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Impact of knowledge, attitude, and practices of Type 2 diabetic patients: A study in the locality in Vietnam

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Abstract:

BACKGROUND: Disease knowledge, appropriate attitude, and proper practices play an important role in disease control and reduction of diabetes-related complications and deaths. This study aims to investigate the impact of knowledge, attitude, and practices (KAPs) of Type 2 diabetic patients' outcomes.

MATERIALS AND METHODS: A cross-sectional research was conducted on a group of 102 Type 2 diabetic participants in 17 communities in Tam Binh District, Vinh Long Province, Vietnam. The research tool employed the KAP questionnaire using IBM SPSS 22 to analyze the data.

RESULTS: The participants' average age was 57.02 ± 6.323 years. The proportion of women was 76.5% (three times higher than men). The knowledge score of the participants was low (30.04 ± 12.823), the attitude toward score of diabetics was moderate (61.544 ± 29.99), and the practice of self-care score was low (50.59 ± 14.881). There were also some significant relationships between KAPs with ethnicity, marital status, diabetic duration, location, employment status, and treatment method. In addition, there were only significant differences between the self-care practice groups and patients' attitude toward Type 2 diabetes.

CONCLUSION: There is a significant relationship between KAP with some participants' characteristics. The KAPs of the diabetic patients in Tam Binh district are still low. This result showed that although the patient's attitude towards disease was good, it was not enough for them to practice good self-control due to poor knowledge.

Keywords:

Diabetes, knowledge, attitude, practice questionnaire, knowledge, attitude, practice

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Introduction

Type 2 diabetes mellitus (T2DM) is a long-term metabolic confusion disease that is related to a high rate of complication and mortality in a population.^[1,2] The worldwide prevalence of diabetes was 177 million in 2000,^[3] which increased to 422 million in 2014,^[4] and it will be reaching 592 million by 2035.^[5] In 2015, there were over 3.5 million Vietnamese adults living with diabetes. Particularly, T2DM is the most common type, with the incidence

doubling in the previous decade (2.7% in 2002–5.4% in 2012).^[6,7]

Diabetic treatment is a lifelong process, so self-motivation of the patient is needed. Therefore, patients need a basic knowledge of diabetes, and if they have knowledge about the disease, they will be more positive about the attitude and better practice.^[8,9] It can help early disease detection and complication reduction.^[10,11] Some authors have assessed the knowledge, attitude, and practice (KAP) of diabetes using the KAP questionnaire and promoted them for better cognizance of how to manage risk factors

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including program intervention of the diabetes.^[12] They also indicated that diabetes knowledge, attitudes toward disease, and practices of the diabetic self-management are associated with a greater understanding of the prevention, diagnosis, and control of risk factors.^[13] This study assessed the impact of knowledge, attitude toward diabetes, and practice of self-care management of T2DM patients. In spite of that, the knowledge related to diabetic control has globally been realized to be scanty.^[9] Especially, no studies have been conducted on the general population in Tam Binh district, Vinh Long province, Vietnam, to assess the KAP of T2DM.

Therefore, this study aims to ascertain the impact of the knowledge, attitude toward diabetes, and practices of T2DM in Tam Binh district, Vinh Long province, Vietnam, which will further identify the relationship between KAPs in participants.

Materials and Methods

The participants

This cross-sectional research was conducted on one group including 102 participants at 17 communes (six participants per commune) in Tam Binh district, Vinh Long province, Vietnam, from July to August 2019. The participants were randomly selected based on each local diabetic management list. Sampling criteria were patients aged 35–65 years with T2DM; diabetic duration from 6 months or more; those who were not hospitalized in the past 3 months; and those who did not have neurological abnormalities and malformations.

The knowledge, attitude, practice questionnaire

The KAP questionnaire was created by the researcher in both Vietnamese and English to suit Vietnamese culture [Supplement Table 1]. The KAP questionnaire consists of four parts including (1) the demographic of the participants, (2) the knowledge of individuals with diabetes, (3) participants' attitude toward diabetics, and (4) participants' self-care management of diabetes. The knowledge part contains ten multiple choices with 1 score for each correct answer.

The attitude toward diabetes component had ten 5-point Likert scale questions about diabetic perspective. The attitude points, after being aggregated, would also be converted to a scale of 100 according to the formula of Jacobson and DCCT, 1994, and Best and Kahn, 2006 "Transformedscale

$$= \left[\frac{\text{Actual raw score} - \text{Lowest possible raw score}}{\text{Possible raw score range}} \right] * 100 \quad \text{.}^{[14,15]}$$

The practice of self-care section has ten questions about diabetic self-management. For a question that is divided into several subtleties, if the participant gives an incorrect answer any of details, the question was considered wrong. Each correct answer is scored "1;" on the other hand, an incorrect answer is scored "0."

The scores are divided into three levels, namely, low level (<60% of the total points), moderate level (60%–79% of the total points), and high level (≥80% of the total points).^[16]

Data collection

The questionnaire was reviewed by five experts with a doctoral or higher degree in Can Tho University of Medicine and Pharmacy, with an item objective congruence = 1 [Supplement Table 2]. Then, the questionnaire was administered to ten participants in Tam Binh District Health Centre center with Cronbach's alpha = 0.738 [Supplement Table 3]. The questionnaire was sent directly to each patient. The staffs would guide how to answer but they had absolutely no hint of the answer.

Statistical analysis

All collected data were coded before they were analyzed by IBM SPSS software version 22, IBM corporation. The descriptive statistics including frequency, mean, and standard deviation were used for evaluating participant characteristics and KAP score. Correlation between variables was assessed using Pearson's correlation coefficients. The relation between knowledge, practice, and attitude sections was analyzed by regression correlation. The significance level for all tests was fixed at $\alpha < 0.05$.

Besides, age was separated into two groups as Group 1 from 35 to 49 years and Group 2 from 50 to 65 years. In addition, the duration of T2DM was divided into four groups as Group 1 under 10 years, Group 2 from 10 to 20 years, Group 3 from 20 to 30 years, and Group 4 over 30 years. Furthermore, the glycemic levels diverged into three groups such as group 1 under 3.9 mmol/L, Group 2 from 3.9 to 6.4 mmol/L, and Group 3 above 6.4 mmol/L. In addition, the HbA1c levels were divided into three groups as Group 1 below 4%, Group 2 from 4% to 6%, and Group 3 above 6%.

Results

Participant demographic data

All the study patients (102) had an average age of 57.02 ± 6.32 years. The proportion of women accounted for 76.5% (more than three times of men, 23.5%). The ethnicity was Kinh who suffered the most from diabetes, 96.1%; 101 participants (99%) were married and are living

with small families for 1–2 generations (73.5%), while 26.5% of the participants are living in large families over three generations. Most of the participants had primary to higher education (94.1%); only 5.9% of them were illiterate. Nearly 76.5% of the patients had jobs, both part time and full time, and the remaining (23.5%) did not work including retirement and unemployment. The majority of participants had a high monthly income of 82.4% (84 participants). The average duration of the diabetics was 4.33 ± 4.56 years, the longest was 22 years, the shortest was 0.5 years. The blood glucose level and HbA1c level of the participants were 9.60 ± 3.77 mmol/L and $7.40 \pm 2.46\%$, respectively [Table 1].

The participants' knowledge, attitudes, and practices

All patients completed the KAP questionnaire, in which the score was low (50.057 ± 10.644). Specifically, their knowledge score was low (30.04 ± 12.823). In particular, the majority of participants (97 people) had a low knowledge level of 95.1% [Table 1]. Despite this, some knowledge had a quite high patient rate such as: "how many types of diabetes" were 71.6%; "the concept of type 2 diabetes" had 53.9%; "the symptoms of hypoglycemic" occupied 66.7%. However, their attitude score was moderate (61.544 ± 29.99). Among them, those with low attitudes accounted for more than half of the 52% (53 people), followed by those with an average attitude of 25.5% (26 patients), and those with high attitude 22.5% (23 participants) [Table 1]. In addition, the practice score was low at 50.59 ± 14.881 . In this section, the practice was recorded as an average with 8.8% (14 people), six times lower than patients with a low level of practice of 86.3% (88 people). However, only 5.9% of the people with diabetes practiced high level of practice [Table 1].

Regarding diabetic self-management practice, the highest percentage of patients treated with oral medication constituted 77.5% (77 participants), followed by insulin injections with 6.9% (7 patients) and diet therapy with 5.9% (6 participants); in addition, patients without treatment accounted for 11.8% (12 patients). The majority of patients using one type of drug to treat diabetes each day accounted for 56.9%. Two patients (2%) used six tables of diabetic drug per day. Patients in the study injected the insulin into the abdomen and shoulders [Table 2].

The relation between participants' characteristics and knowledge, attitude, and practice

Table 3 describes the relation between patients' KAP and their characteristics such as age, gender, ethnicity, location, marital status, type of family, education level, employment status, monthly income, diabetic duration, diabetic information, glycemic

Table 1: The demographic data and knowledge, attitudes, and practices of the participants

Characteristics	Participants (n=102)
Age (mean±SD)	57.02±6.323
Gender, n (%)	
Male	24 (23.5)
Female	78 (76.5)
Monthly income, n (%)	
Low	6 (5.9)
Medium	12 (11.8)
High	84 (82.4)
Employment status, n (%)	
Working (full time)	58 (56.9)
Working (part time)	20 (19.6)
Unemployed	6 (5.9)
Retired	18 (17.6)
Type of family, n (%)	
Small (1- 2 generations)	75 (73.5)
Big (≥3 generations)	27 (26.5)
Diabetic information, n (%)	
Yes	54 (52.9)
No	48 (47.1)
Other diseases, n (%)	
Yes	97 (95.1)
No	5 (4.9)
Diabetic duration (mean±SD, range [year])	4.33±4.56 (0.5- 22)
Ethnicity, n (%)	
Kinh	98 (96.1)
Khmer	4 (3.9)
Glycemic level (mean±SD, range [mmol/L])	9.60±3.77 (3.2- 23.8)
HbA _{1c} (mean±SD, range [%])	7.40±2.46 (4.0- 14.7)
Education level, n (%)	
Illiterate	6 (5.9)
Primary	32 (31.4)
Secondary	34 (33.3)
Tertiary and above	30 (29.4)
Marital status, n (%)	
Married	101 (99)
Widowed	1 (1)
Checking place, n (%)	
Government	95 (93.1)
Private	7 (6.9)
Hypoglycemia, n (%)	
Never once/few months	41 (40.2)
One/week	20 (19.6)
2- 3 times/week	32 (31.4)
Daily	9 (8.8)
KAP	
Total (mean±SD)	50.057±10.644
Knowledge	
Total (mean±SD)	30.04±12.823
High, n (%)	1 (1.0)
Medium, n (%)	4 (3.9)
Low, n (%)	97 (95.1)
Attitude	
Total (mean±SD)	61.544±29.99
High, n (%)	23 (22.5)

Contd...

Table 1: Contd...

Characteristics	Participants (n=102)
Medium, n (%)	26 (25.5)
Low, n (%)	53 (52.0)
Practice	
Total (mean±SD)	50.59±14.881
High, n (%)	6 (5.9)
Medium, n (%)	9 (8.8)
Low, n (%)	87 (85.3)

SD=Standard deviation, KAP=Knowledge, attitude, and practice

level, HbA1c status, glycemic checking place, other disease, treatment method, hypoglycemia, smoking history, and drinking history. It showed a significant relationship in diabetic knowledge between Kinh and Khmer ethnic groups, as well as between groups of patients with different diabetic duration ($P = 0.000$ and 0.043) [Table 3]. Moreover, the results also described a statistically significant relationship between the patients' attitude to diabetes and different patient groups in terms of location ($P = 0.003$) [Table 3], employment status ($P = 0.000$), treatment method, hypo-glycemia and diabetic duration. On the other hand, the research results also found a significant association between marital status and diabetic duration with patients' daily disease self-management practices [Table 3].

The relation between knowledge, attitude, and practice

Table 4 shows the difference in knowledge and attitude of Type 2 diabetic patients between the different practice groups. In this relationship, only the difference in the practice of the attitude groups was statistically significant ($P = 0.014$). There were also differences in knowledge between practice groups, but this was not statistically significant.

Discussion

Diabetes is a chronic metabolic disorder with many different complications.^[5] Therefore, in order to control the disease effectively, patients need to have the right KAP about diabetes.^[9] This study assessed diabetic patients' KAP of diabetes management. It also explored the relationship between KAPs of Type 2 diabetic patients.

The study was conducted on individuals aged between 35 and 65 years because at this age diabetes had been seem to be highly prevalent in Vietnam according to the 2002 National Statistical Survey^[7] and it is also an age group of cognitive maturity. The median age of the patients in this study was 57.02 years, which is consistent with the study of Ng *et al.*^[1] and Le Roux *et al.*^[9] Like many other studies, this study had a higher proportion of women with Type 2 diabetes than men.^[3,6,9] However, some studies report that diabetes is more common in men than in women,^[5,17] but the difference was not significant.

Table 2: The proportion of the components of practice section

Components	Participants, n (%)
Hypoglycemic	
Yes	70 (68.6)
None	32 (31.4)
Treatment	
True	66 (94.3)
False	4 (5.7)
Glycemic	
Check	102 (100)
Place	
Government	94 (92.2)
Private	8 (7.8)
HbA1c	
Check	
Yes	20 (19.6)
None	82 (80.4)
Place	
Government	17 (85)
Private	3 (15)
Exercise	
Yes	62 (60.8)
None	40 (39.2)
Glycemic decrease	
Know	43 (54.8)
Unknown	28 (45.2)
Diet deleted	
Yes	62 (60.8)
None	40 (39.2)
Diet limitation	
True	14 (13.7)
False	88 (86.3)
Smoking	
Yes	17 (16.7)
None	85 (83.3)
Alcohol consumption	
Yes	21 (20.6)
None	81 (79.4)
Treatment	
Tablet	77 (75.5)
Insulin	7 (6.9)
Diet	6 (5.9)
None	12 (11.8)
Foot care	
True	6 (5.9)
False	96 (94.1)

Furthermore, Salem *et al.* also reported that the patients in their study were highly educated from high school and above.^[13] Simultaneously, the study of Saengtippovorn *et al.* reported that 76.5% of their participants had completed primary school education.^[12] Similarly, this study found that most patients had primary or higher level of education (93%). Nevertheless, a study in Iran by Mohammadi *et al.* found that nearly 27 illiterate patients, but the majority (41%) of the study participants, were not attending primary school.^[18] The low levels of education

Table 3: The relation between patients' characteristics and knowledge, attitudes, and practices by one-way ANOVA

Characteristics	Knowledge			Attitude			Practice		
	Mean square	F	Significant	Mean square	F	Significant	Mean square	F	Significant
Age	0.043	0.376	0.688	0.015	0.127	0.881	0.193	1.740	0.181
Gender	0.146	0.798	0.453	0.190	1.047	0.355	0.097	0.529	0.591
Ethnicity	0.442	14.796	0.000	0.073	1.941	0.149	0.014	0.351	0.705
Location	21.749	0.895	0.412	133.057	6.037	0.003	4.771	0.194	0.824
Marital status	0.001	0.025	0.975	0.018	0.457	0.634	0.203	5.642	0.005
Type of family	0.273	1.400	0.251	0.271	1.390	0.254	0.367	1.901	0.155
Education level	0.788	0.945	0.392	0.485	0.577	0.563	0.844	1.014	0.367
Employment status	0.065	0.048	0.953	0.706	0.530	0.591	0.542	0.405	0.668
monthly income	0.028	0.092	0.912	0.415	1.393	0.253	0.300	0.998	0.372
Diabetic information	0.217	0.862	0.425	0.511	2.073	0.131	0.305	1.216	0.301
Other diseases	0.006	0.132	0.877	0.051	1.080	0.344	0.068	1.459	0.237
Treatment method	1.629	1.546	0.218	2.096	2.007	0.140	0.793	0.741	0.479
Hypoglycemia	2.185	2.084	0.130	1.511	1.423	0.246	2.023	1.923	0.152
Checking place	0.070	1.092	0.339	0.083	1.287	0.281	0.022	0.340	0.712
Smoking	0.073	0.516	0.599	0.143	1.018	0.365	0.244	1.768	0.176
Drinking	0.111	0.670	0.514	0.301	1.856	0.162	0.193	1.171	0.314
Diabetic duration	0.340	3.252	0.043	0.006	0.051	0.950	0.606	6.112	0.003
Glycemic level	0.146	0.718	0.490	0.034	0.167	0.847	0.085	0.415	0.662
HbA1c	0.103	0.399	0.672	0.198	0.771	0.465	0.121	0.467	0.628

Table 4: The relation between patients' knowledge, attitude, and practice

Effect	Model fitting criteria	Likelihood ratio tests	
	-2 log likelihood of reduced model	χ^2	Significant
Intercept	13.791	0.000	
Knowledge	15.333	1.542	0.819
Attitude	26.210	12.420	0.014

were also found in the study by Al-Maskari *et al.* with 46% illiteracy.^[19]

Most patients had a job, so their income was high. Concurrently, a study by Saengtibovorn *et al.* showed that 37.1% of the study participants earned <1500 baht per month.^[2] In addition, a study by Mohammadi *et al.* found that only 27% of the patients had jobs and their monthly income was <8,000,000 Rials.^[18] The average duration of diabetes in the study by Al-Maskari *et al.* was 9 years.^[19] Rahaman *et al.* also showed that the average duration of diabetes was 9.16 ± 6.03 years.^[20] However, patients in the current study had a significantly lower duration of Type 2 diabetes than the previous two studies (4.33 ± 4.56 years). More than half of the patients have received information about diabetes. However, Rahaman *et al.* reported that only 38.6% of the patients participated in a diabetes-related education program.^[20] About one-quarter (26%) of the patients in the study by Magbanua and Lim-Alba participated in the diabetes education.^[21]

Most patients had at least one other condition related to diabetes (95.1%) such as hypertension,

hypercholesterolemia, heart disease, vision problems, neurological problems, poor sexual desire, and kidney problems. These issues were also found in the study by Mohammadi *et al.* in Iran.^[18] Participants' blood sugar and HbA1c levels were quite high. High levels of HbA1c were also found in the study by Al-Maskari *et al.*^[19] and Rahaman *et al.*^[20] Rahaman *et al.* also showed that blood glucose levels were also high, although participants tested their own blood glucose levels at home and in the hospital.^[20] However, patients in this study did not self-test their blood glucose and HbA1c level; most of them checked it at government hospitals and a few did at private clinics. Moreover, the results of this study showed that patients with poor glycemic control have a relatively high rate of hypoglycemia (59.8%).

Similar to the research by Karaoui *et al.*,^[22] most patients in the present study have used oral medications to control the disease. In addition, this result was similar to those of Salem *et al.*,^[13] with high smoking denial rates. Similar results were found in the study of Saengtibovorn *et al.* with the rate of never smokers up to 87.1%.^[2] In contrast, Karaoui *et al.* reported that more than half of the smoking patients participated in the study.^[22] Correspondingly, the alcohol consumption rate in this study was low.

The related of knowledge within people with diabetes

The analysis showed that participants' knowledge of diabetes was still low. This was because patients had not been provided with basic information about Type 2 diabetes. This problem had also been reported by Cao My

Phuong *et al.*^[23] Nhung and Dao showed that knowledge about diabetes treatment and complications of the patients was low.^[24] In addition, a research by Karaoui *et al.* showed that the knowledge base of diabetes in the research population was still low.^[22] Indeed, Rahaman *et al.* reported a lack of diabetic knowledge in the research community.^[20] Indeed, the study by Quang *et al.* also indicated that the number of participants without knowledge about diabetes was quite high.^[7]

Attitude toward diabetes in Vietnamese culture

Al-Maskari *et al.* concluded that although patients have poor knowledge, a positive attitude was an important issue in the care and practice of diabetes.^[19] Meanwhile, Salem *et al.* stated that, although most patients have the knowledge of diabetes, it was not at a high level, and their attitude and practice were not satisfactory.^[13] Similarly, this study also showed that participants had an average attitude level toward diabetes.

Practice of self-care management

The participants' diabetes management practices were generally poor. This showed that a medium attitude score is not enough; it requires good knowledge to lead to the right practices to control diabetes. Ng *et al.* concluded that factors of proper knowledge and attitude led to good disease control practices.^[1] Saadia *et al.* also confirmed that the participants' knowledge of diabetes in research was good, but their attitude and practice were poor.^[25]

The relation of participants' components and knowledge, attitude, and practice

Our research shows that most of the relationships between participants' characteristics and their KAPs had a negligible difference. However, there were some significant relational characteristics, such as race and blood sugar that differed significantly in knowledge about Type 2 diabetes; marital status and family type were statistically significantly related to the patient's attitude toward the disease. Moreover, gender, marital status, education, and monthly income were significantly related to diabetes control practices. Similarly, Ghannadi *et al.* also showed that the relationship between sex and marital status with KAP was not statistically significant.^[17] However, Salem *et al.* reported that there was a significant relationship between KAP scores and different categories such as location, gender, and education.^[13] Moreover, Ng *et al.* showed a significant inverse correlation between KAP scores and HbA1c.^[1]

The relation of knowledge and attitude with practice

The results of this study showed that the relationship between patient attitude groups and practical components was statistically significant. However, this was not found in the relationship between knowledge and attitude

of diabetic patients. This was due to the culture of the Vietnamese people. Indeed, the study of Al-Maskari *et al.* also found that there was a significant relationship between practice and attitude of patients, but the authors also reported more meaningful results between attitude and knowledge.^[19] Meanwhile, the study by Ghannadi *et al.* showed that higher knowledge was significantly correlated with higher attitudes and practices.^[17]

Conclusion

Although KAP of self-control in diabetes are important contributions to the good treatment of the disease, patients in the study had low scores for these issues. Despite the average attitude about Type 2 diabetes, limited knowledge about the disease is not sufficient, the lack of which leads to poor practices of care and control. However, the results showed that there was only significant difference between attitude and practice in patients with Type 2 diabetes. Furthermore, the relationship between KAP with patients' characteristics had different significance.

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Conflicts of interest

There are no conflicts of interest.

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Supplement Table 1: Knowledge, Attitude, and Practice Questionnaire



MAHARAKHAM UNIVERSITY

DIABETIC KNOWLEDGE, ATTITUDE, PRACTICE

Participant Number (Office use): _____

Date: _____

A. PARTICIPANT INFORMATION

1. Full name: _____
2. Birth year: _____
3. Gender: Male Female
4. Address: _____
5. Glycemia: _____ mmol/L
6. HbA₁C: _____ %

B. DIABETIC KNOWLEDGE

Please circle in the letter that you think is the best.

1. What is diabetes?
 - a. Diabetes is a chronic metabolic disorder characterized by hyperglycemia
 - b. Diabetes is a chronic metabolic disorder with a manifestation of hypoglycemia
 - c. Diabetes is a disease spread in the community
2. How many types of diabetes are there?
 - a. 1 type
 - b. 2 types
 - c. 3 types
3. What is type 2 diabetes?
 - a. Because the body produces lack or does not produce insulin
 - b. Because the body is resistant to insulin (usually occurs in obese people and >40 years old)
 - c. Occurs in pregnant women (no previous diabetes)
4. Who is at risk for diabetes?
 - a. People who are obese, sedentary, eat a lot of fat, sweet, starch, alcohol, tobacco, family history of diabetes
 - b. Muscular people, exercise regularly, eat well, do not smoke, do not drink alcohol
 - c. Thin people, eat normally, have no family history of diabetes


5. What are diabetic symptoms?
 - a. Eat a lot, drink a lot, lose weight a lot, urinate a lot
 - b. Eating normally, losing little weight, moderate urination
 - c. Eat less, lose weight, urinate often
6. How many types of diabetic complication are there?
 - a. One type: acute complications
 - b. Two types: acute complications and chronic complications
 - c. Three types: acute complication, subacute complication and chronic complication
7. What are the acute complications of diabetes mellitus?
 - a. Hyperglycemia and foot ulcer
 - b. Insomnia, anxiety and weight loss
 - c. Hypoglycemia and coma due to hyperglycemia, ketoacidosis and lactic infections
8. What are the chronic complications of diabetes mellitus?
 - a. Hypoglycemia and coma
 - b. Cardiovascular complications, decreased vision, kidney failure, impotence, foot ulcers
 - c. Insomnia, anxiety, difficulty breathing
9. What are the methods of complication prevention in diabetic patients?
 - a. Routine blood glucose testing, prescription medication, reasonable eating, proper exercise
 - b. There is no need for routine blood glucose testing, no need for food, no medication, and limited movement
 - c. Test whenever you want, just taking the medicine is enough without don't need the well eating and exercise
10. What are the signs of hypoglycemia in diabetic patients?
 - a. High fever, cold shaking
 - b. Uncomfortable, sweating, dizziness
 - c. Abdominal pain, difficulty breathing

C. DIABETIC ATTITUDE

Please circle the answer you choose


1. Do you agree that blood glucose testing for you and your family is necessary?

Strongly disagree Disagree Not sure Agree Strongly agree




2. Do you agree that diabetes can be well controlled?

Strongly disagree Disagree Not sure Agree Strongly agree




3. Do you agree that blood sugar can be controlled by exercise, sports and medicine?

Strongly disagree Disagree Not sure Agree Strongly agree




4. Do you agree with a reasonable diet that can control blood sugar?

Strongly disagree Disagree Not sure Agree Strongly agree




5. Do you agree with the need to have regular medical checkups and blood sugar checks?

Strongly disagree Disagree Not sure Agree Strongly agree




6. Do you agree that complications of diabetes are a very serious problem?

Strongly disagree Disagree Not sure Agree Strongly agree




7. Do you agree that prevention of complications is important in treating diabetes?

Strongly disagree Disagree Not sure Agree Strongly agree

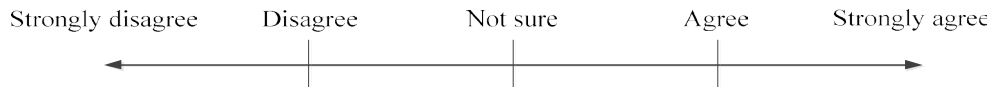


8. Do you agree that daily exercise can control diabetes complications?

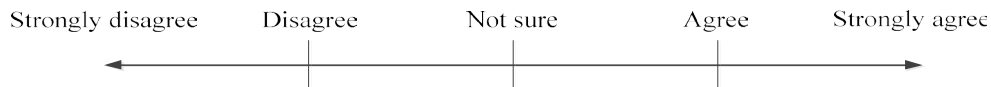
Strongly disagree Disagree Not sure Agree Strongly agree



9. Do you agree about worrying about hypoglycemic complications?



10. Do you agree with taking care of your feet while treating diabetes?



D. DIABETIC PRACTICE

Please answer all the questions below

1. Which method do you treat diabetes with?

- Oral medicine. How many tablets per day? ____ tablets. How many times per day? ____ times
- Insulin injection. How many times of injection? _____ times.
Injection site? _____

2. Do you have regular blood sugar tests? ___ yes ___ no

Where do you check? _____ How often? _____

3. Do you have an HbA1C test? ____ has ____ no

Where do you check? _____ How often? _____

4. Do you exercise regularly? _____ yes _____ no

How long is a day? _____ How many days per week? _____

Which method do you exercise? _____

Do you know exercise can lower blood sugar? ___ yes ___ no

5. How many meals do you eat a day? _____

Should you skip meals? _____ yes _____ no

6. What kind of foods do you need to limit or reduce?

7. Do you smoke cigarettes? _____ has _____ no

How many cigarettes per day? _____ cigarettes

How long have you smoked? _____

8. Do you drink alcohol? _____ yes _____ no

If yes, what is the level of drinking? _____

9. Have you ever had hypoglycemia? _____ has _____ not yet

If so, how did you handle it? _____

10. How do you take care of your feet?

THANK YOU FOR YOUR ANSWERS!

Supplement Table 2: The item objective congruence index

Section	Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Total score	The IOCI Mean of expert score
Knowledge	1	1	1	1	1	1	5	IOCI=5/5=1
	2	1	1	1	1	1	5	IOCI=5/5=1
	3	1	1	1	1	1	5	IOCI=5/5=1
	4	1	1	1	1	1	5	IOCI=5/5=1
	5	1	1	1	1	1	5	IOCI=5/5=1
	6	1	1	1	1	1	5	IOCI=5/5=1
	7	1	1	1	1	1	5	IOCI=5/5=1
	8	1	1	1	1	1	5	IOCI=5/5=1
	9	1	1	1	1	1	5	IOCI=5/5=1
	10	1	1	1	1	1	5	IOCI=5/5=1
Attitude	1	1	1	1	1	1	5	IOCI=5/5=1
	2	1	1	1	1	1	5	IOCI=5/5=1
	3	1	1	1	1	1	5	IOCI=5/5=1
	4	1	1	1	1	1	5	IOCI=5/5=1
	5	1	1	1	1	1	5	IOCI=5/5=1
	6	1	1	1	1	1	5	IOCI=5/5=1
	7	1	1	1	1	1	5	IOCI=5/5=1
	8	1	1	1	1	1	5	IOCI=5/5=1
	9	1	1	1	1	1	5	IOCI=5/5=1
	10	1	1	1	1	1	5	IOCI=5/5=1
Practice	1	1	1	1	1	1	5	IOCI=5/5=1
	2	1	1	1	1	1	5	IOCI=5/5=1
	3	1	1	1	1	1	5	IOCI=5/5=1
	4	1	1	1	1	1	5	IOCI=5/5=1
	5	1	1	1	1	1	5	IOCI=5/5=1
	6	1	1	1	1	1	5	IOCI=5/5=1
	7	1	1	1	1	1	5	IOCI=5/5=1
	8	1	1	1	1	1	5	IOCI=5/5=1
	9	1	1	1	1	1	5	IOCI=5/5=1
	10	1	1	1	1	1	5	IOCI=5/5=1

IOCI=Item objective congruence index

Supplement Table 3: The reliability and validity of the knowledge, attitude, and practice questionnaire

Reliability statistics of the knowledge, attitude, and practice questionnaire					
Cronbach's alpha		Number of items			
0.738		30			
The item-total statistics of the knowledge, attitude, and practice questionnaire					
Section	Question	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Knowledge	1	44.00	23.778	-0.378	0.764
	2	43.40	21.822	0.102	0.739
	3	43.50	21.167	0.225	0.733
	4	44.10	22.322	-0.007	0.742
	5	44.00	22.222	0.000	0.745
	6	43.50	21.833	0.074	0.742
	7	43.70	21.789	0.068	0.744
	8	43.80	19.733	0.523	0.713
	9	44.10	22.989	-0.227	0.751
	10	43.60	20.267	0.401	0.721
Attitude	1	40.50	20.278	0.434	0.720
	2	40.90	18.322	0.627	0.698
	3	41.00	18.000	0.745	0.689
	4	40.80	18.400	0.585	0.702
	5	40.40	20.489	0.454	0.720
	6	40.90	20.100	0.477	0.717
	7	40.60	21.156	0.206	0.734
	8	40.80	20.844	0.273	0.730
	9	40.70	20.011	0.448	0.718
	10	41.00	20.444	0.466	0.719
Practice	1	43.20	22.400	0.000	0.739
	2	43.20	22.400	0.000	0.739
	3	44.00	23.111	-0.219	0.756
	4	44.00	21.111	0.287	0.729
	5	43.70	20.456	0.350	0.725
	6	43.80	19.733	0.523	0.713
	7	43.60	21.822	0.064	0.744
	8	43.60	21.822	0.064	0.744
	9	43.20	22.400	0.000	0.739
	10	44.20	22.400	0.000	0.739

The validity of knowledge, attitude, and practice questionnaire

Rotated component matrix ^a of the knowledge section					
Question	Component				
	1	2	3	4	5
1	0.889	-0.371			
2		0.939			
3					0.906
4		0.347	-0.706		0.503
5				0.923	
6	-0.856				
7	-0.355	0.491		-0.752	
8		0.625	-0.386		
9	0.844				
10			0.896		

Extraction method: Principal component analysis

Rotation method: Varimax with Kaiser normalization.^aRotation converged in ten iterations

Supplement Table 3: Contd...

Rotated component matrix^a of attitude section			
Question	Component		
	1	2	3
1			0.643
2	0.411	0.804	
3	0.829		
4	0.891		
5	0.832		
6	0.696	0.389	
7			0.840
8		0.692	0.338
9	0.313	0.859	
10		0.806	0.416

Extraction method: Principal component analysis

Rotation method: Varimax with Kaiser normalization.^aRotation converged in seven iterations

Rotated component matrix^a of practice section				
Question	Component			
	1	2	3	4
1	-0.487		0.663	
2	-0.509		-0.689	-0.451
3	-0.593	0.612		0.344
4				0.942
5		0.646	0.313	0.629
6			0.916	
7	0.907			
8	0.783	0.455		
9	0.776			-0.300
10		0.935		

Extraction method: Principal component analysis

Rotation method: Varimax with Kaiser normalization.^aRotation converged in five iterations