier, more nutrient-rich foods (ADA, 2021d).

Several studies clarify that the successful DSM with a dietary plan includes slightly higher levels of protein (20-30%) (Ley, Hamdy, Mohan, & Hu, 2014).

Individuals with diabetic nephropathy are advised to maintain dietary protein at the recommended daily level of 0.8 g/kg body weight/day (ADA, 2021d). The Mediterranean diet pattern rich in unsaturated fats is considered to improve glucose metabolism and reduce the risk of cardiovascular disease (Sacks et al., 2017). Diabetic patients should limit their sodium intake to less than 2,300 mg/day, and adults with hypertension are limited to less than 1,500 mg/day (Maillot & Drewnowski, 2012).

Over the past 20 years, the diet of Chinese adults has reduced the intake of coarse grains and increased the intake of edible oils and foods of animal origin (Zhai et al., 2014). Besides, based on the influences of culture and history, Chinese people are used to a carbohydrate-based diet, such as rice and steamed buns. In 2007, China established the Chinese Dietary Guidelines (CDG), which is a national food-based policy (S. S. Wang, Lay, Yu, & Shen, 2016). Investigators set dietary targets based on CDG recommendations, but only one-third of participants in the survey meet them (Wang et al., 2018). The CDG is found to emphasize a balanced diet based on the general meaning of a healthy diet, but lacks sufficient evidence on the relationship between diet and disease in the Chinese population (Wang et al., 2018).

2. Glucose monitoring

Glucose monitoring is the key to the successful treatment of T2DM (Spellman, 2009). Glucose control has been confirmed to prevent microvascular and macrovascular events (Spellman, 2009), thus, it is necessary to control blood sugar for patients with T2DM. Glucose management is primarily assessed by HbA1c testing, and it also serves as a benchmark for determining long-term glucose control (ADA, 2021b; Spellman, 2009). ADA recommends that most people have HbA1c levels < 7% or lower in selected individuals if they can be achieved without hypoglycemic events (ADA, 2021b). Besides, ADA also recommends that HbA1c levels be tested at least twice a year for T2DM patients who meet their blood glucose goals, but those

who are unstable for blood glucose or do not meet the target must be tested four times a year (ADA, 2021b).

In some developed countries, management mainly through glycemic control and cardiovascular risk management has produced good health outcomes, but this is rare for the rest of the world (Gregg et al., 2016). A Chinese study reports that only 41.1% of patients with T2DM have HbA1c < 7.0% (Pan, Yang, Jia, Weng, & Tian, 2009). The recent study shows that glycemic control is poor general for Chinese adults with T2DM, and that only 40.3% of participants are fully aware of their condition, 62.9% received treatment and 16.9% achieved glycemic control (Wang et al., 2018). Previous studies have shown that dyslipidemia is closely related to glycemic control, and HbA1c levels can be used as an indicator of lipid levels in patients with T2DM (Yan et al., 2016). In patients with poor glycemic control, in addition to the initial DSM, attention to lipid levels and timely treatment has been recommended to achieve adequate glucose management (Wang et al., 2018).

The most successful treatments involve patients being encouraged to take an active role in the management of their disease, including glucose management in DSM (Spellman, 2009).

3. Medication adherence

Medication adherence is another part of DSM. Medication adherence is defined as the degree to which a patient adheres to the prescribed doses and intervals of medication (Brown et al., 2016). Medication non-adherence leads to poor health outcomes, increased utilization of health care services and all health care costs (Rasmussen, Chong, & Alter, 2007).

Previous studies have shown that positive health outcomes including good glycemic control, are positively associated with good medication adherence in adults with T2DM (Al-Qazaz et al., 2011). In the Chinese study, DSM behaviors related to medication adherence and diet are found to be significantly associated with HbA1c and explain 17.8% of the HbA1c variance, which means that medication adherence

can reduce blood sugar effectively and achieve better DSM (Ji et al., 2020). Many related intervention studies have been implemented to improve self-management in adults with T2DM (Hunt et al., 2012).

Medication adherence behavior is complex and requires a multifaceted strategy to achieve improvements. In 2003, World Health Organization reports on medication adherence, and there is little improvement and adherence remained poor, estimated at only 50% (De Geest & Sabaté, 2003). Medication adherence among adults with T2DM in Singapore is 65.0% (Lin et al., 2017). The relevant situation in China is similar. A study shows that only 54.8% of patients actively participated in DSM, and the rate of good performance on DSM in medication adherence is 75.8% (Yao et al., 2019). Besides, some studies mention that interventions for medication adherence still need to be further optimized in the future (Lin et al., 2017; Vervloet et al., 2012).

4. Physical activity

Physical activity is a catch-all term, and it includes all activities that increase energy use, which is considered as an important part of DSM (ADA, 2021e). Physical activity has been shown to improve blood glucose control, reduce cardiovascular risk factors, reduce body weight, and improve mood and quality of life (Piercy et al., 2018). In a study of patients with type 2 diabetes mellitus, the exercise intervention for at least 8 weeks duration is found to reduce A1C by an average of .66%, even though there is no significant change in BMI (Boulé, Haddad, Kenny, Wells, & Sigal, 2001).

Most adults with T2DM should engage in 150 minutes or more of moderate aerobic activity at least 3 days per week, with no activity for more than 2 consecutive days, or 2-3 times per week of resistance exercise on nonconsecutive days (ADA, 2021e). All adults with type 2 diabetes are advised to reduce their sedentary behavior and prolonged sitting should be interrupted every 30 minutes for better glycemic control (ADA, 2021e). For older adults with T2DM, activities for flexibility and

balance 2-3 times/week are recommended, like Yoga and Tai Chi can be used to increase flexibility, muscle strength and balance depending on personal preference (ADA, 2021e). Because age, personal health qualities, activities performed, and diabetes-related complications vary, American Diabetes Association [ADA] (2021e) recommends starting with the needs that are appropriate for each, and the diabetes care management team must understand that many patients have difficulty meeting recommended treatment goals and identify individualized approaches to improve goal attainment.

Some studies have found that adults with type 2 diabetes are lacking exercise and are used to sitting down (Bennett et al., 2019; Leng et al., 2016). The result of the recent study shows that a lower level of physical activity is associated with a higher risk of diabetes (HR = .95, 95% CI: .93- .97), while the lower level of sedentary leisure time is associated with a higher risk of diabetes (adjusted HR = 1.04, 95% CI: 1.03-1.05) (Bennett et al., 2019). The relationship between physical activities and diabetes may be largely mediated by adiposity, which underscores the importance of lifestyle and behavioral changes to promote glycemic stability and improve health outcomes (Bennett et al., 2019).

5. Physician contact

Physician contact is defined as regular visits to the physicians, nurses, or other health care providers, or in the case of an unstable medical condition, and it is designed to monitor their health and support self-management (du Pon et al., 2019). Higher levels of patient participation in these consultations have been shown to stabilize blood sugar, reduce complications and improve quality of life (Dulmen & Bijnen, 2011).

Engagement in medical follow-up consultation refers to actively contributing to the care process by asking questions, expressing concerns and stating preferences (Street & Millay, 2001). As part of DSM, patient involvement is also a prerequisite for shared decision-making, which has been shown to improve clinical,

psychosocial, and behavioral outcomes (ADA, 2021c). The complexities of changing behaviors in T2DM require a consultation-based approach, rather than the traditional approach of providing information and advice (Goetz et al., 2012).

The situation about physician contact is not ideal generally (du Pon et al., 2019). Some studies have found that several factors hindered follow-up of adults with T2DM, including a lack of need or motivation to engage, patients' fears of being seen as a nuisance, feeling time pressure during the visit, forgetting to ask questions, and difficulty remembering specifics after the visit, all contribute to poor rates of physician contact (Goetz et al., 2012; Henselmans, Heijmans, Rademakers, & van Dulmen, 2015). Effective physician contact is a significant part of DSM, but there is little evidence to examine in-depth about physician contact among Chinese adults with T2DM.

Effective dietary control, glucose monitoring, medication adherence, physical activity, and physician contact are confirmed to improve the condition of T2DM. Thus, in this study, DSM is defined as activities that adults with T2DM actively participate in recommended behavioral activities, including dietary control, glucose monitoring, medication adherence, physical activity, and physician contact.

Diabetes self-management among type 2 diabetes mellitus in China

China is the largest developing country in the world, with the largest population of diabetes in the world (140.9 million), accounting for a quarter of all adults with diabetes globally (IDF, 2021; Y. Z. Li et al., 2020). The prevalence of diabetes as defined by WHO criteria in Chinese adults increases from 9.7% in 2007 to 11.2% in 2017 (Y. Z. Li et al., 2020). T2DM for over 90% of all diabetes cases and also becomes a serious public health problem in China (IDF, 2021; T. Yin et al., 2019). The incidence of T2DM is increasing at a younger age, as a result of unhealthy eating habits and lifestyles leading to an increase in obesity (Wang et al., 2020). In China, there are numerous obstacles to providing good health care for diabetic adults and assisting them in controlling their blood sugar levels (Y. Wang et al., 2017).

Although there are a large number of people with T2DM, several studies have consistently stated that DSM was not ideal among Chinese adults with T2DM (Cui et al., 2020; Ji et al., 2020; Luo et al., 2015; Yao et al., 2019). Zhang et al. (2017) investigated 452 patients with T2DM in the community of Beijing and clarified that only 20.6% of the participants had optimal DSM (measured by SDSCA, the average score was 35.38), which was similar to the results of the studies conducted in Changsha, Hunan Province (20.5%) (Yu et al., 2013) and Xi'an, Shanxi Province (16.06%) (Cui et al., 2020). Also, a similar study on DSM of outpatients in Beijing showed that the average score (measured by SDSCA) was about half of the full score (47.70) (Lin et al., 2017). A study in Shandong showed that only 54.8% of patients actively participated in DSM, and the rates of good performance on DSM in medication adherence, dietary control, physical activity, and self-monitoring was 75.8%, 74.5%, 61.0%, and 25.8%, respectively (Yao et al., 2019). The finding was comparable to a study in western urban China, which found that only half of T2DM patients exhibited good DSM behaviors, with various percentages accounting for different dimensions (drug management 91.39%; diet management 81.68%; glucose monitoring 79.88%; foot care 77.37%; exercise management 74.99%; prevention and treatment of hyperglycemia/hypoglycemia 67.71%) (Huang et al., 2014). In Zhejiang province, C. R. Chen and Huang (2019) indicated that the level of DSM of patients with T2DM was not high (percentage of good levels of DSM was only 21%), through a survey of patients in Jinhua.

The reasons for the poor adherence to DSM for Chinese adults with T2DM are still not clear, which presents that the factors related to DSM need to be identified urgently and interventions should be considered to address these problems (Luo et al., 2015). Some studies show, compared with patients in other Asian countries, the Chinese pay more attention to exercise and have more health-conscious (How, Ming, & Chin, 2011). Culture and belief also need to be taken into consideration. In China, DSM among diabetic adults always occurs in a family context (T. Liu, 2012). In

Chinese traditional culture, strong family bonds and close family relationships are highly valued, which may have even more profound implications for DSM (T. Liu, 2012). In recent years, the effect of treatment combined with traditional Chinese medicine on DSM has also been considered and studied (K. Li, 2017).

Moreover, some limitations of the current studies also should be recognized. In some studies, the information about DSM is based on self-reporting, which is subjective and affected by memory easily; in some studies, the sample size of studies is not sufficient, which is the reason to suspect some bias; and in the present studies, there are a variety of measurement tools to measure DSM and many factors that they study, which exists some differences, like the common instruments measuring self-management of diabetes in China are Summary of Diabetes Self-Care Activities (SDSCA) or Diabetes Self-management Assessment Report Tool (D-SMART) (C. R. Chen & Huang, 2019; Luo et al., 2015; Sun, Zhao, Dong, & Li, 2011; H. X. Yang, 2020; T. Yin et al., 2019).

Measurement for diabetes self-management

The Chinese version of The Diabetes Self-Management Questionnaire (DSMQ): For the evaluation of self-management of patients with diabetes, researchers have developed and used many scales for diabetic patients to study self-management behavior, such as the Diabetes Self-management Assessment Report Tool (D-SMART), Diabetes Self-Care Activities (SDSCA) and so on. But many scales have not been confirmed to correlate with glycemic control, or the correlation is weak (C. Q. Li et al., 2018). The DSMQ is selected to assess DSM in this research.

The DSMQ was designed and developed by Schmitt in 2013. In 2018, Li and his colleagues translated and revised this questionnaire according to the culture and situation in China (C. Q. Li et al., 2018). Combined with the cultural background of China, item 3, item 7 and item 10 are changed to be more concise and clearer to understand. Item 6 is adjusted because patients no longer have to take traditional pen and paper records (C. Q. Li et al., 2018). The Chinese version of DSMQ contains 16

items and 5 dimensions, including dietary control (item 2, 5, 9, and 13 [5 and 13 reverse-scored]), glucose monitoring (item 1, 6, and 10 [10 reverse-scored]), medication adherence (item 4 and 12 [12 reverse-scored]), physical activity (item 8, 11 and 15 [11 and 15 reverse-scored]) and physician contact (item 3, 7 and 14 [7 and 14 reverse-scored]), plus sum scale about overall evaluation (item 16).

The total scale Cronbach's α was .764, the Cronbach's α of five dimensions ranged from .651 to .899 (the Cronbach's α of dietary control, glucose monitoring, medication adherence, physical activity, and physician contact: .651, .753, .748, .899 and .824 respectively), and the split-half reliability was .864, which shows that this scale can more scientifically evaluate the self-management behavior of patients with diabetes (C. Q. Li et al., 2018).

Factors related to diabetes self-management among adults with type 2 diabetes mellitus

In the IFSMT, many factors are considered to affect health behavior change during the process of self-management, which may affect outcomes directly or indirectly (P. Ryan & Sawin, 2009). Based on the theory, the factors - diabetes knowledge, perceived self-efficacy, fatalism and social support are selected as independent variables, which is presented in Figure 2 and also shows the interaction of these factors among dimensions. The association between these factors and diabetes self-management is as follows.

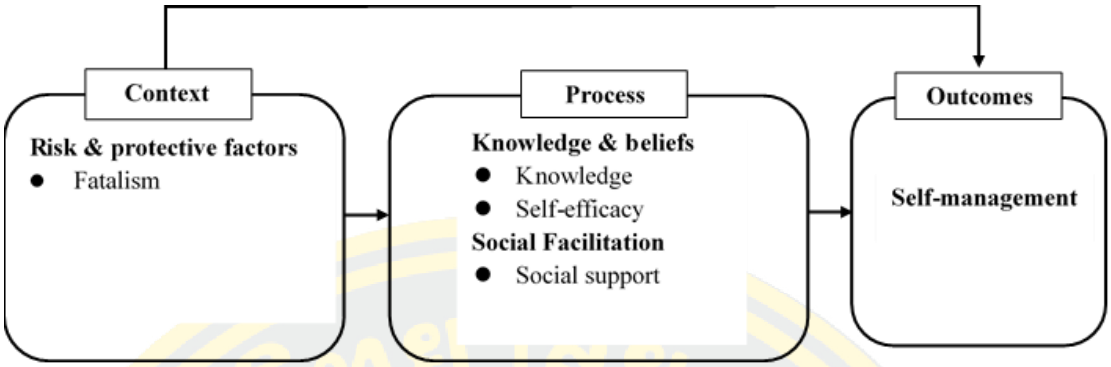

Figure 2 Study framework

Diabetes knowledge

Diabetes knowledge is defined as the patient's understanding of information about the physiological aspects of diabetes and the understanding of the principles of diabetes treatment (X. Yin et al., 2008). It is an important aspect of DSM, and improving diabetes knowledge in adults can facilitate the resolution of disease conditions and help improve DSM (Hu et al., 2012). P. Ryan and Sawin (2009) also explained the tight correlation between diabetes knowledge and DSM. Many previous studies showed the association between diabetes knowledge and DSM (Adu et al., 2019; Bezo, Huang, & Lin, 2020; Kueh et al., 2017; Schmidt-Busby, Wiles, Exeter, & Kenealy, 2018). Bezo et al. (2020) found that diabetes knowledge could significantly affect DSM (β = .26, p = .001), and the similar result was showed from the cross-sectional study conducted in Malaysia (β = .15, p < .05) (Kueh et al., 2017). However, the correlation between diabetes knowledge and DSM was confirmed in another study (r = .26, p = .003) (Kurnia et al., 2017). In a study conducted by Abubakari et al. (2013), participants' diabetes knowledge scores (measured by DKT) were lower overall and there were some differences by ethnicity (white British participants scored higher than black African (11% points difference) and black Caribbean (7% points difference), which means that differences by ethnicity may affect patients' DSM and overall disease outcomes.

In China, prior studies also presented the influence of diabetes knowledge on DSM to varying degrees (Ji et al., 2020; Luo et al., 2015; M. Shi et al., 2016). M. Shi et al. (2016) divided the participants who were diagnosed with T2DM into the family-involved group (FIG, $n = 60$) and single-involved group (SIG, $n = 60$) to investigate the effect of the family-involved group from the aspect of knowledge. They presented that the scores of two groups were not high (measured by the knowledge, attitude and practice (KAP) questionnaire; the score of FIG and SIG: 30.75 and 12.42) and that diabetes knowledge highly correlated with DSM outcomes (FIG: OR = 1.95, $p < .001$; SIG: OR = 8.55, $p < .001$) (M. Shi et al., 2016). Luo et al. (2015) made a summary in the systematic review that diabetes knowledge is positively correlated not only with overall DSM, but also with certain specific DSM behaviors, such as medication management, foot care, self-monitoring, and healthy lifestyle behaviors. The result of the study in 2020 revealed that there was only a correlation between diabetes knowledge and DSM ($r = .16$, $p < .01$) and showed that the mean score of diabetes knowledge was 10.7 (measured by DKN) (Ji et al., 2020). However, the study conducted for diabetic adults in Beijing found that there was no significant correlation between diabetes knowledge and DSM ($r = .06$, $p = .60$) (Hu et al., 2012).

Perceived self-efficacy

Perceived self-efficacy refers to the degree of confidence in a person's ability to act successfully under normal and stressful situations (P. Ryan & Sawin, 2009). It is the confidence in their abilities and is involved in DSM. Better perceived self-efficacy promotes the positive evaluation of information and skills used in DSM and also can help remove barriers in the DSM process (Adu et al., 2019). The review by Joseph et al. (2015) summarized the strong association between perceived self-efficacy and DSM, which was confirmed and further inferred as a predictor ($\beta = .217$, $p < .001$) by Kurnia et al. (2017). In the result of the study by Kurnia et al. (2017), about 66% of participants had moderate confidence (measured by the Self-Efficacy for Diabetes scale; 3-3.9 points), and then about 24.4% of the participants had highly

confidence (≥ 4 points). Other studies just clarified that there was a relationship between perceived self-efficacy and DSM, like the randomized controlled trial of a self-management program to improve self-efficacy among Thai adults with T2DM (β = .4, 95% CI: .2- .6, p < .001) (Wichit et al., 2017).

Studies about the association between perceived self-efficacy and DSM have also been conducted in different places in China. T. Liu and Wei (2021) studied 2609 cases of T2DM in three provinces and found that perceived self-efficacy could predict DSM (β = - .204, p < .001). In a 2019 study of 2166 T2DM patients, the mean score of self-efficacy was 31.9 out of 40 (measured by the Diabetes Empowerment Scale-Short Form), and the percentage of patients who performed well in DSM of medication adherence, dietary control, physical activity, and self-monitoring of blood glucose was 75.8%, 74.5%, 61.0%, and 25.8%, respectively (Yao et al., 2019). The result of the study also confirmed that self-efficacy and DSM kept a positively significant correlation (OR = 1.06; 95% CI: 1.04-1.08; p < .001) (Yao et al., 2019). Similarly, Huang et al. (2014) concluded that there was positive correlation between DSM and self-efficacy in Chengdu, a typical city in western China (OR = .93; 95% CI: .90- .96; p < .001), with being significant on both each specific aspects of DSM (diet management, sports management, drug management, blood glucose monitoring, foot care, and prevention and treatment of hyperglycemia/hypoglycemia: r= .23, .33, .24, .22, .30 and .19 respectively, p < .01). In Beijing, the study about the effect of perceived self-efficacy on patients with T2DM showed an indirect effect on DSM (OR = 1, β = .33, p < .001) (Lin et al., 2017).

Fatalism

Fatalism is always described as the health belief that each event and situation is predetermined and is beyond one's power to change the course of these events (Rustveld et al., 2009; Sukkarieh-Haraty et al., 2018). It follows that individuals with the high level of fatalism are more likely to lose all means of self-control and become reliant on a higher power completely (Unantenne et al., 2013).

Fatalism encompasses the concepts of predestination, luck, and pessimism (Shen et al., 2009). It always shows as inhibitions and passivity in seeking medical care and health-care utilization (Franklin et al., 2007). Fatalism, mainly in diabetes and cancer, has been presented to be a barrier to effective self-management (Unantenne et al., 2013). It can lead to uncontrolled glucose levels, increased risk of mental illness and reduced quality of life (Egede & Ellis, 2010; Walker et al., 2012). Thus, this is seen to be a significant psychosocial structural factor that may affect self-management outcomes, and adults with this personality trait or life view may benefit from targeted interventions when considered into the adjustment (P. Ryan & Sawin, 2009; Walker et al., 2012).

From previous studies, Egede and Bonadonna (2003) conducted seven focus groups and found that fatalism was multidimensional for people with T2DM and it was associated with DSM in African Americans. The review by Gonzalez-Zacarias et al. (2016) summarized that fatalism was associated with DSM, and emphasized the effect of ethnic differences in this regard. Osborn et al. (2010) found that less fatalism (r = - .22, p < .05), more diabetes knowledge (r = .22, p < .05) and more social support (r = - .27, p < .01) were independent and direct predictors of DSM, which also influenced blood glucose control (r = - .20, p < .05). A study clarified that fatalism resulted in ineffective DSM behavior and poor adherence to DSM (Saidi, Milnes, & Griffiths, 2018). By contrast, the relationship was described in more detail in the study by Walker et al. (2012). The result showed that fatalism was significantly associated with medication adherence (β = .029, p < .001), dietary control (β = - .063, p < .001), physical activities (β = - .055, p < .001) and glycemic management (β = - .055, p = .001), but there was no significant correlation between diabetes fatalism and foot care (r = - .107, p = .057) (Walker et al., 2012). In China, there were few studies about the association between fatalism and DSM and there were few measurements about fatalism in China (Suo, Yan, & Zhang, 2019).

Social support

Social support is considered as the individual's perception that if a person needs assistance, he or she can get assistance at any time (Ahola & Groop, 2013). Provided support may be emotional, informational, appraisal or others, which may be obtained from various approaches, including friends, family, medical workers, and so on (Tang et al., 2008). In a factor analysis of Chinese studies, social support is often divided into family support and extra-family support, considering the specific family culture (Jiang, 1996). Effective social support can increase self-efficacy, improve DSM and boost treatment goals (Gonzalez-Zacarias et al., 2016). Many studies confirmed that social support was an important factor to affect patients' DSM (Adu et al., 2019; Frier et al., 2020; Gonzalez-Zacarias et al., 2016; Wichit et al., 2017). Social factors and T2DM were interdependent, and inadequate DSM in T2DM was more common in people with poor social support, but the level of social support was uneven (Frier et al., 2020). Gunggu et al. (2016) clarified that family support was considered to be an important factor influencing DSM (β = .198, p = .007). The result of the study of 2017 in Indonesia showed that about 40% of the participants had the low social support they receive (measured by the brief Chronic Illness Resources Survey) and nearly half (52.8%) were in the middle of the range of social support (Kurnia et al., 2017). This study by Kurnia et al. (2017) also presented that social support did not have any significant effects on DSM among adults with T2DM in Malang City (r = .314, p < .01), which was the same as the result of the study by Wattanakul (2012). King et al. (2010) found social support was independently associated with healthy lifestyle behaviors (β = .25, p < .0001), but not medication management (β = - .009, p = .84).

In China, the study of adults with T2DM in the community found that the participants received a higher level of indirect support (measured by directive and nondirective support scale among patients with diabetes [DNSS-PD]; the mean score of 3.13) than direct support (the mean score of 2.53) and that only 27.6% of adults

received a high level of direct support and about half of the adults (50.8%) received a high level of indirect support, which means that both levels of social support were low (Zhang et al., 2017). Many studies presented the association between social support and DSM (Luo et al., 2015; M. Shi et al., 2016; T. Yin et al., 2019; Zhang et al., 2017). Through the multi-factor analysis, there was a positive correlation between social support and DSM (OR = .62, 95% CI: .49- .94, p = .023) (Huang et al., 2014). A recent research conducted in China also showed that social support effect DSM, including medication adherence (OR = 1.25, 95% CI: 1.02-1.55); exercise management (OR = 1.19, 95% CI: 1.06-1.35); self-monitoring of blood glucose [SMBG] (OR = 1.16, 95% CI: 1.03-1.32), but expect for diet management (OR = 1.09, 95% CI: .93-1.27) (T. Yin et al., 2019). Social support and DSM have only been shown to correlate in the study of Ji et al. (2020) (r = .30, p < .01). Data on the relationship between socioeconomic factors and DSM are reportedly scarce and there are socioeconomic differences in DSM in China (Le et al., 2016; T. Yin et al., 2019).

Summary

Diabetes has undoubtedly become a public health issue that cannot be ignored, and it is also a major challenge for China as the country with the largest number of diabetics in the world. T2DM accounts for the great majority of total diabetes and has been studied widely by various professional domains in China. Diabetes self-management, which is acknowledged as an important approach of diabetes care, has inevitably become the focus of attention. However, the situation about DSM in China is not ideal generally, and adults with T2DM are often unable to adhere to DSM. The causes for poor adherence to DSM among Chinese adults with T2DM are still inadequate, and it is particularly necessary to identify the correlate factors that can promote DSM. According to the literature review, the results are found to be inconsistent in the studies exploring the relationship of these factors with DSM and it is still unclear if the factors act alone or in concert in DSM. In addition,

there are still limited studies to explore the factors related to the self-management of adults with T2DM, particularly in Zhejiang province in China.

Therefore, the researcher conducted this research about DSM among adults with T2DM and examined whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict DSM among adults with T2DM. The finding of this study supplied this gap and provided scientific evidence to support the future development of DSM for people with T2DM in nursing practice and nursing research.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter presents the research methodology that includes research design, population and sample, study setting, research instruments, psychometric property of the instruments, protection of human rights, data collection procedures, and data analysis procedures.

Research design

A predictive correlational study was conducted to ascertain diabetes self-management among adults with T2DM and to examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with T2DM.

Population and sample

Population

The population of this research was adults with T2DM, who came to the diabetes outpatient department at the First Affiliated Hospital of Wenzhou Medical University in Wenzhou, Zhejiang province, China. The information collected from this diabetic OPD showed that approximately 80 to 100 diabetic patients visit the OPD every day.

Sample

The sample was adults with T2DM, who came to diabetes OPD at the First Affiliated Hospital of Wenzhou Medical University, Zhejiang province, China. The inclusion criteria of the sample include:

1. Age ≥ 18 years of age, ≤ 60 years old
2. Diagnosed with T2DM for at least 6 months

3. Have a certain ability to write and can speak Chinese

4. Have good orientation to place and time and has no history of mental illness

5. Have no major physical disability such as blindness or reduced physical mobility requiring assistants

6. Have stable conditions such as no limitation of physical activity caused by complications or comorbidities

Sample size

The sample size was determined based on a rule of thumb "$N \geq 104 + m$", where N is the number of participants and m is the number of independent variables (Tabachnick & Fidell, 2007). Considering this study, it was calculated as $N \geq 104 + 4 = 108$, with four independent variables. Thus, 108 samples were recruited in this study.

Sampling technique

Simple random sampling was used in this research. Samples randomly selected in this way are unbiased and it can ensure that the difference between sample and population attributes is purely accidental. Each selected participant is accidental and fair.

The researcher numbered the outpatients who met the criteria (outpatient nurses reviewed relevant medical records and determined if criteria is met). The application program with simple random sampling was used to select the queue number to recruit participants. After signing in for attendance at the diabetes OPD, the individual was guided by the outpatient nurse to the special private room of diabetes OPD. The researcher introduced the study simply. With the consent of the selected patient, the researcher guided the individuals to sign the consent form and complete the questionnaires. About 5 to 10 individuals were recruited a day, five days a week. When the samples reached the required sample size, the recruitment was stopped for the next phase of the study.

Study setting

The study was conducted in the diabetes outpatient department (OPD) of the First Affiliated Hospital of Wenzhou Medical University in China, which is one of the first four comprehensive hospitals in Zhejiang province that have passed the third grade hospital accreditation. Diabetes OPD has two hospital sites: the old hospital in the Lucheng district and the new one in the Ouhai district. This study was conducted in the new hospital (the Ouhai hospital district, where the Diabetes OPD is mainly located), with a construction area of 355,000 m^2 and a larger number of attendances compared to the other sites. The diabetes OPD is open five days a week (from Monday to Friday), and service from 08:30 am to 11:30 am and from 01:30 pm to 04:30 pm, and it serves about 80 to 100 diabetic patients in a day.

The diabetes OPD is run by two to four diabetes specialists and three nurses a day. Diabetes patients come to diabetes OPD, according to the physician's advice on the time of re-visit (usually 3-6 months for each visit), or according to their condition (like blood sugar control situation). Most patients who came to diabetes OPD were accompanied by families or friends. Physicians are mainly responsible for adjusting treatment schemes and dealing with health problems and concerns raised by patients and their companions. After the appointment with the physician, the nurse leads the patient and companion to the health education room, and provide them with routine health education about DSM, such as appropriate diet and exercise, information and dosage of medication the patient uses, how to inject insulin, how to avoid hypoglycemia, and so on. In the process, the nurse also checks the patient's eyesight, feet and skin, and reminds the patient of the next time to see the doctor.

Research instruments

Data were collected by six questionnaires: the demographic questionnaire, the Diabetes Self-Management Questionnaire (DSMQ), the Chinese version of the Diabetes Knowledge (DKN) scale, the Chinese version of the Self-efficacy Scale for

Patients with Type 2 Diabetes Mellitus (SE-Type 2 scale), the Chinese version of Fatalism Scale, and the Chinese version of the perceived social support scale (PSSS).

The demographic questionnaire

The demographic questionnaire was developed for this research by the researcher. It includes 1). General information: gender, age, weight, height, BMI, educational level, marital status, living condition, working status, income level; 2). Health information: duration of T2DM diagnosis, diabetic medications, glycemic control situation (like FBG, 2-h PG, and HbA1c), any complications related to T2DM, and any comorbidities. The information from the first part of the demographic questionnaire was obtained by participants' self-report, and the second part was obtained from the medical record.

The Diabetes Self-Management Questionnaire (DSMQ)

The DSMQ was designed and developed by Schmitt in 2013 (Schmitt et al., 2013). It was developed based on the literature on putative predictors of glycemic outcomes, which consisted of 16 items (Schmitt et al., 2013). In this study, the Chinese version of DSMQ (C. Q. Li et al., 2018) was used to measure DSM. Li and his colleagues translated and revised this questionnaire according to the culture and situation in China (C. Q. Li et al., 2018). Combined with the cultural background of China, item 3, item 7 and item 10 were changed to be more concise and clearer to understand. Item 6 is adjusted because patients no longer have to take traditional pen and paper records (C. Q. Li et al., 2018). The Chinese version of DSMQ contains 16 items and 5 dimensions, including dietary control (item 2, 5, 9, and 13 [5 and 13 reverse-scored]), glucose monitoring (item 1, 6, and 10 [10 reverse-scored]), medication adherence (item 4 and 12 [12 reverse-scored]), physical activity (item 8, 11 and 15 [11 and 15 reverse-scored]) and physician contact (item 3, 7 and 14 [7 and 14 reverse-scored]), plus sum scale about overall evaluation (item 16). Item 16 is only included in the total score and is not a subcategory.

The questionnaire is signed as a four-point Likert scale, which assigns 0-3 points from “does not apply to me” to “applies to me very much”. In this scale, 7 items are worded positively (items 1, 2, 3, 4, 6, 8, 9), and 9 items are worded negatively (items 5, 7, 10, 11, 12, 13, 14, 15, 16). Reverse worded items would be scored the other way around, with higher scores indicating better self-management. The score can be the score of each subscale or a total score for the whole instrument as a “sum score”. Score index = (actual score score/highest possible score) x 10, for example, 37 (exemplary sum) / 48 (maximum possible sum of 16 Items) x 10 = 7.7 points. The score ranges from 0 to 10 for the total scale and each subscale. The higher the score, the better the self-management behavior (C. Q. Li et al., 2018).

The total scale Cronbach's α is .764, and the split-half reliability is .864 (C. Q. Li et al., 2018). For each of these dimensions, the Cronbach's α of dietary control, glucose monitoring, medication adherence, physical activity, and physician contact are .651, .753, .748, .899, and .824, respectively (C. Q. Li et al., 2018). These show that this scale can assess the self-management of adults with diabetes more scientifically.

The Diabetes Knowledge (DKN) scales

Diabetes knowledge was measured with the Chinese version of the Diabetes Knowledge scales (X. Yin et al., 2008), which includes 14 items. This instrument was adapted from the Diabetes Knowledge scales that was developed, based on the literature on diabetes knowledge and pilot-testing from over 300 diabetic subjects, which includes 15 items (Beeney, Dunn, & Welch, 2003). The DKN scale is designed to measure patients’ knowledge in the basic physiology of diabetes, food choices, general diabetes care, and sick day management.

The original DKN scale in U.S. samples is reasonably internally consistent (Cronbach’s alpha ranged from .72 to .79) (Beeney et al., 2003). Changes are made in the original DKN to adapt the instrument for Chinese adults with type 2 diabetes (X. Yin et al., 2008). For items 11 and 14, diet or food exchange reflecting American

tastes are modified or excluded to comply with Chinese eating habits. Considering the diet habit, item 4 in the original scale is deleted because it is repeated with item 5. The last three multiple-choice questions are turned into single-choice topics (X. Yin et al., 2008).

Participants received a score of 1 for a correct answer or 0 for an incorrect or unknown answer. The total score could range from 0 to 14, with a higher score indicating a higher level of diabetes knowledge. The Cronbach's alpha for the Chinese version of the knowledge measure is .62 (X. Yin et al., 2008). It is considered that Chinese mainland diabetes patients may have less access to systematic diabetes education than those in the United States, which reflects the reduced Cronbach's alpha value between two populations (X. Yin et al., 2008).

The Self-efficacy Scale for Patients with Type 2 Diabetes Mellitus (SE-Type 2 scale)

Perceived self-efficacy was measured with the Chinese version of the SE-Type 2 scale (X. Yin et al., 2008). The scale was translated and modified from SE-Type 2 scale that was developed by Bijl, Poelgeest-Eeltink, and Shortridge-Baggett (1999) based on Bandura's concept of self-efficacy (Bandura, 1977). Taking into account the current situation and economic and cultural background of the diabetic patients in China, SE-Type 2 scale was selected and the corresponding cultural adjustment was carried out (X. Yin et al., 2008).

In the original version of the SE-Type 2 scale, the items related to the management of hypoglycemia or hyperglycemia are deleted, because Chinese adults with T2DM always are not instructed on how to adjust according to blood sugar levels (X. Yin et al., 2008). Instead, it is up to physicians to adjust the drugs and make other relevant suggestions. There are also other changes to the wording to reflect cultural differences. For item 3, It is changed to "I think I am able to follow my diet when I dine together with my friends.", because it is more common for Chinese people to

have dinner with friends rather than to attend a reception or party (X. Yin et al., 2008).

The Chinese version of the SE-Type 2 scale includes 7 items to evaluate the self-efficacy of patients with T2DM in the aspects of dietary control (item 2 and 3), physical activity (item 5 and 6), glucose management (glucose testing [item 1]; medication adherence [item 7]), and foot care (item 4). Each item adopts the scoring method of the Likert five-level score. 1 = no, surely not; 2 = probably no; 3 = maybe yes/maybe no; 4 = probably yes; 5 = yes, surely. The total score of 7 items reflects the level of patients' self-efficacy and the score ranges from 7 to 35. The higher the score, the stronger the sense of self-efficacy (Bijl et al., 1999).

The Cronbach's α of the total scale is .81 and the test-retest reliability with a 5-week time interval is .79 ($p < .001$) (Bijl et al., 1999). In 2006, the scale is adapted because of cross-culture, and the Cronbach's α of the total scale is .88, and test-retest reliability with a 4-week time interval is .91 (Kara, van der Bijl, Shortridge-Baggett, Asti, & Erguney, 2006). The Cronbach's α of the Chinese version of the SE-Type 2 scale is .87, the range of the Cronbach's α of each dimension is from .793 to .943, which shows it is valid and reliable (X. Yin et al., 2008).

The Fatalism Scale

Fatalism was measured with the Chinese version of the Fatalism Scale, which was the only one that had been translated into the Chinese version to measure fatalism in China (X. Zhang et al., 2018). The original scale is developed by Shen and colleagues based on analyses of the literature and their own conceptualization, and it is composed of 20 items, which consists of three dimensions: predetermination, luck, and pessimism (Shen et al., 2009).

In the original version of this scale, the meaning of item 1 is repeated with that of item 2 (X. Zhang et al., 2018). Item 4 can be understood as either predetermined or pessimistic, and the characteristic roots of item 4 and item 5 are close to 1 (1.16 and 1.07, respectively) (X. Zhang et al., 2018). In the context of

Chinese culture, the meaning of item 5 and item 6 is not consistent with the dimension “predetermination”, which is closer to judging the probability of the event (X. Zhang et al., 2018). Thus, 4 items (item 1, 4, 5, and 6) are deleted. The Chinese version of the Fatalism Scale is revised and consisted of 16 items, and still contains three dimensions: Predetermination (item 1, 2, 3, 4, 5, and 6), Luck (item 7, 8, 9, and 10), and Pessimism (item 11, 12, 13, 14, 15, and 16) (X. Zhang et al., 2018).

The scale uses Likert 5 score, which means "totally disagree", "disagree", "uncertain", "agree" and "totally agree" respectively. The total score ranges from 16 to 80. The higher the score, the higher the level of fatalism, which means that the individual has less self-control. The Cronbach’s α for the Chinese version of Fatalism Scale is .84, and the test-retest reliability is .79, which reflects the scale is a valid and reliable instrument to evaluate fatalism in Chinese culture (X. Zhang et al., 2018).

The perceived social support scale (PSSS)

The original version of the perceived social support scale was developed by Blumenthal et al. (1987) and translated into Chinese version by Jiang (1996). This scale was used to measure the degree of social support that an individual perceived.

The perceived social support scale has 12 items which consist of 2 subscales, including family support, and support outside the family. The original scale has three subscales which are family, friends and significant others, however, the author who developed the Chinese version considered the situation in China and make “friends and significant others” these two subscales into “support outside the family”. The scale uses a 7-point Likert scale (1 = very strongly disagree; 2 = strongly disagree; 3 = disagree; 4 = neutral; 5 = mildly agree; 6 = strongly agree; 7 = very strongly agree). The accumulated score of item 3, 4 8, 11 indicate the final score of family support, and the accumulated score of other items indicate the final score of support outside the family. The score ranges from 12 to 84, with the higher score indicating a higher level of social support (Jiang, 1996). The Cronbach’s α of the total

scale is .88, and the scale tested in T2DM patients showed the Cronbach'α is .795, which shows it is valid and suitable (Sang, Leng, Lei, Xiong, & Jin, 2019).

Psychometric property of the instruments

The Chinese version of all the instruments was used in this study, and they were tested and validated by the experts in some previous studies, which meant all instruments had good validities. The Cronbach's α could be found in previous studies to show that the reliability of all instruments applied in this study was ideal. The reliability of the instrument was used Cronbach's alpha to determine the reliability of each questionnaire with 30 adults with T2DM, who had the same characteristics as the sample of the study. Cronbach's alpha of the DSMQ, the DKN, the SE-Type 2 scale, the fatalism scale and the PSSS for try out and main study were presented in Table 1.

Table 1 The reliability of the instruments

	Try out (n = 30)	Main Study (n = 108)
DSMQ	.775	.774
DKN	.806	.776
SE-Type 2 scale	.778	.776
Fatalism scale	.819	.855
PSSS	.866	.827

Protection of human rights

The research proposal was submitted for approval from the Institutional Review Board (IRB) of Burapha University (BUU) (G-HS 111/2563) and IRB in the First Affiliated Hospital of Wenzhou Medical University, China (2021-093). Only after that, this research was carried out.

Before the data collection process, all participants were informed carefully about the aims of the study and the involvement procedure. The researcher described

the nature of the study and also emphasized the individuals' rights to participate or to refuse to participate in the study. The data in this study only was collected from those individuals who were willing to participate and signed the consent form. The consent form was completed before data collection. The participants were informed that they have the right not to answer any questions and have the right to change their mind and withdraw from the study at any time if they want. All the forms for collecting data were anonymous and participating in this study was no harm for the participants.

Confidentiality was maintained and no names or other identifiable information was disclosed in this study report. All data on the paper documents were stored in a secure place and only utilized for the research, and all electronic data were locked by a password that only the researcher can be accessed. All data will be destroyed one year after the publication of the research day. Also, if any individuals would like to know the results of this study, they could contact the researcher.

Data collection

The data collection procedures in the study were conducted by the researcher as follows:

1. After the researcher got approval from the Faculty of Nursing in BUU, the researcher submitted the research proposal to IRB in BUU and IRB in the First Affiliated Hospital of Wenzhou Medical University, China for ethical review.

2. The researcher asked permission for data collection from the Faculty of Nursing in BUU and the First Affiliated Hospital of Wenzhou Medical University, China regarding the objectives and procedures of the study information.

3. After the researcher got permission from the First Affiliated Hospital of Wenzhou Medical University, China. The researcher explained the data collection procedure to the staff who worked in the diabetes OPD. The researcher talked with doctors and nurses in advance and ensured that if the patient was occupied when the queue number was called, the patient' s visit to the doctor would be protected.

4. The researcher went to the Diabetes OPD from 8:30 am to 11:30 am and from 1:30 pm to 4:30 pm every weekday (from Monday to Friday).

5. The queue numbers of those individuals who fulfilled the inclusion criteria was recorded in advance in the application program for simple random sampling. The queue number was randomly selected to recruit the participants in this study. The individual was taken by the outpatient nurse to the special private room after check-in at the diabetes OPD.

6. The researcher met and informed the participants about the aim of the study, ethical issues, and human protection of the study. Written consent was signed after the participants understood and were willing.

7. The data was collected through self-reported questionnaires in a special private room. Reading glasses were prepared to make sure the participants see clearly. It took 15-20 minutes to complete the whole set of questionnaires. The researcher made sure that the participants could see the doctors in time as soon as the questionnaires were completed.

8. The researcher checked if the questionnaires had been filled completely after the participants submitted them. All the participants were informed if they chose not to answer some of the questions purposely, they could leave them unanswered.

9. Three participants refused to answer the fatalism scale of questionnaires. For this, the researcher adjusted the order of the questionnaire and put the fatalism scale at the end to prevent participants from being influenced in their responses to other scales.

10. This process was repeated until the required sample size was reached.

Data analysis

Data were analyzed by using statistic software (SPSS 26.0). The result of the study was evaluated using a conventional statistical criterion ($\alpha = .05$), and data analysis included:

1. The descriptive statistics were used to describe frequencies, percentages, means, and standard deviations of the participants' demographic data and variables.

2. Various functions of the statistics were used to test the assumptions of multiple regression, including normality of variables, no outlier, no autocorrection, homoscedasticity, linearity, and no multicollinearity.

3. Standard multiple regression was performed to examine the predicting factors of diabetes self-management among adults with T2DM.

CHAPTER 4

RESULTS

This chapter presents the results of data analysis. The purpose of this study was to ascertain diabetes self-management among adults with T2DM and to examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with T2DM in Wenzhou, China. The result of the study is presented through 3 sections: description of demographic characteristics and health information, description of dependent and independent variables, and factors influencing diabetes self-management among adults with type 2 diabetes mellitus

Description of demographic characteristics and health information

Demographic characteristics

A total number of 108 adults with T2DM coming to the diabetes OPD at the First Affiliated Hospital of Wenzhou Medical University in Wenzhou, Zhejiang province, China was included in this study. The participants consisted of 65 males (60.2%) and 43 females (39.8%). The age of participants ranged from18 years old to 60 years old with a mean age of 47.7 years, and 75.9% of them were over 40 years old. The largest proportion for the level of education was to complete secondary school (50%), followed by primary school (26.9%) and Bachelor's degree and higher level (14.8%). 94.6% of the participants had married and 90.7% lived with family members. For individual income, there are 19.4% of the participants having less than RMB 3,000 in a month, and most participants (97.2%) had medical insurance. In the samples, no one needed assistance to carry out daily activities at home. The same percentage of participants (22.2%) drank alcohol and smoked cigarettes currently. Demographic characteristics of the participants are shown in Table 2.

Table 2 Demographic characteristics of the participants (n=108)

Characteristics	**Number (*n*)**	**Percentage (%)**
Gender		
Male	65	60.2
Female	43	39.8
Age (*M* = 47.69, *SD* = 9.46, Min = 18, Max = 60)		
18 - 30 years	5	4.6
31 - 40 years	21	19.5
41 - 50 years	32	29.6
51 - 60 years	50	46.3
Level of education		
Less than primary	9	8.3
Primary school	29	26.9
Secondary school	54	50
Bachelor's degree and higher	16	14.8
Marital status		
Married	102	94.6
Single	5	4.5
Divorced/widowed	1	0.9
Living condition		
Living alone	10	9.3
Living with family members	98	90.7
Individual income (income/month in Yuan)		
Less than ¥ 3,000	21	19.4
¥ 3,000 - 4,999	36	33.3
¥ 5,000 - 10,000	34	31.5
More than ¥ 10,000	17	15.8

Table 2 (Continued)

Characteristics	Number (*n*)	Percentage (%)
Payment method of medical expenses		
Medical insurance	105	97.2
At one's own expense	3	2.8
Alcohol		
Current alcohol drinker	24	22.2
Former alcohol drinker	12	11.1
No history of drinking alcohol	72	66.7
Smoking status		
Current smoker	24	22.2
Former smoker	14	13
No history of smoking	70	64.8

Health information

Health information of the participants is shown in Table 3. Through calculation, 37.9 % of the participants were overweight and 6.5% were obese (include class I and class II), while few participants (3.7%) were underweight. It was observed that the diabetes diagnosis duration of participants ranged from .5 years to 30 years with a mean duration of 6.37 years. 76.9% of the participants came to the diabetes OPD less than 2 times in a year (M = 2.24, SD = 1.95). More than half of the participants (n = 63, 58.3%) only used oral medication for T2DM, and 17.6% of participants (n = 19) used combined therapy with oral medication and insulin. 47.2% of the participants had a co-morbidity (n = 51), of which hypertension accounted for nearly a half (n = 25). The majority of the participants (88.9%) didn't have diabetes-related complications, such as retinopathy, nephropathy and neuropathy. Based on the data, only 16.7% of the participants had controlled blood glucose (latest HbA1c < 7.0%), while 21.3% had uncontrolled blood glucose moderately (latest HbA1c: 7.0% -

7.9%) and 62% had high levels of poor blood glucose control (latest HbA1c ≥ 8.0%) (*M* = 9.15, *SD* = 2.24).

Table 3 Frequency, percentage, mean, and standard division of health information of the participants (n=108)

Health information	**Number (*n*)**	**Percentage (%)**
Body Mass Index (BMI, *M* = 24.71, *SD* = 3.70, Min = 17.70, Max = 39.20)		
Underweight (< 18.5 kg/cm^2)	4	3.7
Normal weight (18.5 - 24.9 kg/cm^2)	56	51.9
Overweight (25 - 29.9 kg/cm^2)	41	37.9
Obesity class 1 (30 – 34.9 kg/cm^2)	5	4.6
Obesity class 2 (35 – 39.9 kg/cm^2)	2	1.9
Duration of T2DM (*M* = 6.37, *SD* = 5.54, Min = 0.5, Max = 30)		
< 1 years	9	8.3
1-5 years	47	43.6
6 - 10 years	40	37
> 10 years	12	11.1
Frequency of visit to diabetes OPD (in 1 year) (*M* = 2.24, *SD* = 1.95, Min = 1, Max = 15)		
≤ 2 times	83	76.9
3 - 4 times	17	15.7
≥ 5 times	8	7.4

Table 3 (Continued)

Health information	**Number (*n*)**	**Percentage (%)**
Medication		
Only oral medication (Biguanides, Sulfonylureas, others [α-Glucosidase inhibitors, Thiazolidinediones, DPP-4 inhibitors])	63	58.3
Single oral medication	35	32.4
2 oral medications	23	21.3
3 oral medications	5	4.6
Only insulin	26	24.1
Combined therapy	19	17.6
Co-morbidities		
None	41	38.0
1 co-morbidity	51	47.2
Hypertension	25	23.1
Chronic kidney disease	2	1.9
Others (hepatic adipose infiltration, hyperlipemia, gout)	24	22.2
More than 1 co-morbidity	16	14.8
Diabetes-related complications		
None	96	88.9
Retinopathy	4	3.7
Nephropathy	1	0.9
Neuropathy	4	3.7
More than 1 complication (retinopathy and neuropathy)	3	2.8

Table 3 (Continued)

Health information	Number (*n*)	Percentage (%)
Latest HbA1c (*M* = 9.15, *SD* = 2.24, Min = 4.7, Max = 16.7)		
< 7.0%	18	16.7
7.0% - 7.9%	23	21.3
≥ 8.0%	67	62.0

Description of dependent and independent variables

The study variables were diabetes self-management, diabetes knowledge, perceived self-efficacy, fatalism and social support. DSM is described from 5 dimensions, including dietary control, glucose monitoring, medication adherence, physical activity and physician contact, which is presented in Table 4. The independent variables are shown in Table 5.

As illustrated in Table 4, the overall score of diabetes self-management ranged from 2.1 to 8.8, and the mean score of DSM among participants was 4.85 out of 10 (*SD* = 1.42). For the subscales, medication adherence had the highest mean score of 6.31 (*SD* = 2.85), followed by physician contact (*M* = 6.20, *SD* = 1.66), dietary control (*M* = 5.32, *SD* = 2.09) and physical activity (*M* = 4.50, *SD* = 2.88). The glucose monitoring subscale had the lowest mean scores of subscales (*M* = 2.40, *SD* = 1.95)

Table 4 Range, mean and standard deviation of diabetes self-management (n=108)

DSM and its subscales	Range		*M*	*SD*
	Possible score	Actual score		
Diabetes self-management	0 - 10	2.1 - 8.8	4.85	1.42
Dietary control	0 - 10	0.8 - 10	5.32	2.09
Glucose monitoring	0 - 10	0 - 8.9	2.40	1.95
Medication adherence	0 - 10	0 - 10	6.31	2.85
Physical activity	0 - 10	0 - 10	4.50	2.88
Physician contact	0 - 10	1.1 - 10	6.20	1.66

In table 5, results revealed that the mean score of diabetes knowledge was 7.87, ranging from 2 to 13 (*SD* = 2.69). The overall score of perceived self-efficacy ranged from 15 to 33, with a mean score of 24.19 (*SD* = 4.50). The mean score of fatalism was 33.65 (Actual score: 16-57, *SD* = 8.47). Social support score of the participants ranged from 40 to 78 with a mean score of 57.32 (*SD* = 8.60).

Table 5 Range, mean and standard deviation of the independent variables (n=108)

Independent variables	Range		*M*	*SD*
	Possible score	Actual score		
Diabetes knowledge	0 - 14	2 - 13	7.87	2.69
Perceived self-efficacy	7 - 35	15 - 33	24.19	4.50
Fatalism	16 - 80	16 - 57	33.65	8.47
Social support	12 - 84	40 - 78	57.32	8.60

Factors influencing diabetes self-management among adults with type 2 diabetes mellitus

Preliminary analysis was conducted to test the assumption of the regression analysis, including checking normality of the variables, outliers, homoscedasticity, linear relationship, and multicollinearity. The normal distributions were met which tested through skewness, standard error, P-P plots and Kolmogorov-Smirnov test. Boxplot, leverage and cook' s distance presented no outliers. Durbin-Watson test was performed to test for autocorrelation and the Durbin-Watson statistic value was 1.49 which indicated the absence of autocorrelation. The scatter plot of the residuals showed that the assumption of linearity and homoscedasticity were met. The linear relationship among study variables was shown in scatter plot and correlation test. Collinearity diagnostics determined no multicollinearity among independent variables by tolerance and variance inflation factors (VIF), and correlation test showed that no correlation among the variables was greater than .85. However, fatalism was not correlated with diabetes self-management, therefore, fatalism was not entered into the regression model.

Table 6 shows the correlation of the variables. It could be seen from the correlation matrix that diabetes self-management was positively related with diabetes knowledge (r = .594, p < .001), perceived self-efficacy (r = .447, p < .001) and social support (r = .312, p = .001) with statistical significance. However, there was no significant correlation between diabetes self-management and fatalism (r = -.152, p = .117).

Table 6 Correlation matrix among the variables (n=108)

	Diabetes self-management	**Diabetes knowledge**	**Perceived self-efficacy**	**Fatalism**	**Social support**
Diabetes self-management	1.000				
Diabetes knowledge	.594**	1.000			
Perceived self-efficacy	.447**	.487**	1.000		
Fatalism	-.152	-.429**	-.081	1.000	
Social support	.312**	.292**	.281**	-.106	1.000

** $p < .01$; * $p < .05$

Standard multiple regression was performed to examine whether diabetes knowledge, perceived self-efficacy, and social support can predict diabetes self-management. The summary of standard multiple regression is shown in Table 7. The results revealed that diabetes knowledge, perceived self-efficacy, and social support explained 38.2% of the variance in diabetes self-management ($F_{3, 104} = 23.021$, $p < .001$). The analysis presented that only diabetes knowledge ($\beta = .468$, $p < .001$) and perceived self-efficacy ($\beta = .184$, $p = .039$) significantly predicted diabetes self-management. Of two significant predictors, diabetes knowledge better explained the variance in DSM followed by perceived self-efficacy. However, social support ($\beta = .123$, $p = .129$) could not predict DSM significantly.

Table 7 Summary of regression analysis for variables predicting diabetes self-management among patients with type 2 diabetes mellitus (n=108)

Predicting factors	***B***	***SE***	***β***	***T***	***p*-value**
Diabetes knowledge	.247	.047	.468	5.290	< .001
Perceived self-efficacy	.058	.028	.184	2.086	.039
Social support	.020	.013	.123	1.531	.129
Constant = .334, R^2 = .399, Adj R^2 = .382, $F_{(3, 104)}$ = 23.021, p < .001					

CHAPTER 5
CONCLUSION AND DISCUSSION

This chapter makes the summary and discussion of the study. Conclusion, the implication of the findings, and recommendations for future researches are also provided in this chapter.

Summary of findings

This research was conducted to ascertain diabetes self-management among adults with T2DM and to examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support could predict diabetes self-management among adults with T2DM. This research was based on P. Ryan and Sawin (2009)' s the individual and family self-management theory (IFSMT). A total of 108 adults with T2DM who visited diabetes OPD at the First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China was recruited by simple random sampling. Data were collected by self-report questionnaires using the demographic questionnaire, the Chinese version of DSMQ (C. Q. Li et al., 2018), the Chinese version of DKN (X. Yin et al., 2008), the Chinese version of the SE-Type 2 scale (X. Yin et al., 2008), the Chinese version of Fatalism Scale (X. Zhang et al., 2018), and the Chinese version of PSSS (Jiang, 1996). The Cronbach alpha of the DSMQ, the DKN, the SE-Type 2 scale, the fatalism scale and the PSSS were .774, .766, .766, .855 and .827, respectively.

The results revealed that 60.2% of the participants were males (n = 65) and 39.8% were females (n = 43). The mean age of participants was 47.7 years, 75.9% of whom were over 40 years old. Half of the participants (50%) had the education level of secondary school and 26.9% completed primary school. The majority of the participants had married (94.6%) and lived with family members (90.7%), but no one needed assistance to carry out daily activities at home. 33% participants had RMB 3,000-4,999 in a month, followed by RMB 5,000-10,000 in a month (31.5%). Also, most participants (97.2%) had medical insurance. The same percentage of participants (22.2%) drank alcohol and smoked cigarettes currently.

In terms of health information, about half of the participants (51.9%) had normal weight (18.5 - 24.9 kg/cm^2), while 37.9 % of them were overweight and 6.5% were obese. The diabetes diagnosis duration of participants ranged from .5 years to 30 years with a mean duration of 6.37 years. Most of the participants (76.9%) came to the diabetes OPD less than 2 times in a year (M = 2.24, SD = 1.95). All visits were regular follow-up visits to supplement or modify medications. 58.3% of the participants (n = 63) only used oral medication for T2DM, and 17.6% of participants (n = 19) used combined therapy with oral medication and insulin. 47.2 % of the participants had a co-morbidity (n = 51) and almost half of them had hypertension (n = 25). Most participants (88.9%) didn't have diabetes-related complications while 11.1% had one or more diabetes-related complications. According to the data, the HbA1c level ranged from 4.7% to 16.7% and only 16.7% of the participants had controlled blood glucose (HbA1c < 7.0%), while 83.3% had uncontrolled blood glucose (HbA1c > 7.0%) (M = 9.15, SD = 2.24).

The overall score of diabetes self-management among the participants ranged from 2.1 to 8.8, with the mean score of DSM being 4.85 out of 10 (SD = 1.42) which reflected suboptimal DSM. Considering the DSM subscales, the medication adherence subscale had the highest mean score (M = *6.31*, SD = 2.85), followed by physician contact (M = 6.20, SD = 1.66), dietary control (M = 5.32, SD = 2.09) and physical activity (M = 4.50, SD = 2.88). In addition, the glucose monitoring subscale had the lowest mean scores of the subscales (M = 2.40, SD = 1.95). It was also stated that the mean score of diabetes knowledge was 7.87 out of 14 (SD = 2.69), the mean score of perceived self-efficacy was 24.19 out of 35 (SD = 4.50), and the mean score of fatalism was 33.65 out of 80 (SD = 8.47). Also, it was reported that social support was at a moderate level (M = 57.32, SD = 8.60).

The result of standard multiple regression analysis indicated that diabetes self-management among adults with T2DM was only predicted by diabetes knowledge (β = .468, p < .001) and perceived self-efficacy (β = .184, p = .039). The regression model showed that diabetes knowledge, perceived self-efficacy, and social support could explain 38.2% of the variance in diabetes self-management among adults with type 2 diabetes mellitus ($F_{3, 104}$ = 23.021, p < .001).

Discussion

1. Diabetes self-management (DSM) among adults with T2DM

From the result, the mean score of DSM among adults with T2DM was 4.85 out of 10 (*SD* = 1.42), which was less than half of the total score and highlighted that the DSM is not ideal. The subscale about medication adherence had the highest mean score of 6.31 (*SD* = 2.85), followed by physician contact (*M* = 6.20, *SD* = 1.66), dietary control (*M* = 5.32, *SD* = 2.09) and physical activity (*M* = 4.50, *SD* = 2.88). The glucose monitoring subscale had the lowest mean scores of all subscales (*M* = 2.40, *SD* = 1.95). The overall mean score and the mean scores of each subscale indicate suboptimal diabetes self-management among adults with T2DM, which is consistent with the findings of some previous studies in China (Cui et al., 2020; Ji et al., 2020; Yao et al., 2019). This is also similar to the study of Al-Qahtani (2020) in Saudi Arabia, who used the Arabic version of DSMQ, reported that the mean sum was 5.04 out of 10, and the mean score of health care use (physician contact), glucose management (including medication adherence and glucose monitoring), dietary control and physical activity was 5.63, 5.12, 4.96 and 4.46 respectively, all were inadequate.

In this present result, the medication adherence subscale had the highest score and the score for glucose monitoring subscale was significantly lower than other subscales, which is congruent with the finding in China (X. Y. Chen, Yan, Yuan, & Chen, 2018). X. Y. Chen et al. (2018) clarified that the subscale about medication adherence had the highest score (6.12±1.72) while the score of glucose monitoring subscale was lowest (1.54±1.56), which is similar to the previous study in China as well (Han, Yuan, Yang, & Shen, 2013). It can be seen that there is a wide variation in the dimensions of DSM in China, which may be a reason for the low level of DSM overall.

A prior study in China mentioned that compared with other dimensions, adults with T2DM are not fully aware of the significance of glucose monitoring (Zhu, F., & Ma, 2020). Also, this may be due to the lack of knowledge and skills about glucose monitoring, as well as the pain and financial burden associated with long-term blood glucose monitoring, the importance of diet and medication has been well understood by comparison (Zhu et al., 2020). In addition to this, the situation of

Covid-19 has restricted participants' physical activity to a certain extent, forcing individuals and families to adjust or cancel their plans, which may lead to physical activity being the second lowest of the subscales. The relatively high scores for medication adherence compared to other dimensions of DSM in this study might suggest that most adults with T2DM prefer to take their medication rather than change their behavior, which was more difficult for improving DSM. This thought had also been mentioned in the previous study (Gunggu et al., 2016).

From the IFSMT, P. Ryan and Sawin (2009) proposed that physical and individual factors including age, level of education, income, BMI, and comorbidities, impact directly the outcome that is DSM in this study. In terms of individual factors in demographic information, one possible reason might be that the mean age of participants was 47.7 years and most of them were working-age, who engaged in careers and had less time to take care of themselves. The finding of the previous study consistently was showed that age is identified as positive factor for DSM (Alodhayani et al., 2021; Huang et al., 2014). Compared with the elderly, they are busy engaging themselves in careers and social interactions so as to spend less time managing disease regularly (Weijman et al., 2005), which has also been clarified in other articles (Bezo et al., 2020; Yamashita, Kart, & Noe, 2012).

The previous study reported that patients with a higher level of education and higher income had significantly higher mean scores of DSM (Khalooei & Benrazavy, 2019). In this study, 26.9% of participants only completed primary school and 50% of them completed the secondary school, which means the overall level of education of the participants in this study was not high. In accordance with the IFSMT, educational level identified as the individual factor influences the SM outcome directly (P. Ryan & Sawin, 2009). Milo and Connelly (2019) stated that compared to those with lower educational levels, adults with higher levels of education had a better understanding of diabetes and diabetes complications, leading to lower HbA1c levels and desirable DSM outcomes.

In addition to educational level, income may also be a cause of poor DSM. In this study, 19.4% of the participants were still below the minimum income per capita (Less than RMB 3,000), 33% and 31.5% participants had RMB 3,000-4,999 and RMB 5,000-10,000 in a month respectively, which means that most participants

have low to medium levels of income. Despite the fact that the majority of people (97.2%) had medical insurance, those who need to take medication for a long period still had to bear part of the cost. A significant positive association between higher levels of income and better DSM was observed, and it was assumed to be related to adjustments in diet and medication, regulation of glucose (Luo et al., 2015).

BMI is used to document weight status (ADA, 2021g). For the result about BMI, 37.9 % of the participants were overweight and 6.5% were obese, which may be a contributor for poor DSM. Some studies approved that abnormal BMI seen as the negative factor influencing DSM was the barrier to achieving optimal DSM (Nwose et al., 2019; Zhang et al., 2017). An explanation that, patients with high BMI are more likely to develop comorbidities and complications (ADA, 2021g). The problem about insulin resistance and metabolic syndrome may exacerbate the complexity of condition, affecting DSM outcomes (Clark, 2004). Nwose et al. (2019) also stressed the complexity and significance of physical activity for diabetic adults with abnormal BMI.

Co-morbidities were considered to add the extra burden on DSM (Schmidt-Busby et al., 2018). Based on the IFSMT, the complexity of disease as the risk factor can influence self-management outcomes (P. Ryan & Sawin, 2009). In this study, 47.2 % of the participants had a co-morbidity, nearly half of which had hypertension, and 14.8% had more than one comorbidity. Individuals struggling with their own condition, need to manage multiple illnesses and prioritize the most severe symptoms or conditions they have ever encountered (Mayberry & Osborn, 2012; McElfish et al., 2015). Concerns about maintaining an appropriate regimen, according to Wild et al. (2007), can not only increase psychological stress, but also have a negative impact on DSM adherence.

HbA1c is known to be an indicator of improving glycemic control, and a good DSM program can reduce HbA1c levels (ADA, 2021f; Kassahun, Gesesew, Mwanri, & Eshetie, 2016). P. Ryan and Sawin (2009) expounded that the achievement of proximal outcomes leads, at least in part, to distal outcomes, and they also explained by the example that DSM promotes HbA1c control, thereby improving morbidity and mortality. However, 83.3% of participants had uncontrolled blood glucose, which is similar to the finding of Bukhsh et al. (2019) (83.0%). HbA1c

values obtained in this finding, as a DSM outcome indicator, also rationalize the DSM results that this population has poor DSM, and it must be taken into account.

2. Factors influencing diabetes self-management among adults with T2DM

The result of standard multiple regression analysis showed that all predictors could explain 38.2% of the variance in diabetes self-management among adults with type 2 diabetes mellitus ($F_{3, 104} = 23.021$, $p < .001$). Diabetes management among adults with T2DM was only predicted by diabetes knowledge ($\beta = .468$, $p < .001$) and perceived self-efficacy ($\beta = .184$, $p = .039$). Of two significant predictors, diabetes knowledge better explained the variance in DSM followed by perceived self-efficacy. From the correlation matrix, social support ($r = .312$, $p = .001$) was significantly related with DSM. However, there were no significant correlation between DSM and fatalism ($r = -.152$, $p = .117$). The results can be discussed as follows:

Diabetes knowledge

In this current finding, diabetes knowledge could predict DSM significantly ($\beta = .468$, $p < .001$), which means that diabetic adults with better diabetes knowledge had higher scores of DSM. Consistently, some prior studies also affirmed that diabetes knowledge could influence DSM in different areas, as a strong predictor (Bezo et al., 2020; Hou, Bai, XIao, & Xie, 2020; Kueh et al., 2017).

P. Ryan and Sawin (2009) explained the association between diabetes knowledge and DSM well and they clarified that knowledge itself does not lead to behavioral change, but enhanced knowledge is interrelated with many factors, and the self-regulatory behavior supported by knowledge engagement leads to engagement in SM behaviors and outcomes. The finding presented that the mean score of diabetes knowledge was 7.87 out of 14 ($SD = 2.69$), which means that the participants had not a high level of diabetes knowledge and it could be one possible reason for the low DSM score.

For low knowledge of diabetes, previous literature confirmed that duration of diabetes less than 5 years and low educational level were linked to low and moderate levels of diabetes knowledge (Kassahun et al., 2016; Milo & Connelly, 2019). In this current result, the number of participants with T2DM lasting less than 5 years was more than a half (51.9%) and the overall educational level of the

participants was not high, which could explain low diabetes knowledge scores. Diabetic adults with low educational levels may lack the abilities essential to seek for information on the internet or through other public resources, making it difficult for them to gain the necessary diabetes knowledge and skills (Kassahun et al., 2016). When compared to people with lower levels of education, Milo and Connelly (2019) clarified that those with greater levels of education had a better understanding of diabetes and diabetes complications, resulting in more desirable outcomes, Moreover, adults with more years of T2DM had more time to gain diabetes knowledge and skills than those with less diagnostic duration.

Perceived self-efficacy

Besides, perceived self-efficacy was also the variable that could significantly predict DSM (β = .184, p = .039). It implies that participants who had higher perceived in DSM self-efficacy would perform frequently the DSM activities. Similar with previous studies, perceived self-efficacy was found to be a predictor of DSM significantly in many different areas (Gunggu et al., 2016; Kurnia et al., 2017; T. Liu & Wei, 2021; Milo & Connelly, 2019).

P. Ryan and Sawin (2009) noted that self-efficacy is the degree of confidence in one's ability to successfully engage in behavior under normal and stressful situations. Individuals with T2DM are involved in many dimensions of DSM such as diet control, physical activities, blood glucose monitoring. These behavioral adjustments and changes require the individual's ability, confidence and determination based on self-assessment, which is probably why low self-efficacy leads to not ideal self-management adherence and poor DSM (Chin, Huang, & Hsu, 2013).

The results further validate the IFSMT theory that individuals and families develop self-efficacy when they gain knowledge and beliefs, which leads to better self-management outcomes (P. Ryan & Sawin, 2009). It could be checked from the correlation matrix that diabetes knowledge was correlated with perceived self-efficacy significantly (r = .487, p = < .01), which implies that inadequate diabetes knowledge may impact perceived self-efficacy, resulting in the low DSM score.

In the result of the perceived self-efficacy scores, the participants had not high mean score of perceived self-efficacy (M = 24.19, SD = 4.50), and the dimension involving glucose testing had a lower score than other dimensions, which is similar to

the results of the prior study (Yao et al., 2019) and compatible with the DSMQ results. Schmidt-Busby et al. (2018) also stated that low self-efficacy in DSM leads to less frequent blood glucose monitoring and that adults with T2DM may be concerned about the side effects of (multiple) medications or doses, as well as fear of being responsible for many things such as diet, exercise, medications, co-morbidities, all of which can lead to suboptimal DSM.

Fatalism

The current result presented that fatalism was not significantly correlated with DSM (r = -.152, p = .117) and it could not predict DSM, which rejected the hypotheses of this study. The result of this study was not in accordance with previous studies which have demonstrated that fatalism was associated with DSM (Lange & Piette, 2006; Osborn et al., 2010) and even could predict DSM significantly (Berardi et al., 2016; Walker et al., 2012). However, the finding of this study was corroborated by previous studies that fatalism could not predict DSM nor was it associated with DSM directly (Asuzu et al., 2017; Egede & Osborn, 2010).

One possible explanation was that the participants' understanding of the fatalism scale was poor, resulting in a low mean score (M = 33.65) and a high standard deviation (SD = 8.47). This could be considered in relation to the educational level of participants. The low mean score of fatalism indicated that the participants had better self-control. Due to traditional Chinese culture, participants might be hesitant to freely think about or answer questions about death that were included in the scale. Fatalism was also considered as the context in this study, but it was often described as a contextual structure that manifests itself primarily during difficulties and sudden outbreaks of illness or symptoms (Keeley, Wright, & Condit, 2009). Fatalism was not visible in the participants, who were adults aged 18 to 60 and were mostly in a stable state of illness, so there was no correlation with the DSM, which could be another cause (Sukkarieh-Haraty et al., 2018).

Another reason might be that it was a cross-sectional study, no pathways of causality or association could be discussed. According to the IFSMT, factors in the process dimension are linked to and interrelated with factors in the context dimension, and factors in the context dimension indirectly or directly influence the outcome (P. Ryan & Sawin, 2009). In the finding, fatalism and diabetes knowledge were found to

have a moderately significant relationship (r = -.429, p = < .001), implying that fatalism may be related to DSM indirectly. Asuzu et al. (2017) studied the pathway and discovered that fatalism affected DSM indirectly (r = -.27, p < .001). Furthermore, there were other confounding factors that might influence the association between fatalism and DSM, which could also be an explanation. Health literacy and multiple co-morbidities were mentioned in the earlier study, and it was speculated that they might influence the association confounding factors, which could be tested in the future (Walker et al., 2012).

Apart from these, limited scales for measuring fatalism could be another possible reason. The scale used by the researcher was the only one that had ever been translated into Chinese and used solely in ethnic areas to measure fatalism in China (X. Zhang et al., 2018). As mentioned in the literature review, the impact of ethnic differences needs to be focused on (Gonzalez-Zacarias et al., 2016) since this scale was not designed specifically for diabetic adults, it had certain limitations in terms of studying the relationship between fatalism and DSM.

Social support

The results of this study indicated that social support could not predict DSM among adults with T2DM (β = .123, p = .129) which rejected the hypotheses of this study, although social support was correlated with DSM moderately with statistical significance (r = .312, p = .001). This finding was similar to some previous studies (Gonzalez-Zacarias et al., 2016; Huang et al., 2014; Ji et al., 2020; Osborn et al., 2010; Zhang et al., 2017). However, it was inconsistent to another study which was stated that social support could significantly influence DSM as a predictor, especially for family support (Gunggu et al., 2016).

Based on the IFSMT, social support was considered to contribute to enhanced knowledge, improved self-regulation skills and higher levels of self-efficacy, leading to better self-management (P. Ryan & Sawin, 2009). This could account for the association between social support and DSM. Social support can have an evaluative and informative effect as well as provide coping strategies to assist individuals to manage diabetes-related stress, changes in daily life and improve DSM (Kadirvelu, Sadasivan, & Ng, 2012). The mean score of social support in this study was 57.32 out of 78 (SD = 8.60), which was not high. It could be observed in the

demographic characteristics that no one needed assistance to carry out daily activities at home, which could explain the low level of social support.

Social support is interpreted in the IFSMT as emotional, instrumental or informational support provided by individuals or families with the explicit goal of assisting or facilitating their participation in health behaviors, the source of which can be health care providers, family or others, or print or electronic media (P. Ryan & Sawin, 2009). The current scores for the parts of social support presented that family support is higher than support outside the family, which means that diabetic adults receive more support from their families than any other support. This could be explained by Chinese culture in which strong family ties and family intimacy are highly valued, and a cohesive and supportive family can provide opportunities for patients to express their feelings and concerns (T. Liu, 2012). This statistic also verified that 90.7% of the participants lived with their families in this results. However, the family support score was not as high as it should have been. The researcher attributed this to ineffective family support, perhaps because family members lacked diabetes knowledge and spent insufficient time with them, resulting in individuals not receiving appropriate social support and negatively impacting DSM scores.

Except for family support, the participants' score for the support outside the family was low, indicating that they received less support from outside the home. The majority of participants were of working age, who might be under employment-related pressure. Employment has a profound effect on DSM owing to discrimination and stigma from co-workers or society, due to a lack of disease understanding (Bezo et al., 2020). As a result, adults with T2DM are reluctant to share too much information about disease with others. It's also possible that healthcare workers are overworked so that they don't have enough time to support patients, especially in the context of Covid-19. Furthermore, some patients may visit less frequently or shorten the time in the diabetes OPD, due to fear of Covid-19 or discomfort with hospital precautions (C. Shi, Zhu, Liu, Zhou, & Tang, 2020), which is reflected in the data in Table 3 about health information.

The Inconsistency of the results on family support and the support outside the family could explain why social support cannot predict DSM in this study. Also,

the scale used to measure social support only includes family support and the support outside the family, although adults can also acquire support from other sources, including printed or electronic mediums such as magazines, television, or the internet (P. Ryan & Sawin, 2009), which could be another cause.

In conclusion, the study result revealed that diabetes knowledge and perceived self-efficacy could predict DSM significantly, while fatalism, social support could not predict DSM significantly. Additionally, the result showed that all independent variables could influence each other, thus influencing diabetes knowledge and perceived self-efficacy. P. Ryan and Sawin (2009) clarified that factors in each dimension can influence each other and thus directly or indirectly influence the outcome of SM. Based on the theory, reducing fatalism by increasing diabetes knowledge could help improve DSM. It was also suggested in this study that improving diabetes knowledge and perceived self-efficacy, reducing fatalism and enhancing effective social support could improve the DSM.

Implications of the findings

Though the study focusses on the DSM and its predictors, and the results showed that participants had suboptimal DSM, insufficient diabetes knowledge, low score of perceived self-efficacy. Significantly, results from the study revealed that most of the participants had overweight, uncontrolled DM, and had one or more co-morbidities, and that some participants still drink or smoke. These are likely to increase the risk of developing diabetes complications. Unfortunately, some participants already had complications. Therefore, relevant interventions are urgently needed for adults with T2DM to enhance their DSM to help them control blood glucose and delay the occurrence of diabetic complications. The recommendations are as follows:

Nursing practice

The results of this study demonstrated that diabetes self-management was suboptimal among adults with T2DM in Wenzhou, China. Particularly for the aspect of glucose monitoring in DSM, healthcare providers need to focus on increasing individuals' knowledge, self-efficacy, and DSM skills. Furthermore, improving

individual's and family's ability to think critically and act autonomously can help promote individuals practice DSM effectively.

Additionally, 83% of the participants in this study had abnormal BMI, more attention and support should be given to weight management during the DSM process for diabetic adults with obesity, especially in terms of physical activity and dietary adjustments. As recommended in the guideline for the prevention and treatment of T2DM in China, individualized physical activity programs should be designed for individuals and families in accordance with the recommendations of the Chinese guidelines for the management of T2DM (Chinese Journal of Diabetes, 2021). Health care providers should assist diabetic adults with one or more co-morbidities in tailoring positive coping strategies to reduce their physical and psychological burden. Interventions to achieve HbA1c treatment goals should be developed promptly and the awareness of diabetic adults about the significance of HbA1c values needs to be raised in the future.

Diabetes knowledge and perceived self-efficacy were found to be predictive of DSM in this result. By inference, the program aimed at increasing diabetes knowledge and perceived self-efficacy may help adults with T2DM optimize their lifestyle, minimize the risk of diabetes-related complications, and develop and maintain the ideal diabetes self-management outcomes. Increased knowledge of foot care, in particular, should be emphasized in order to prevent or delay the complication like diabetic foot.

Nursing research

For further study, recommendations include a similar study should be conducted elsewhere in China to corroborate these findings, as the study results are limited in generalization to adults with T2DM in other areas of China. Secondly, fatalism and social support are two variables in this study that require further research for DSM. In China, diabetes fatalism is still a relatively new and the information in Chinese context is limited. Future research could draw on the strengths and weaknesses of international studies to generate new ideas for promoting DSM in China. Thirdly, the study variables could explain only 38.2% of the variation of DSM, therefore, other potential variables affecting DSM should be examined further such as health literacy and multiple co-morbidities. Fourthly, the Chinese version of diabetes

fatalism's scale needs to be developed further to make it fit to adults with T2DM in Chinese context. Lastly, the intervention program focuses on increasing DSM knowledge and self-efficacy should be developed to improve DSM among adults with T2DM to help them effectively control plasma glucose and prevents diabetic complications.

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APPENDICES

APPENDIX A

Additional information about dependent and independent variables

1.1. Range, mean and standard deviation of the DKN (n = 108)

Independent variable	Range		M	SD
	Possible score	Actual score		
Diabetes knowledge	0 - 14	2 - 13	7.87	2.69
Diet	0 - 3	0 - 3	1.26	.91
Glucose	0 - 3	0 - 3	2.37	.82
Medication	0 - 1	0 - 1	.49	.50
Physical activity	0 - 2	0 - 2	1.08	.31
physiology	0 - 4	0 - 4	2.60	1.05
Foot care	0 - 1	0 - 1	.09	.29

1.2. Range, mean and standard deviation of the SE-Type 2 scale (n = 108)

Independent variable	Range		M	SD
	Possible score	Actual score		
Perceived self-efficacy	7 - 35	15 - 33	24.19	4.50
Diet	2-10	3 - 10	7.41	1.70
Exercise	2-10	2 - 10	6.57	2.11
Glucose testing	1-5	1 - 5	3.31	1.21
Medication	1-5	2 - 5	4.82	.54
Foot care	1-5	1 - 5	2.07	.96

1.3. Range, mean and standard deviation of the Fatalism Scale (n = 108)

Independent variable	Range		M	SD
	Possible score	Actual score		
Fatalism	16 - 80	16 - 57	33.65	8.47
Predetermination	6 - 30	6 - 24	13.70	4.69
Luck	4 - 20	4 - 16	5.38	2.50
Pessimism	6 - 30	6 - 24	14.56	3.40

1.4. Range, mean and standard deviation of the PSSS (n = 108)

Independent variable	Range		M	SD
	Possible score	Actual score		
Social support	12 - 84	40 - 78	57.32	8.60
Family support	4 - 28	12 - 28	20.91	4.69
Support outside the family	8 - 56	21 - 51	36.42	3.40

2. Scoring rate, mean and standard deviation of the DKN (n = 108)

Sub-category/Items	True n (%)	False n (%)	M	SD
Physiology				
1. The common causes of type 2 diabetes are:	23(21.3)	85(78.7)	.21	.411
4. Complications of diabetes include:	100(92.6)	8(7.4)	.93	.263
5. Which of the following sentences is correct:	83(76.9)	25(23.1)	.77	.424
6. The key to diabetes control is:	75(69.4)	33(30.6)	.69	.463
Dietary				
7. Diabetics should:	37(34.7)	71(65.3)	.34	.477
10. Rice is mainly:	19(17.6)	89(82.4)	.18	.383
11. Of the following foods, you can eat in unlimited quantities:	80(74.1)	28(25.9)	.74	.440
Glucose				
2. Without treated diabetes, blood sugar will	99(91.7)	9(8.3)	.92	.278
3. The normal range of fasting blood sugar is:	73(67.6)	35(32.4)	.68	.470
12. The purpose of your own blood sugar test is to:	81(75)	27(25)	.75	.435
Physical activity				
8. In general, diabetics who are in the right shape should exercise:	10(9.3)	98(90.7)	.09	.291
9. The effects of physical activity are usually:	107(99.1)	1(0.9)	.99	.096
Medication				
14. The role of oral medicines for diabetes is to:	53(49.1)	55(50.9)	.49	.502
Foot care				
13. The reasons why diabetics should take care of their feet are:	10(9.3)	98(90.7)	.09	.291

APPENDIX B

Questionnaires in English and Chinese version

1. The Demographic Questionnaire

Direction: Please read questions in part 1 carefully and give an honest answer. Answers to question part 2 will be collected from the medical record by the researcher. Please write "√" in the box of your answer or write your information in the space provided.

Part 1: Personal profile (To be completed by the participant)

1. Age:
2. Height: _____cm Weight: _____kg
3. Gender

   ☐ Male ☐ Female
4. Highest level of education

   ☐ Less than primary ☐ Primary school

   ☐ Secondary school ☐ Graduate and up
5. Marital Status

   ☐ Single ☐ Married ☐ Divorced ☐ Widowed
6. Living condition

   ☐ Living alone ☐ Living with family members

   ☐ Living with friends/colleagues ☐ Living with others
7. Individual income (income/month in Yuan)

   ☐ Less than ¥ 3000 ☐ ¥ 3000 - 4,999

   ☐ ¥ 5,000 - 10,000 ☐ More than ¥ 10,000
8. Payment method of medical expenses.

   ☐ Medical insurance ☐ At one's own expense
9. Assistance required by you from others to carry out daily activities at home

   ☐ None ☐ Minimal ☐ Moderate ☐ Maximum

   Relationship with caregiver (if assistance is required)
10. Alcohol drinking status

☐ Current alcohol drinker

Duration _____ years Quantity _____ glass/day

☐ Former alcohol drinker

Duration _____ years Quantity (in the past) _____ glass/day

☐ No history of drinking alcohol

11. Smoking status

☐ Current smoker

Duration _____ years Quantity _____ cigarettes/day

☐ Former smoker

Duration _____ years Quantity (in the past) _____ cigarettes/day

☐ No history of smoking

Part 2: Health Information (To be collected by researcher from patient record)

1. Duration of T2DM: ____years
2. Frequency of visit to diabetes OPD (in l year)
3. Last date of admission to hospital due to T2DM (if applicable)
4. Medications

1) ☐ Oral medication

☐ Metformin (Dose/frequency/day)

☐ Sulfonylureas (Dose/frequency/day)

☐ Others ____ (Dose & frequency/day)

2) ☐ Insulin

Specify____ (Dose & frequency/day)

5. Co-morbidities

☐ None ☐ Hypertension ☐ Chronic kidney disease ☐ Heart diseases

☐ Others, specify

6. Diabetes-related complications

☐ None ☐ Retinopathy ☐ Nephropathy ☐ Neuropathy

☐ Others, specify

7. Latest HbA1c: ____ % (date: __/__/__)

8. Latest FBG (fast blood glucose): ____mg/dL (date: __/__/__)

2. The Diabetes Self-Management Questionnaire (DSMQ)

Direction: The following statements describe self-management activities related to your diabetes. Thinking about your self-management **over the last 8 weeks**, please specify the extent to which each statement applies to you. Please choose the answer by tick "√".

	Applies to me very much	Applies to me to a conside rable degree	Applies to me to some degree	Does not apply to me
1. I check my blood sugar levels with care and attention. ☐ Blood sugar measurement is not required as a part of my treatment.	☐ 3	☐ 2	☐ 1	☐ 0
2. ……	☐ 3	☐ 2	☐ 1	☐ 0
3. ……	☐ 3	☐ 2	☐ 1	☐ 0
4. ……	☐ 3	☐ 2	☐ 1	☐ 0
5. ……	☐ 3	☐ 2	☐ 1	☐ 0
6. ……	☐ 3	☐ 2	☐ 1	☐ 0
7. ……	☐ 3	☐ 2	☐ 1	☐ 0
8. ……	☐ 3	☐ 2	☐ 1	☐ 0
9. ……	☐ 3	☐ 2	☐ 1	☐ 0
10. ……	☐ 3	☐ 2	☐ 1	☐ 0
11. ……	☐ 3	☐ 2	☐ 1	☐ 0
12. ……	☐ 3	☐ 2	☐ 1	☐ 0

(Continued)

	Applies to me very much	Applies to me to a conside rable degree	Applies to me to some degree	Does not apply to me
13. ……	☐ 3	☐ 2	☐ 1	☐ 0
14. ……	☐ 3	☐ 2	☐ 1	☐ 0
15. ……	☐ 3	☐ 2	☐ 1	☐ 0
16. My diabetes self-care is poor.	☐ 3	☐ 2	☐ 1	☐ 0

3. The translation of the Chinese version of the Diabetes Knowledge (DKN) scales

Direction: This questionnaire asks you about your knowledge of diabetes. Please read and think about the questions carefully and answer the following questions honestly. Please tick all the answers you think are correct. In each question, only tick ("I don't know") if you have no idea at all.

1. The common causes of type 2 diabetes are:
A. The body does not make good use of insulin.
B. The body does not produce insulin at all.
C. The body rejects insulin.
D. I don't know

2. In uncontrolled diabetes the blood sugar is:
A. Normal.
B. Increased.
C. Decreased.
D. I don't know.

……..

13. The reasons why people with diabetes should take care of their feet are:
A. Long-term injections of insulin into the leg can lead to foot swelling.
B. Diabetic patients are often complicated with flatfoot.
C. Blood circulation in the feet of middle-aged and elderly patients with diabetes may be poor.
D. I don't know.

14. The effects of oral drugs for diabetes are:
A. reduce blood sugar.
B. increase insulin secretion.
C. increase insulin sensitivity.
D. all three of the above are true.

4. The Self-efficacy Scale for Patients with Type 2 Diabetes Mellitus (SE-Type 2 scale)

Direction: The following topic is to understand your confidence status when carrying out the following activities. When answering each question, please choose the answer that best describes your idea. Please tick "√" in the corresponding space.

(1 = no, surely not; 2 = probably no; 3 = maybe yes/maybe no; 4 = probably yes; 5 = yes, surely)

Item	1	2	3	4	5
1. I think I am able to check my blood glucose.					
2. I think I am able to follow my diabetic diet most of the time.					
3. I think I am able to follow my diabetic diet when I dine out.					
4. I think I am able to examine my feet for lesion.					
5. I think I am able to get sufficient physical activities.					
6. I think I am able to take extra exercise, when the doctor advises me to do so.					
7. I think I am able to take medicine or inject the insulin as prescribed.					

5. The Fatalism Scale

Direction: The following topic is to understand your perception of what they encounter during diabetes self-management, from 1 to 5 representing "totally disagree" to "totally agree". Please tick "√" in the corresponding space.

(1= totally disagree; 2 = disagree; 3 = uncertain; 4 = agree; 5= totally agree)

1. If someone is meant to get a serious disease, they will get it no matter what they do.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

2. If someone gets a serious disease, that's the way they were meant to die.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

3. How long I live is predetermined.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

……..

14. I often feel helpless in dealing with the problems of life.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

15. Sometimes I feel that I'm being pushed around in life.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

16. There is really no way I can solve some of the problems I have.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

6. The Perceived Social Support Scale (PSSS)

Direction: There are 12 sentences, each question has 7 answer. Please choose an answer after each sentence according to your actual situation. For example, choose "1" means you really strongly disagree with this sentence, which states that your actual situation does not agree with this sentence; choose "7" means your actual situation does agree with this sentence; choose "4" means in the middle of state; and so on. Please tick "√" in the corresponding space.

(1 = very strongly disagree; 2 = strongly disagree; 3 = disagree; 4 = neutral; 5 = mildly agree; 6 = strongly agree; 7 = very strongly agree)

1. There is a special person (leaders, relatives, colleagues) who is around when I am in need.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

2. There is a special person (leaders, relatives, colleagues) with whom I can share joys and sorrows.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

3. My family really tries to help me.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

…….

10. There is a special person (leaders, relatives, colleagues) in my life who cares about my feelings.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

11. My family is willing to help me make decisions.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

12. I can talk about my problems with my friends.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

一、社会人口学问卷

导语：请仔细阅读第一部分的问题并如实回答。第二部分问题的答案将由研究者从病历中收集。请在答案的方框内打“√”，或在空格内写上您的答案。

第1部分：一般资料（由参与者自行完成）

1. 年龄：
2. 身高：_____cm　　体重：_____kg
3. 性别：

   ☐ 男　☐ 女
4. 受教育程度

   ☐ 小学以下　☐ 小学　☐ 初高中　☐ 大学及以上
5. 婚姻状况

   ☐ 单身　☐ 已婚　☐ 离异　☐ 丧偶
6. 居住方式

   ☐ 独居　　☐ 与家人住一起

   ☐ 与朋友/同事住一起　　☐ 与其他人住一起
7. 人均收入（单位：元）

   ☐ 少于3000　☐ 3000-4,999　☐ 5000-10,000　☐ 大于10,000
8. 医疗费用支付方式

   ☐ 医疗保险

   ☐ 自费
9. 你在家中进行日常活动时需要他人的帮助

   ☐ 没有　☐ 比较少　☐ 中等　☐ 比较多

   与照顾者的关系是(如果需要帮助)
10. 饮酒情况

    ☐ 目前饮酒

    持续时间_____年　_____杯/天

    ☐ 已戒酒

    戒酒时间_____年　戒酒前_____杯/天

☐ 从未喝酒

11. 吸烟情况

☐ 目前吸烟

持续时间_____年　　数量_____根/天

☐ 已戒烟

戒烟时间_____年　戒烟前数量____根/天

☐ 从未抽烟

第2部分：健康信息（由研究者通过病人收集）

1. 患糖尿病时间：_____年
2. 糖尿病门诊就诊次数(在1年内)
3. 因2型糖尿病入院的最后日期(如适用)
4. 药物

1）☐ 口服药物

☐ 二甲双胍(剂量/频率/天)

☐ 磺脲类(剂量/频率/天)

☐ 其他(剂量和频率/天)

2）☐ 胰岛素

请写下____ (剂量和频率/天)

5. 共病

☐ 无　☐ 高血压　☐ 慢性肾病　☐心脏病

☐ 其他

6. 与糖尿病相关的并发症

☐ 无　☐ 视网膜病变　☐ 肾病　☐ 神经系统疾病

☐ 其他

7. 最近一次HbA1c：_____%（时间：__/__/__）
8. 最近一次空腹血糖：_____mg/mL（时间：__/__/__）

二、中文版糖尿病自我管理量表

导语：以下陈述描述了与您的糖尿病有关的自我照顾活动。思考一下您**最近8周**的自我照顾情况，请指明每项陈述符合您的程度。请在相应的空格上打勾。	非常符合	相当符合	部分符合	不符合
1. 我细心认真地检查我的血糖水平。 ☐ *血糖监测不是我治疗所需的一部分。*	☐ 3	☐ 2	☐ 1	☐ 0
2. ……	☐ 3	☐ 2	☐ 1	☐ 0
3. ……	☐ 3	☐ 2	☐ 1	☐ 0
4. ……	☐ 3	☐ 2	☐ 1	☐ 0
5. ……	☐ 3	☐ 2	☐ 1	☐ 0
6. ……	☐ 3	☐ 2	☐ 1	☐ 0
7. ……	☐ 3	☐ 2	☐ 1	☐ 0
8. ……	☐ 3	☐ 2	☐ 1	☐ 0
9. ……	☐ 3	☐ 2	☐ 1	☐ 0
10. ……	☐ 3	☐ 2	☐ 1	☐ 0
11. ……	☐ 3	☐ 2	☐ 1	☐ 0
12. ……	☐ 3	☐ 2	☐ 1	☐ 0
13. ……	☐ 3	☐ 2	☐ 1	☐ 0
14. ……	☐ 3	☐ 2	☐ 1	☐ 0
15. ……	☐ 3	☐ 2	☐ 1	☐ 0
16. 我的糖尿病自我照顾很差。	☐ 3	☐ 2	☐ 1	☐ 0

三、中文版糖尿病患者知识量表

导语：这份问卷询问您对糖尿病的了解。请仔细阅读和思考这些问题，并诚实地回答以下问题。**每个问题只有一个正确答案**。如果您知道答案，请在答案前的字母上打勾．如果您不知道答案，请在“我不知道”的选项前的字母上打勾。

1. 2型糖尿病通常的病因是：
A. 身体不能很好地利用胰岛素
B. 身体根本不产生胰岛素
C. 身体排斥胰岛素
D. 我不知道

2. 没有经过治疗的糖尿病，血糖将会：
A. 正常
B. 升高
C. 降低
D. 我不知道

……..

13. 糖尿病患者应该照顾好自己的脚的原因是：
A. 长期地在腿上进行胰岛素注射会导致脚的肿胀
B. 糖尿病患者常会并发平足
C. 患糖尿病的中老年患者的脚部的血液循环可能会不好
D. 我不知道

14. 治疗糖尿病的口服药的作用是：
A. 降低血糖
B. 增加胰岛素的分泌
C. 增加胰岛素敏感性
D. 以上三个都可以

四、中文版2型糖尿病自我效能问卷

导语：以下问题是了解您在进行如下活动时的信心状态。在回答每个问题时，请选择一个**最能描述您想法**的答案。请在相应空格里打“√”。

（1=肯定不行；2=可能不行；3=不确定；4=可能可以；5=肯定可以）

条目	1	2	3	4	5
1. 我认为我能够自己检查血糖					
2. 我认为我能够在大部分的时候遵从糖尿病饮食					
3. 我认为我能够在与朋友聚餐时遵从糖尿病饮食					
4. 我认为我能够自己检查脚上是否有伤口					
5. 我认为我能够进行充分的锻炼，如散步，打太极，等等					
6. 当医生建议进行额外的体育锻炼时，我认为我可以做到					
7. 我认为我能够遵照处方服用口服药或注射胰岛素					

五、中文版宿命论量表

导语：下面的题目是了解你对他们在糖尿病自我管理过程中遇到的问题的看法。下面一些描述或说法，您可能同意，也可能不同意，**请根据您自己实际情况，在题后给出的5个选项中进行选择，并在相应的数字上打“√”。每题只选一个答案。**

条目	完全不同意	比较不同意	不能确定	比较同意	完全同意
1.如果有些事情注定要发生，那么不管我做什么它都会发生。					
2 …….					
3 …….					
4. …….					
5. …….					
6. …….					
7. …….					
8. …….					
9.…….					
10.…….					
11.…….					
12.…….					
13.…….					
14.…….					
15.……...…….					
16. 我真的没有办法解决我所遇到的一些问题。					

六、中文版领悟社会支持量表

导语：以下有12个句子，每一句子后面各有7个选项，请您**根据自己的实际情况**在每句后选择一个选项。例如，选择“1”表示您极不同意，即说明您的情况与这一句子极不相符；选择“7”表示您极同意，即说明您的实际情况与这一句子极相符；选择“4”表示中间状态。

（1=极不同意；2=很不同意；3=稍不同意；4=中立；5=稍同意；6=很同意；7=极同意）

1. 在我遇到问题时有些人（领导、亲属、同事）会出现在我身旁。

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

2. 我能够与有些人（领导、亲属、同事）共享快乐与忧伤。

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

3. 我的家庭能够切实具体地给我帮助。

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

……

10. 在我的生活中有些人（领导、亲戚、同事）关心着我的感情。

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

11. 我的家庭能心甘情愿协助我做出各种决定。

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

12. 我能与朋友们讨论自己的难题。

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

APPENDIX C

Permission letters

Permission letter to use the Diabetes Knowledge scales (DKN)

The original version:

From <stewart.dunn@sydney.edu.au>

Fri 6/25/2021 11:39 AM

To Ni Yang

Subject: DKN

Hullo Ni. You certainly do have permission to use the DKN Scale. Thank you for asking and best wishes with your research.

Stewart

The Chinese version of:

From Yin Xu <noreply@formstack.com>

Sat 11/14/2020 0:26 AM

To Ni Yang

Subject: The Chinese version of DKN

Hi Ni Yang,

This is Dr. Xu. I received your email and request. Yes you can use the Chinese version for your research study. Good luck.

Best,

Dr. Xu

Permission letter to use the Self-efficacy Scale for Patients with Type 2 Diabetes Mellitus (SE-Type 2 scale)

The original version:

From Jaap van der Bijl <jaapvanderbijl033@gmail.com>;

Tue 6/29/2021 7:15 AM

To Ni Yang

Subject: SE-Type 2 scale

Dear Ni Yang,

Thank you so much for your message. I am pleased to learn about your research. You have our permission to use it in your research. Good luck with your research.

Best regards,

Jaap van der Bijl

The Chinese version:

From Yin Xu <noreply@formstack.com>

Sat 11/14/2020 0:26 AM

To Ni Yang

Subject: The Chinese version of SE-Type 2 scale

Hi Ni Yang,

This is Dr. Xu. I received your email and request. Yes you can use the Chinese version for your research study. Good luck.

Best,

Dr. Xu

Permission letter to use the Fatalism Scale

The original version:

From Shen, Lijiang <lus32@psu.edu>

Fri 7/25/2021 1:25 AM

To Ni Yang

Subject: Fatalism Scale

Dear Ni Yang,

The scale is published and in the public domain. It is free to use provided with proper citation and reference.

Best,

LJ

The Chinese version:

From 张翔 <zhangxiangpsy@mails.ccnu.edu.cn>

Wed 12/9/2020 4:19 PM

To Ni Yang

Subject: The Chinese version of the Fatalism Scale

您好！可以使用，请注明文献出处！

Permission letter to use the perceived social support scale (PSSS)

The original version:

From <gzimet@iu.edu>

Tue 6/22/2021 10:56 PM

Subject: PSSS

Dear Ni Yang,

You have my permission to use the Multidimensional Scale of Perceived Support in your research.

I hope your research goes well.

Best regards,

Greg Zimet

The Chinese version:

From 姜乾金 <jqj@zj.com>

Wed 12/9/2020 10:44 AM

To Ni Yang

Subject: The Chinese version of PSSS

尽管使用

姜乾金 浙江大学 教授 主任医师

APPENDIX D

Participant’s information sheet and consent form

Participant Information Sheet

IRB approval number: .....……..…….……

Title of study: Factors Influencing Diabetes Self-Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China

Dear participants

I am Miss Ni Yang, a graduate student at Faculty of Nursing, Burapha University Thailand. My study is “Factors Influencing Diabetes Self-Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China”. The objectives are to examine diabetes self-management and examine whether diabetes knowledge, perceived self-efficacy, fatalism and social support can predict diabetes self-management among adults with type 2 diabetes mellitus in Wenzhou, China.

This study is a survey study. Participating in this study is voluntary. If you agree to participate in this study, you will answer the following questionnaires, which will take approximately 20-30 minutes. During the data collection, period, the researcher will clarify any question posed by the participants for clarity regarding the language or content. You will not get any direct benefits by participating in this study. Patients will not get any direct benefits by participating in this study. However, the information collected from this study can further identify factors influencing DSM for nurses and other primary care providers, and help them to better develop diabetes self-management plans and interventions for adults with T2DM to promote health and improve quality of life. The information will also help health care providers, especially nurses, to further study this population and conduct future intervention studies with this population. There will be no identified physical and psychological risk to the person participating in the study and no risk to the society.

You have the right to end your participation in this study at any time, and no necessary to inform the researcher, and it will not affect the quality of services you receive from the diabetes OPD. Any information collected from this study, including

your identity, will be kept confidential. A coding number will be assigned to you and your name will not be used. Findings from the study will be presented as a group of participants and no specific information from any individual participant will be disclosed. All data will be accessible only to the researcher which will be destroyed one year after publishing the findings. You will receive a further explanation of the nature of the study upon its completion, if you wish.

The research will be conducted by Miss Ni Yang under supervision of my major-advisor, Assistant Professor Dr. Khemaradee Masingboon. If you have any questions, please contact me at mobile number: +8619817770681 or by email Nellie_Y@outlook.com, and/or my advisor's e-mail address khemarad@hotmail.com. Or you may contact Burapha University Institutional Review Board (BUU-IRB) telephone number 038 102 561-62. Your cooperation is greatly appreciated. You will be given a copy of this consent form to keep.

Ni Yang

Consent Form

IRB approval number: .....…….....…….……

Title of study: Factors Influencing Diabetes Self-Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China

Date of data collection ……....…Month….....…….……Year …….

Before giving my signature below, I have been informed by researcher Miss Ni Yang about purposes, method, procedures, benefits and possible risk associated with participation in this study thoroughly, and I understood all of the explanation. I consent voluntarily to participate in this study. I understand that I have the right to leave the study any time I want, without fearing that it might affect the quality of health care services that I will receive from the hospital and diabetes OPD hereafter.

The researcher Miss Ni Yang has explained to me that all data and information of the participants will be kept confidential and only be used for the purpose of this study. I have read and understood the information related to participation in this study clearly and I am signing this consent form.

Signature

…….……..
Participant

(…….)

参与者信息表

研究项目编号: G-HS 111/2563

研究题目：探究温州地区2型糖尿病患者自我管理的影响因素分析

亲爱的参与者：

我是杨妮，一名泰国东方大学护理学院的研究生，我的研究课题是“探究温州地区2型糖尿病患者自我管理的影响因素分析”。这项研究的目的是为了评估温州地区2型糖尿病患者的自我管理情况，并检验糖尿病知识、自我效能、宿命论和社会支持对糖尿病自我管理是否具有预测性。

这项研究是一项调查研究，参与者都是自愿参加的。如果你同意参加这项研究，你将会填写一些调查问卷，这将会耗费大概20-30分钟左右的时间。在数据收集的期间，如您有任何问题，研究者将会为您解释清楚以明确有关语言或者内容的问题。在这项研究中，您将不会获得任何直接的好处，损失的时间也不会得到补偿。但是，这项研究所收集的数据可能可以为护士及其他医务工作者进一步确定影响2型糖尿病患者自我管理的因素，并帮助他们更好地为糖尿病患者制定糖尿病自我管理计划及干预措施，以促进健康及提高生活质量。这些信息还将帮助卫生保健提供者特别是护士，进一步研究这一人群并对这一人群进行未来的干预研究。参与这项研究的人不会有确定的身体和心理风险，也不会对社会产生风险。

您有权随时停止参与此项研究，无需通知研究人员，也不会影响您在糖尿病门诊接受的服务质量。从本研究中收集的任何信息，包括您的身份，都将保密。在该研究中，将随机分配一个编码给您，并且我们不会使用您的姓名。研究结果将作为一组参与者提出，不会透露任何参与者的具体信息。所有数据将只对研究人员开放，研究人员将在公布调查结果一年后销毁这些数据。如果您希望的话，您将在研究完成后获得对研究性质的进一步解释。

这项研究将由杨妮在她的主要导师Khemaradee Masingboon教授的监督下进行。如果您有任何问题，请拨打手机号码：+8619817770681 或者通过电子邮

件 Nellie_Y@outlook.com 联系我，和/或我导师的电子邮箱 khemarad@hotmail.com。如果研究人员没有按照分发给受试者的信息表中所示执行，您可以拨打电话038102561-62联系东方大学伦理委员会的主席或代表。非常感谢您的合作。您将得到同意书的副本作为保留。

杨妮

项目参与者知情同意书

研究项目编号: G-HS 111/2563

(东方大学伦理委员会办公室是研究项目编号的颁发者)

研究题目：探究温州地区2型糖尿病患者自我管理的影响因素分析数据收集的时间_____月_____年

在下方签名前，研究员杨妮护师已经全面告知我参与这项研究的目的、方法、程序、好处和可能的风险，我理解所有的解释。我自愿同意参加这项研究。我理解我有权随时离开研究，且不必担心这可能会影响我接受医院和糖尿病门诊提供的医疗保健服务的质量。

研究员杨妮护师向我解释了参与者的所有数据和资料都将保密，仅用于该研究。我已阅读并清楚地了解了参与这项研究相关的信息，我正在签署这份同意书。

签名：.....

参与者（.....）

APPENDIX E

Ethical approval letter and data collection letter

Certificate Number IRB3-022/2564

Certificate of Human Research Approval
Burapha University

BUU Ethics Committee for Human Research has considered the following research protocol

Protocol Code : G-HS 111/2563
Protocol Title : Factor Influencing Diabetes Self Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China
Principal Investigator : Miss Ni Yang
Affiliation : Graduate Program of Faculty of Nursing

BUU Ethics Committee for Human Research has considered the following research protocol according to the ethical principles of human research in which the researchers respect human's right and honor, do not violate right and safety, and do no harms to the research participants.

Therefore, the research protocol is approved (See attached)

1. Form of Human Research Protocol Submission	Version 2 : 5 March 2021
2. Research Protocol	Version 1 : 26 February 2021
3. Participant Information Sheet	Version 1 : 26 February 2021
4. Informed Consent Form	Version 1 : 26 February 2021
5. Research Instruments	Version 1 : 26 February 2021
6. Others (if any)	Version - : -

Approval Date : 15 March 2021
Valid Date : 15 March 2022

Sign

(Assistant. Professor Ramon Yampratoom)
Chair of The Burapha University Institutional Review Board
Panel 3 (Clinic / Health Science / Science and Technology)

温州医科大学附属第一医院临床研究伦理委员会审查批件

（Review of Ethics Committee in Clinical Research (ECCR) of the First Affiliated Hospital of Wenzhou Medical University）

临床研究伦审 Issuing Number（2021）第（093）号

项目名称 Project	探究温州地区2型糖尿病患者糖尿病自我管理的影响因素分析 Factors Influencing Diabetes Self-Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China		
申办者 Applicant	泰国东方大学	试验目的 Objective	临床科研 Clinical research
试验科室 Department	结直肠肛门外科		
试验项目负责人 Principal Investigator	夏丽敏		
审查方式和时间 Form and Date	□ 会议审查 Review Conference，时间：_____ ☑ 快速审查 Fast track，时间：2021 年 05 月 24 日		
审查地点 Review Site	新院 1-4A18 会议室		
审查材料 Documents for Review	1、医学临床科研项目及伦理审查申请表，v1.0 版； 2、临床研究方案，v1.0 版，2021.03.31； 3、受试者知情同意书，v1.0 版，2021.03.31； 4、研究者团队成员目录（职责）； 5、主要研究者、团队成员简历及 GCP 证书，v1.0 版； 6、研究者责任声明； 7、CRF/临床观察表样板，v1.0 版。		
审查意见 Comments	根据国家卫健委《涉及人的生物医学研究伦理审查办法》(2016)、WMA《赫尔辛基宣言》和 CIOMS《人体生物医学研究国际道德指南》的伦理原则，经本伦理委员会审查，同意该项目开展。 According to the Regulations and Rules of "Ethical Reviews for Biomedical Research Involving Human Subjects" (2016) the National Health Commission of PRC , "Declaration of Helsinki" of WMA, and "International Ethical Guidelines for Human Biomedical Research" of CIOMS , the project was **approved** by **ECCR** .		
主任委员/副主任委员签字 Signature of the **ECCR** Chair		签发日期 Date	2021.05.25
温州医科大学附属第一医院临床研究伦理委员会（盖章） Ethics Committee in Clinical Research of the First Affiliated Hospital of Wenzhou Medical University (Seal)			

MHESI 8137/ 814

Graduate School, Burapha University
169 Longhaad Bangsaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

April 21st, 2021

Dear Dean of The First Affiliated Hospital of Wenzhou Medical University,

Enclosure: 1. Certificate ethics document of Burapha University
2. Research Instruments (Try out)

On behalf of the Graduate School, Burapha University, I would like to request permission for Ms. NI YANG to collect data for conducting research (Try out).

Ms. NI YANG, ID 62910075, a graduate student of the master of Nursing Science program, major in Adult Nursing Pathway, Faculty of Nursing, Burapha University, Thailand, was approved her thesis proposal entitled: "Factors Influencing Diabetes Self-Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China" under supervision of Asst. Prof. Dr. Khemaradee Masingboon as the principle advisor. She proposes to collect data from thirty eligible participants in your organization selecting by a purposive sampling with the criteria: **30 adults (age ranging from 18 - 60 years) with type 2 diabetes mellitus**.

The data collection will be carried out from April 23rd, 2021 - May 21st, 2021. In this regard, you can contact Ms. NI YANG via mobile phone +86-1981-7770-681 or E-mail: Nellie_Y@outlook.com

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
http://grd.buu.ac.th

MHESI 8137/ 815

Graduate School, Burapha University
169 Longhaad Bangsaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

April 21st, 2021

Dear Dean of The First Affiliated Hospital of Wenzhou Medical University,

Enclosure: 1. Certificate ethics document of Burapha University
2. Research Instruments

On behalf of the Graduate School, Burapha University, I would like to request permission for Ms. NI YANG to collect data for conducting research.

Ms. NI YANG, ID 62910075, a graduate student of the master of Nursing Science program, major in Adult Nursing Pathway, Faculty of Nursing, Burapha University, Thailand, was approved her thesis proposal entitled: "Factors Influencing Diabetes Self-Management Among Adults with Type 2 Diabetes Mellitus in Wenzhou, China" under supervision of Asst. Prof. Dr. Khemaradee Masingboon as the principle advisor. She proposes to collect data from one hundred and two eligible participants in your organization selecting by a purposive sampling with the criteria: **102 adults (age ranging from 18 - 60 years) with type 2 diabetes mellitus.**

The data collection will be carried out from May 17th, 2021 - October 16th, 2021. In this regard, you can contact Ms. NI YANG via mobile phone +86-1981-7770-681 or E-mail: Nellie_Y@outlook.com

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
http://grd.buu.ac.th

BIOGRAPHY

NAME	Ni Yang
DATE OF BIRTH	10 Dec 1995
PLACE OF BIRTH	Zhoushan city, Zhejiang province, China
PRESENT ADDRESS	Donghe commune, Shenjiamen street, Putuo District, Zhoushan city, Zhejiang province, China
POSITION HELD	Nurse Practitioner
EDUCATION	2014-2018 Bachelor of Science (B.S.C), Lishui University, Li Shui, China. 2019-2022 Master of Nursing Science (International Program) (M.N.S), Faculty of Nursing, Burapha University, Chonburi, Thailand.