Journal of Clinical and Nursing Research, 2024, Volume 8, Issue 4
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Determinants of Knowledge, Attitudes, and Practices among Young Adults Type 2 Diabetes Patients in Selected Tertiary Hospitals in Shandong Province, China

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Abstract: *Objective:* The purpose of this study is to understand the current situation of knowledge, attitude, and practice of self-management in young patients with type 2 diabetes mellitus (T2DM) and to explore the relationship between general conditions (personal, social, and environment, clinical factors) and their knowledge, attitude, and practices (KAP) of diabetes self-management, This aims to provide patients with high-quality nursing care management and services, as well as to provide relevant recommendations for effective self-management. *Methods:* This study is a descriptive correlational study that used the purposive sampling method to investigate 359 patients with T2DM aged 18–25 years in four designated tertiary hospitals in Shandong Province. *Results:* Knowledge of self-management was correlated with sex, age, education level, occupation and work situation, monthly household income, medical payment method, family and friend support, frequency of diabetes health education, and diabetes complications. The attitude subscale was correlated with sex, age, education level, work situation, and family and friend support. The practice subscale was associated with age, education level, work situation, family and friend support, frequency of diabetes health education, and HbA1c values. *Conclusion:* Young adults aged 18–25 with T2DM have positive attitudes towards diabetes self-management, but there are still deficiencies in knowledge acquisition and behavioral practice. The KAP of self-management of diabetes is influenced by personal factors such as sex, age, and education level, and socio-environmental factors such as family income and family or friends' social support. Additionally, clinical factors such as complications and HbA1c values significantly impacted the patient's disease self-management ability.

Keywords: Determinants; Type 2 diabetes mellitus; Young adults; Knowledge, attitudes, and practices (KAP)

Online publication: April 30, 2024

1. Introduction

Type 2 diabetes mellitus (T2DM) is the main type of diabetes, accounting for about 90% of diabetic patients [1]. According to the epidemiological survey of diabetes in China, the prevalence of diabetes in Shandong Province is as high as 13.4%, significantly higher than the overall prevalence of diabetes in China of 12.8% [2]. T2DM

is a growing threat to the health of young adults [3]. Most individuals aged 18–25 years with T2DM have just entered society to launch their careers, hence they are faced with multiple conflicts brought by personal, social environment, and clinical factors [4]. Early diagnosis, treatment, and management of T2DM are crucial for achieving disease and optimal glycemic control. Therefore, self-management of diabetes is of utmost importance [5].

This study aimed to understand the current status of diabetes self-management in young adults aged 18–25 with T2DM and to explore the relationship between their general conditions and their diabetes self-management knowledge, attitude, and practices (KAP), hoping to provide patients with targeted advice from the perspective of medical and surgical care for the effective prevention and treatment of T2DM.

2. Survey subjects and methods

2.1. Sample

This study is a descriptive correlational study that used the purposive sampling method to investigate 359 patients with T2DM aged 18–25 years in four designated tertiary hospitals in Shandong Province. Inclusion criteria: (1) Patients aged 18–25; (2) patients diagnosed with T2DM (according to 1999 World Health Organization (WHO) diabetes diagnostic criteria [6]) for more than 3 months; (3) able to communicate properly; (4) consented. Exclusion criteria: (1) Patients diagnosed with other types of diabetes; (2) patients suffering from other serious diseases, such as heart, liver, and kidney insufficiency, respiratory failure, and malignant tumors; (3) history of mental illness.

2.2 Methods

2.2.1. Measurements

A questionnaire was used in this study, which was divided into two parts. Part 1 was the General Condition Questionnaire (self-made), which consisted of personal factors, social environment factors, and clinical factors. Part 2 was the Diabetes Self-management Knowledge, Attitude, and Behavior Assessment Scale (DSKAB) [7].

The General Condition Questionnaire (self-made) was divided into three parts: (1) Personal factors: sex, age, BMI, educational level, marital status, living conditions, work situation, current or previous occupation; (2) social and environmental factors: monthly household income, medical payment method, family and friends support, diabetes health education (times), participation in diabetes-related organizations or WeChat groups; (3) clinical factors: family history, diabetes complications, type of complications, hospitalization for diabetes, hospitalizations for diabetes (times), average length of hospitalization, treatment method (type), hemoglobin (HBG) levels, and hemoglobin A1C (HbA1c) value.

The DSKAB Questionnaire was divided into three dimensions: knowledge, attitude, and practice, which allows for a rapid assessment of the self-management ability of diabetic patients. The content covers 6 aspects, including diet treatment, exercise treatment, drug treatment, blood glucose and blood pressure monitoring, foot care, and hypoglycemia prevention, with a total of 42 items. The higher the score, the better the self-management. In this study, the Cronbach's alpha coefficient of SDKAB was 0.870, and the Cronbach's α of each subscale ranged from 0.728– 0.873. The reliability shows the Kaiser-Meyer Olkin (KMO) = 0.903, and the reliability of each dimension was 0.902, 0.799, and 0.826, respectively. This shows that the questionnaire in this paper has good reliability and validity, and the empirical analysis based on data has strong persuasion.

2.2.2. Data collection

Nurses who had worked in the hospital's endocrinology department for more than a year were recruited to form a survey group. Respondents were given offline or online questionnaires at outpatient clinics and wards of endocrinology departments in selected hospitals. During the study period, a total of 377 questionnaires

were distributed. Due to personal reasons, the patient could not complete the questionnaire, so 18 invalid questionnaires were excluded, and a total of 359 effective questionnaires were issued. The effective rate of questionnaire delivery was 95.2%.

2.2.3. Data analysis

The statistical analysis was performed with the SPSS 26 software and Excel 2016. Analysis of the status of diabetes self-management was performed using descriptive analysis. To analyze the correlation between general conditions and diabetes self-management, the normal test and Shapiro-Wilk test (SW test) were performed on the data first, and the results showed that the data did not conform to the normal distribution. Therefore, a non-parametric test was used to analyze whether different options had significant differences in dimensions of KAP, and the median (lower quartile, upper quartile) was used to describe them. The Mann-Whitney U test was used for binary classification items, and the Kruskal-Wallis test was used for multi-classification items. Spearman correlation analysis was used for the numerical items.

2.3. Ethics statement

This study underwent an extensive review process by the Angeles University Foundation (AUF) Ethics Review Committee and was approved by the ethics committee of the selected hospital (ERC code: 2023-MAN-Student-104). Participation was voluntary and informed consent was obtained from all participants. Strict measures were taken to protect the participants' privacy and confidentiality throughout the research.

3. Results

3.1. KAP subscale scores in DSKAB

As shown in **Table 1a**, the highest score of the knowledge subscale was Q6, where patients were asked: "Do you think it is correct that patients with diabetes should consult their doctor about the precautions and contraindications of exercise before making an exercise plan?" The lowest score was Q3b, where patients were asked: "Did you know that poor blood sugar control in patients with diabetes can cause coronary heart disease?"

As shown in **Table 1b**, the highest score of the attitude subscale was Q4, where patients were asked: "Do you think it is important for diabetics to take their medication as prescribed by their doctor for blood sugar control?" The lowest score was Q3, where patients were asked: "Do you think exercise under the guidance of a doctor is important for blood sugar control?"

As shown in **Table 1c**, the highest score of the practice subscale was Q6, where patients were asked: "Have you been wearing the right size of shoes and socks for six months?" The lowest score was Q8, where patients were asked: "Have you visited a medical institution regularly for foot check-ups over the past year?"

3.2. Correlation between the general condition and the DSKAB

Knowledge of self-management was correlated with sex, age, education level, occupation and work situation, monthly household income, medical payment method, family and friend support, diabetes health education (times), and diabetes complications. The attitude subscale was correlated with sex, age, education level, work situation, and support from family and friends. The practice subscale was associated with age, education level, work situation, family and friend support, diabetes health education (times), and HbA1c values.

Table 1a. Knowledge subscale (n = 359)

Title	Mean	S.D.
Q1	0.69	0.463
Q2a	0.67	0.471
Q2b	0.65	0.477
Q2c	0.38	0.486
Q3a	0.43	0.496
Q3b	0.36	0.480
Q3c	0.50	0.501
Q3d	0.56	0.497
Q3e	0.57	0.496
Q4	0.67	0.472
Q5	0.50	0.501
Q6	0.71	0.456
Q7	0.50	0.501
Q8	0.59	0.492
Q9	0.46	0.499
Q10	0.46	0.499
Q11	0.57	0.496
Q12	0.64	0.482
Q13a	0.59	0.492
Q13b	0.56	0.497
Q14a	0.51	0.501
Q14b	0.65	0.476

Table 1b. Attitude subscale (n = 359)

Title	Mean	S.D.
Q1	3.33	1.290
Q2	3.95	1.142
Q3	3.26	1.344
Q4	4.20	0.929
Q5	3.84	1.189

Table 1c. Practice subscale (n = 359)

Title	Mean	S.D.
Q1	2.70	1.059
Q2	3.14	1.068
Q3	3.40	1.062
Q4	2.69	0.985
Q5	3.45	0.990
Q6	3.67	1.077
Q7	2.92	1.039
Q8	0.27	0.446
Q9	3.55	1.099
Q10	3.20	1.158
Q11	2.92	1.094
Q12	2.67	1.241
Q13	0.33	0.472
Q14	0.36	0.480
Q15	0.28	0.448

3.2.1. Personal Factors

(1) Sex

As shown in **Table 2**, there were significant differences in the knowledge and attitude subscale between different sex ($P < 0.05$), but no significant differences in the practice subscale ($P > 0.05$).

(2) Age

As shown in **Table 3**, age showed low positive correlations with the DSKAB scales.

(3) Education level

As shown in **Table 4**, there were significant differences in the DSKAB scales among different education levels ($P < 0.05$).

(4) Work status

As shown in **Table 5**, there were significant differences in the DSKAB scales in different working situations.

(5) Current or previous occupation

As shown in **Table 6**, there were significant differences in the knowledge subscale among different occupations ($P < 0.05$), but no significant differences in attitude and practice subscale ($P > 0.05$).

Table 2. Differences in the DSKAB scales and sex

Scales	Male	Female	Z	*P*
Knowledge	12 (7,16)	13 (9.25,18)	2.694	0.007
Attitude	19 (15,22)	20 (17.25, 22.75)	2.821	0.005
Practice	35 (31,40)	36 (31, 41.75)	0.466	0.641

Table 3. The correlation of DSKAB scales with age

		Age	Knowledge	Attitude	Practice
Spearman's rho	Correlation coefficient	1.000	0.333**	0.272**	0.120*
	Sig.(2-tailed)	.	0.000	0.000	0.023
	Correlation coefficient	0.333**	1.000	0.387**	0.260**
	Sig.(2-tailed)	0.000	.	0.000	0.000
	Correlation coefficient	0.272**	0.387**	1.000	0.333**
	Sig.(2-tailed)	0.000	0.000	.	0.000
	Correlation coefficient	0.120*	0.260**	0.333**	1.000
	Sig.(2-tailed)	0.023	0.000	0.000	.

Note: Spearman's correlation coefficient ranges from -1 to 1. The closer the absolute value of the correlation coefficient is to 1, the stronger the correlation is; a correlation coefficient greater than 0 shows a positive correlation, less than 0 shows a negative correlation, and correlation is considered to exist at the level of $P < 0.05$. None * indicates no correlation between the two variables, * indicates that the correlation is significant at the 0.05 level, and ** indicates that the correlation is significant at the 0.01 level.

Table 4. Differences in DSKAB scales and different education levels

Scales	Junior high school and below	High school/ junior college	College/undergraduate	Masters and above	Z	*P*
Knowledge	1 (0,4.5)	7 (5,10)	14 (10,17)	18 (13,20)	112.344	0
Attitude	10 (9.5,12.5)	14 (12,17)	20 (18,22)	22 (20,23)	117.866	0
Practice	32 (29.5, 37.5)	33 (30,37)	36 (32,41)	40 (38, 43)	25.137	0

Table 5. Differences in the DSKAB scales and working status

Scales	Working	Sick leave/absence	Unemployed	Z	*P*
Knowledge	13 (8.5,17)	8 (5,14)	13 (9,18)	17.365	0
Attitude	19 (16.5,22)	17 (12,21)	20 (17,22)	11.051	0.004
Practice	34 (31.5,17.5)	34 (30,38)	36 (32,41)	6.661	0.036

Table 6. Differences in the DSKAB scales and occupation

Occupation	Knowledge	Attitude	Practice
Individual /Student	13 (8,17)	20 (16,22)	36 (31,41)
Ordinary staff	14 (9.25,18)	19 (15,21)	35.5 (30.25,41.75)

Table 5 (Continued)

Occupation	Knowledge	Attitude	Practice
Company employee	13 (10,16)	21 (18,23)	37 (31,43.5)
Technical personnel	10 (6,14.5)	14 (12,21.5)	35 (31.5,40.5)
Staff of state organs	16 (10,17)	21 (15,23.5)	42 (32.5,43)
Service personnel	9.5 (6,14.5)	19 (14.75,21)	33.5 (31,39.25)
Scientific, educational, cultural, and health workers	17 (9,19)	20 (18,22)	36 (32,42)
Other	10 (3,16.5)	19 (13.5,21.5)	33 (32,40)
Z	15.834	10.97	3.676
P	0.027	0.14	0.816

3.2.2. Social and environmental factors

(1) Monthly household income (CNY)

As shown in **Table 7**, the monthly income of different families has a significant difference in the knowledge ($P < 0.05$), but no significant difference in the attitude and practice subscale ($P > 0.05$).

(2) Medical payment method

As shown in **Table 8**, there were significant differences among different medical payment methods in the knowledge subscale, but no significant differences in the attitude and practice subscale.

(3) Support from family and friends

As shown in **Table 9**, there were significant differences in the DSKAB scales and the support of friends and family.

(4) Diabetes health education

As shown in **Table 10**, there were significant differences in the frequency of diabetes health education on the knowledge and practice subscale, but no significant differences in the attitude subscale.

Table 7. Differences in the DSKAB scales and different monthly household income

Scales	1000–3999	4000–6999	7000–9999	≥ 10000	Z	*P*
Knowledge	9 (6,14)	12.5 (7,16)	12 (8,18)	13 (9,18)	8.351	0.039
Attitude	18 (14,21)	20 (16,22)	19 (15.5,22)	19 (16,22)	3.234	0.357
Practice	36 (33,39)	35 (31,41)	37 (31.5,42)	35 (31,40)	2.502	0.475

Table 8. Differences in the DSKAB scales and different payment methods

Scales	Public medical	Medical insurance	New rural cooperative medical system	Self-payment	Z	*P*
Knowledge	13 (9,18)	15 (10,18.5)	11 (7,14)	16 (11,19.8)	15.684	0.001
Attitude	20 (17,22)	21 (17,23)	19 (14,21)	19 (15,22)	6.269	0.099
Practice	36 (31,42)	35 (31.5,39)	35 (32,39.75)	35 (30,40)	1.332	0.722

Table 9. Differences in the DSKAB scales and the presence and absence of support from friends and family

Scales	Yes	No	Z	*P*
Knowledge	13 (8.25,17)	11 (4,15)	-2.989	0.003
Attitude	20 (16,22)	18 (13,21)	-2.191	0.028
Practice	36 (32,41)	34 (30,38)	-2.699	0.007

Table 10. Differences in the DSKAB scales and the frequency of diabetes health education

Scales	0 times	1–4 times	4–12 times	> 12 times	Z	*P*
Knowledge	11 (7,16)	14 (9.75,18)	12.5 (9,16.25)	18.5 (12.25,19.75)	16.433	0.001
Attitude	19 (16,22)	19.5 (16,22)	20 (17,22.5)	20 (15,22.75)	0.477	0.924
Practice	34 (31,39)	37 (32,42)	36 (31.75,31)	41 (35.25,45)	11.298	0.01

3.2.3. Clinical factors

(1) Diabetes complications

As shown in **Table 11**, there was a significant difference in the knowledge subscale, but no significant difference in the attitude and practice subscale.

(2) HbA1c value

As shown in **Table 12**, there was no correlation between HBA1c levels and the knowledge and attitude subscales, and the HBA1c value has a weak negative correlation with the practice subscale (r = -0.116, $P = 0.028$).

Table 11. Differences in the knowledge, attitude, and practice subscale and diabetes

Scales	Diabetic	Non-diabetic	Z	*P*
Knowledge	14 (9,18)	12 (8,16)	-2.181	0.029
Attitude	20 (16,22)	19 (16,22)	-0.078	0.938
Practice	37 (33,41)	35 (31,41)	-1.691	0.091

Table 12. The correlation of the DSKAB scales with HBA1c levels

		HbA1c (%)	Knowledge	Attitude	Practice
Spearman's rho	Correlation coefficient	1.000	-0.078	-0.101	-0.116*
	Sig.(2-tailed)	.	0.143	0.057	0.028
	Correlation coefficient	-0.078	1.000	0.387**	0.260**
	Sig.(2-tailed)	0.143	.	0.000	0.000
	Correlation coefficient	-0.101	0.387**	1.000	0.333**
	Sig.(2-tailed)	0.057	0.000	.	0.000
	Correlation coefficient	-0.116*	0.260**	0.333**	1.000
	Sig.(2-tailed)	0.028	0.000	0.000	.

Note: Spearman's correlation coefficient ranges from -1 to 1. The closer the absolute value of the correlation coefficient is to 1, the stronger the correlation is; a correlation coefficient greater than 0 shows a positive correlation, less than 0 shows a negative correlation, and correlation is considered to exist at the level of $P < 0.05$. None * indicates no correlation between the two variables, * indicates that the correlation is significant at the 0.05 level, and ** indicates that the correlation is significant at the 0.01 level.

4. Discussion

4.1. Current situation of diabetes self-management KAP

In the dimension of diabetes comprehension, the average score of self-management knowledge of diabetic patients is more than 50%, yet there is still room for improvement. The average score indicates that patients

have some understanding of diabetes, but there may exist blind spots or misunderstandings. The highest score is Q6 on the precautions for exercise, which shows that most patients realize the importance of consulting a doctor before exercise and have a certain understanding of exercise [8]. The lowest score was for Q3b's knowledge of diabetes combined with coronary heart disease, indicating that many patients lack sufficient awareness of the cardiovascular complications that can result from diabetes [9]. This is particularly concerning as cardiovascular disease is one of the leading causes of death in diabetic patients. In the attitude dimension, patients' average score was high, close to three-quarters of the perfect score. This indicates that most patients had a positive attitude toward self-management of diabetes, which was consistent with previous research by Wei *et al* [14]. The highest score was for adherence to prescribed medication, indicating that patients understood the importance of prescribed medication and the important role of medication in the effective control and treatment of T2DM [11]. The lowest-scoring question was Q3 regarding exercise and blood sugar control, which may reflect patients' lack of awareness of the importance of physician-directed exercises [8]. The practice dimension had the lowest average score among the three dimensions, and the lowest score is Q8 regarding foot examinations, which indicates that most patients ignore the importance of regular foot examinations. This finding was consistent with previous research by Yang [12], and diabetic foot disease is one of the common complications of diabetes patients. Nonetheless, we found that there is still a certain gap in the practical implementation of self-management behavior in young T2DM patients.

4.2. Relationship between general condition and diabetes self-management KAP

4.2.1. Relationship between personal factors and diabetes self-management KAP

The influence of individual factors on diabetes self-management was mainly reflected in sex, age, education level, occupation, and work situations.

For sex, this is possible because women are generally more proactive in seeking health information and may be more knowledgeable about diabetes prevention and management. Men have a more passive attitude towards their health and are less likely to seek health information actively, so they may lack understanding of diabetes [13].

Younger patients are more likely to be adept at using digital tools and social media to access health information [8]. However, the impact on diabetes self-management is not well demonstrated, as they lack awareness of the risk of diabetes, assume that they are in a low-risk state, lack sufficient attention to diabetes, and have a negative attitude [4].

For education level, younger respondents generally have a higher education level, which allows them to better acquire health knowledge, and understand and implement diabetes self-management. Additionally, a higher education level can lead to a wiser attitude towards diabetes management, and increased willingness to adopt healthy behaviors [10].

As for occupation and work situations, some jobs are so busy that people have no time to pay attention to their health, which often affects the acquisition of diabetes knowledge. High social pressure causes them to have no time for diabetes self-management, which limits the time for patients to carry out daily self-management activities [14].

4.2.2. Relationship between social and environmental factors and diabetes self-management KAP

The influence of social environment factors on diabetes self-management was mainly reflected in monthly household income, family and friends support, and frequency of diabetes health education.

The influence of household income on diabetes knowledge is multifaceted. Higher household incomes lead

to more preventive measures, better quality health care, and better access to health education. Lower family income may lead to a certain level of financial stress, resulting in less attention to aspects of personal health and a lack of willingness to understand diabetes [10].

Individuals covered by health insurance or public health services often have access to more health education resources and management tools, which can help improve disease knowledge and self-management skills. However, this can also increase one's disregard and over-reliance on public health services, thereby reducing their motivation to proactively learn about diabetes [8].

Emotional support from family and friends can improve patients' self-efficacy and motivation to conduct diabetes management [11]. A lack of support or misunderstandings from family members can lead to the patient's negative attitudes toward diabetes management and feelings of isolation and frustration [4].

Young adults at this stage are less involved in diabetes education, which may cause them to have low awareness of the disease, lack management skills, and a reduced quality of life [5]. Regular participation in health education activities can significantly improve the patients' self-management ability. However, inadequate education may lead to a lack of key disease knowledge and self-management skills [1].

4.2.3. Relationship between clinical factors and diabetes self-management KAP

The influence of clinical factors on diabetes self-management is mainly reflected in diabetes complications and HbA1c values.

The emergence of diabetes complications tends to increase the patients' and families' awareness of the disease, resulting in a greater emphasis on diabetes education. However, it can also place a serious psychological burden on patients, including anxiety and depression [15]. These negative emotions may affect the patient's ability to acquire and apply knowledge about diabetes [8].

HbA1c is an indicator of average blood sugar levels for the past 2–3 months, hence short-term improvements in self-management may not immediately lead to a significant decrease in HbA1c levels [9]. In addition, HbA1c detection itself has certain measurement errors and biological variability, which may affect the interpretation of the relationship between HbA1c value and self-management behavior [16]. Hence, the relationship between self-management practice and HbA1c value is not directly positive. However, adherence to self-management practices is critical to improving HbA1c levels.

5. Conclusion

Although diabetic patients are more active in self-management, they still have deficiencies in knowledge acquisition and behavioral practice. In the knowledge dimension of diabetes self-management, patients had a certain degree of understanding of the basic knowledge, but not enough about the complications of the disease, especially the cardiovascular complications that can be caused by poor glycemic control. In the attitude dimension of diabetes self-management, patients generally believed that following the doctor's instructions for medication was important for glycemic control, showing a positive attitude towards disease management. However, there was insufficient awareness of the importance of physician-guided exercises. In the practice dimension of diabetes self-management, despite the presence of positive attitudes, patients had challenges in translating these attitudes into healthy behaviors, reflected in the low level of regular foot examinations.

Personal factors such as sex, age, and education level, and social-environmental factors such as family income and family or friends' social support significantly influenced the patient's diabetes self-management KAP. Additionally, clinical factors such as complications and HbA1c values significantly impact the patient's ability to effectively self-manage their condition.

6. Recommendations

The self-management of diabetes can be improved in many ways. First, personalized diabetes management and education programs can be provided, which focus on improving disease-related knowledge and resolving bad habits. A self-management care plan and program can be developed according to the patient's characteristics. Secondly, social support can be improved. It is crucial to encourage the participation and support of family members and friends, provide more social support through community activities and diabetes-related organizations, and help patients improve their self-management attitudes and behaviors. Third, medical resources should be fully utilized to promote and improve relevant policies and nursing services. More accessible and affordable medical resources should be provided to young patients, and the level and coverage of diabetes care management services should be improved. Policy changes and healthcare system improvements should also be advocated to promote better access to diabetes care resources, regular medical screenings, and other services.

Disclosure statement

The authors declare no conflict of interest.

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