Diabetes Knowledge Among Patients with Type 2 Diabetes at the University of Santo Tomas Hospital Using the Filipino Version of Michigan Diabetes Knowledge Test (Filipino-DKT)

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Abstract

Background: A well-informed patient with Type 2 diabetes may be more compliant with treatment. This study aims to evaluate the diabetes-related knowledge and socio-demographic determinants of patients seen at University of Santo Tomas Hospital through a translated and validated Filipino–DKT questionnaire.

Methods: Standard translation procedure was used to produce the Filipino version of the DKT2. A convenience sample of 112 outpatients with Type 2 diabetes was identified for six months at the University of Santo Tomas Hospital, Philippines. All data were collected using the Filipino-DKT and a demographic questionnaire.

Results: The Filipino-DKT demonstrated an acceptable Cronbach's alpha of 0.70 and an acceptable average inter-item correlation of 0.40 ($p<0.001$). The test-retest reliability was excellent, with a Pearson coefficient r of 1.00 ($p<0.001$).

Our study demonstrated that of the 112 patients with diabetes who answered the general knowledge test, the majority had average knowledge of 78.64%, while 16.07% had poor knowledge. A total of 55 participants on insulin answered the second part of Filipino-DKT that measures insulin knowledge. Surprisingly, 56% of the subjects on insulin had poor knowledge, and only 7% had good knowledge. Results showed that the majority (56%) had poor knowledge. Participants who reported poor control of their diabetes (HbA1c >7%) also reported lower levels of knowledge about diabetes and insulin use. There was no association between duration of diabetes, family history of diabetes, and type of diabetes with knowledge of diabetes.

Conclusion: The Filipino diabetic knowledge of diabetes is poor and not related to age, sex, and duration of diabetes. Filipino-DKT is an acceptable, reliable, and valid measure of diabetes knowledge used in our clinical practice and research.

Keywords: Diabetes Knowledge, translation, validation

Introduction

Type 2 diabetes (T2D) has spread from affluent industrialized nations to the emerging economies of Asia, Latin America, and Africa. In Southeast Asia alone, prevalence has increased by 74% affecting 88 million of the population. The Philippines is home to 3.7 million people with diabetes at a 6.2% prevalence.[1] This increase in prevalence is strongly associated with an increasing trend in overweight and obesity. Three out of 10 adult Filipinos are overweight and obese. The recent National Nutrition Survey revealed that the prevalence of obesity increased from 20.2% in 1998 to 37.2% in 2018.[2,3] This is due to increased consumption of unhealthy diets rich in carbohydrates, fats, sugars, and salts, a physically inactive or sedentary lifestyle, and low fruit and vegetable intake. Only 19% of Filipinos eat fruit and vegetables more than four times a day.[4] Foods high in fat and sodium are cheaper and more readily available, while fruits and vegetables are expensive and beyond the reach of the ordinary working Filipino. The availability of motorized transportation led to lesser opportunities for physical activity. Chronic disease such as diabetes requires patient education on management to achieve good glycemic control and prevent complications. In a Filipino community screened for T2D, 20% of the diagnosed patients had already micro-vascular complications such as retinopathy in 12%, neuropathy in 20%, and overt proteinuria in 42%. Seventy-six percent

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had an abnormal ankle-brachial index; 2% had a myocardial infarction, 3% had ischemic changes, and 6% had left ventricular hypertrophy.[5]

The treatment of diabetes is long-term and complex, involving lifestyle changes through diet and exercise, weight control, blood glucose monitoring, oral medications and insulin, foot and eye care, and control of macrovascular risk factors, all of which places greater responsibility on the patient. Patients struggle to cope with the level of self-care needed to achieve the target goals of control. Several studies have reported the importance of diabetes education for all patients with diabetes to acquire skills and empower them to assume daily responsibilities to achieve their target blood glucose levels.[6,7] Patients with lower literacy skills have poorer self-reported health status and greater educational needs. Patients with insufficient knowledge of diabetes are least likely to comply with management and instructions from healthcare professionals.[8,19]

A knowledgeable patient with diabetes can easily accept the diagnosis and is willing to do behavioral changes necessary to become an active participant in their treatment. In the Philippines, many studies have assessed the risk factors, complications, and management of diabetes and the effect of knowledge, attitudes, and adherence to self-care behaviors in rural and urban areas.[10-15] About 43% of T2D in a rural community had poor knowledge, and 38% of the respondents strongly believed in the need for patient autonomy.[10] In an urban tertiary government hospital, half of the patients with limited knowledge about DM had fair adherence to the seven self-care behaviors.[11] This study highlighted the importance of evaluating knowledge, attitudes, and practices as crucial means to guide behavioral change.

There seems to be a significant knowledge and skill deficit in 50% to 80% of diabetic individuals.[16] Despite the advances in management, less than half of the patients with T2D can monitor their blood glucose, verified through HbA1c.[17,18] However, diabetes knowledge does not guarantee the achievement of good glycemic control. In a cross-sectional study among 40 inpatients and 60 outpatients with T2D in Shanghai, China, Hu et al found no difference in the overall diabetes knowledge among Chinese people who have good glycemic control or suboptimal glycemic control.[19] Nevertheless, there was a negative correlation (r= -0.208, *p=0.038*) between diabetes knowledge with age.

Various factors have been associated with poor diabetes knowledge, including lower educational level, older age, lower-income, shorter diabetes duration, and lack of English language fluency.[20-22] Of these, lower education level has consistently emerged as an independent risk factor for limited diabetes knowledge. Attending a diabetes education course, having health insurance, and home glucose monitoring have been associated with better diabetes knowledge.[21,22] Measurement of knowledge as outcomes in diabetes education programs has been carried out using knowledge tests in the past two decades. These tools evaluate the patients' knowledge and help determine how effective the intervention was in imparting diabetes knowledge to the patients.

In 1994, the University of Santo Tomas Hospital (USTH) Diabetes Education Clinic was established to render comprehensive individualized and group education for patients with diabetes. Diabetes Education included the following modules: diabetes nature and complications, micro and macro-vascular, medical nutrition therapy and exercise, self-monitoring of blood glucose and insulin administration, foot care, sick day guide, travel, and gestational diabetes. The modules help them understand their disease, reinforce their initiative to maintain a healthy lifestyle, and eventually empower them to live a life with minimal or no complications.

There is a Diabetes club with regular monthly free lay forums called "Ugnayan," which gives updates about diabetes. The USTH Diabetes education clinic was renamed St. Thomas Diabetes Center in 2004. Pre- and post-education tests are given for the effective evaluation of the diabetes education program; however, this evaluation tool was never validated. An extensive literature review yielded several questionnaires to choose from, such as the validated Filipino version of the American Association of Clinical Endocrinologists (AACE) Knowledge Evaluation Form, Diabetes Knowledge Questionnaire (DKQ), the Revised Diabetes Knowledge Scale, and the Diabetic Numeracy Test (DNT).[13,24,25]

The Michigan Diabetes Research and Training Center had developed a series of valid and reliable knowledge tests used in research and clinical practice. The 1998 Michigan Diabetes Knowledge Test (DKT) is a reliable instrument for the expert evaluation of patients' general knowledge of diabetes. It is a 23-item instrument designed to assess patient knowledge of diabetes concerning diet, exercise, blood glucose levels, glucose testing, and self-care activities. The first 14 items apply to all patients, and the remaining nine items are relevant to those using insulin.[26]

In 2011, the 1998 version of the DKT was reviewed and subsequently revised and modified based on the current self-management education and practice standards and was renamed DKT2 (revised Michigan's Research Center's Brief Diabetes Knowledge Test).[27] No items were added to or withdrawn from the new DKT2, but seven items were adjusted to simplify the questions and answers. The DKT2 is a reliable and valid instrument with 23 questions testing the patients' general understanding of diabetes concerning diet, blood glucose monitoring, foot care, diabetes complications, proper insulin usage, adverse effects of insulin, and factors that influence blood glucose levels.[28] The DKT2 with a reliability score of 0.7 and 0.71 from two different Michigan populations was adapted for use in Greece, Ireland, Jamaica, Malaysia, New Zealand, Northern Ireland, Norway, and Singapore and translated by researchers into Spanish, Greek, Navajo, Norwegian, Bahasa Malaysian, and Arabic.[29-36]

To initiate and customize an appropriate diabetes education program for our patients referred at the St. Thomas Diabetes Center, we have to evaluate the level of their diabetes knowledge initially. We only use pre- and post-intervention tests in English that are not validated. The wide use of the DKT2 Scale as a diabetes knowledge instrument encourages us to translate, validate, and adopt the DKT2 Questionnaire for Filipinos with T2D.

This study aims to evaluate the diabetes-related knowledge and socio-demographic determinants of patients with T2D using the Filipino Version of the Diabetes Knowledge Test (Filipino-DKT) to enable us to adopt educational strategies that are matched to the patient's abilities. And specifically, to translate and validate DKT2 into the Filipino version (Filipino-DKT)

Materials and Methods

This study was approved by the University of Santo Tomas Hospital (USTH) Institutional Research Board and Ethics Committee. All subjects provided written informed consent before participation.

Participants and *Setting*. This is a descriptive cross-sectional study conducted at the USTH Out-patient Clinics of the Department of internal medicine. The USTH is a large, private, tertiary teaching hospital in Manila. It provides emergency healthcare treatment for all illnesses and accidents and is a major referral center. The Clinical division outpatient clinic offers free treatment and medical services to people with low socioeconomic status. A convenience sample of 112 outpatients with T2D was recruited from June to November 2017. Inclusion criteria were: Patients 18 years old and above, diagnosed with T2D based on the American Diabetes Association (ADA) criteria, able to read and understand the Filipino language, give consent, and willing to return after two weeks at the outpatient clinics. Face-to-face interviews included collecting socio-demographic data and administration of the 23-items questionnaire. Eligible patients were invited to participate, and the study procedure was discussed. Those interested gave their voluntary written consent then answered the Filipino-DKT questionnaire. Each section of the DKT2 can be used independently, but we used both parts with a global Filipino-DKT score out of 23. The patients were asked to answer the questionnaire independently and immediately address any questions to the researcher. In addition, 30 patients from the sample were randomly selected and agreed for a two-week reliability test-retest analysis. The investigator performed all the face-to-face and re-interviews.

Instrument. The Michigan Research Center's Diabetes Knowledge Test (DKT2)

The DKT2 contains two sections, and each is scored separately

1. A 14-item general knowledge tests the patients' understanding of diabetes concerning diet, blood glucose monitoring, foot care, and diabetes complications. This test is appropriate for adults with type 1 and type 2 diabetes.
2. Nine-item insulin use subscale testing proper insulin usage, adverse effects of insulin, and factors influencing blood glucose levels. This subscale is appropriate for adults with type 1 and type 2 diabetes using insulin. Each test segment can be used independently. The 23-item test takes approximately 15 minutes and is easy to complete. The Flesch-Kincaid grade level measured the test's readability. The reading level was calculated at the fourth-grade reading level. The questionnaire demonstrated reliability with a coefficient alpha at the general test (0.77) and the insulin use subscale (0.84). The total knowledge score was determined by awarding one point for each correct answer and a zero for a wrong answer or no response. The total knowledge score ranged from 0-23 and was categorized as follows: <11= poor knowledge, 11–17= average knowledge, and >17 = good knowledge. The general knowledge score was categorized as: <7= poor, 7–11= average, >11 = good. Insulin use knowledge was categorized as follows: <5= poor, 5–7 = average and >7 = good. The DKT2 is a quick and low-cost method of assessing general knowledge of diabetes and diabetes self-care.[27]

Phase I (Questionnaire Validation). A two-step protocol including translation of the DKT2 to the Filipino-DKT and validation of the Filipino-DKT instrument were performed. This was patterned after the International Society for Pharmaco-economics and Outcomes Research (ISPOR) Task Force for translation and cultural adaptation.[37]

Instrument Translation. Michigan Research Center's Diabetes Knowledge Test (DKT2). Permission to use the English version of DKT2 was given through an electronic mail communication with the first developers of the questionnaire. Forward translation of the original questionnaire was undertaken by translation from English to the Filipino language to produce a version that was semantically and conceptually as close as possible to the original questionnaire.

A language expert at the University of the Philippines-Manila Sentro ng Wikang Filipino translated the original 23 items questionnaire to Filipino, which our patients can easily understand. A multidisciplinary committee composed of two endocrinologists, one nutritionist, and one bilingual nurse reviewed the forward translation. The committee considered that the Filipino language includes the modified or nativized words from the English and Spanish languages, for instance, "*silya,*" to refer to a chair instead of using "*salumpuwit.*" Moreover, they also recognized transliteration, or how a local spell a word, based on how they pronounce it. For example, in Filipino, it is acceptable for a driver to be spelled as "*drayber*."

The committee discussed each word translated and, on one scale, recommended an appropriate alternative. The identification and modification assured the comprehensibility of inadequate expressions.

Two other native speakers who do not know the original tool were requested to back-translate the Filipino version. Word changes in the questionnaire were done accordingly to ensure accuracy and consistency with the original questionnaire.

The final version of the Filipino-DKT was given to the panel of experts composed of two endocrinologists, one nurse educator, and one nutritionist, who are all diabetes experts, to assess the content validity (CVI) of the Questionnaire. The CVI consists of each item-level content validity (I-CBI) and the scale-level content validity index (S-CVI), which determines the content validity of an overall scale.[15] Acceptable content validity has an I-CVI of 0.78 or higher or S-CVI universal agreement (S-CVI/UA) of 0.80 or 0.90 or greater. It is recommended that a minimum of three experts should engage in this task. A 4-point scale was employed to rate the items, with 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = very relevant.[38] The multidisciplinary committee reviewed the linguistic and cultural quality of the scales. They then consolidated all items and reached a consensus to produce a 23-item Filipino version that was culturally appropriate and conceptually equivalent to the originally constructed questionnaire. A final version, the Filipino-DKT, ready for testing, was generated.

Pilot testing was done on 30 patients from the Outpatient Clinics of Internal Medicine. This was done to assess the degree of a respondent's comprehension of each item in the questionnaire. Patients were asked to identify questions that were difficult to understand and may require rephrasing and the level of difficulty encountered when answering each question. The following were guide questions: *"Madali bang intindihin ang bawat tanong?*; *May salita bang sa tingin niyo ay mahirap intindihin?* ; *Angkop ba ang mga tanong para sa inyo?"* Most patients indicated that the Filipino-DKT instruction was easy to follow but moderately difficult to answer since some terms are unknown, such as "free food." Some words were changed based on the patients' feedback, such as using juice instead of "katas" blood sugar instead of "asukal sa dugo." In addition, some phrases which were difficult to understand were simplified and or rephrased.

The questionnaire took about 10-15 minutes to complete. The committee review discussed the patients' comments. Additional insights from the pilot subjects provided refinement of the questionnaire. Therefore, these individuals were not included in the validation study. The final version of the Filipino-DKT was completed and printed for quantitative validation.

Instrument Administration. One hundred twelve patients were included, each responding to the General Knowledge subscale of 14 items to achieve 80% power to detect a margin of 20% ± 10 to detect a 0.05 level of significance. The values used for this sample size computation were based on a study by Boren et al.[39] Due to logistics constraints, convenience sampling was done. A cover letter explaining the purpose of the study, the researcher's contact information, and a written assurance on the confidentiality of the answers was provided to each participant. Internal consistency and reproducibility (test-retest reliability) were measured.

Table I. Content Validity Index (CVI) of Filipino-DKT

Item description	Experts	1	2	3	4	No. of agreements I-CVI
Scale item 1	4	4	4	3	4	1
Scale item 2	3	3	4	3	4	1
Scale item 3	4	4	4	2	3	0.833
Scale item 4	3	4	2	3	3	0.833
Scale item 5	4	4	3	4	4	1
Scale item 6	4	4	4	4	4	1
Scale item 7	4	3	3	4	4	1
Scale item 8	3	3	3	3	4	0.833
Scale item 9	4	4	4	4	4	1
Scale item 10	4	3	3	4	4	1
Scale item 11	3	3	3	3	4	1
Scale item 12	4	4	4	4	4	1
Scale item 13	3	3	4	3	4	1
Scale item 14	4	4	3	3	4	1
Scale item 15	3	3	4	4	4	1
Scale item 16	4	3	4	3	4	1
Scale item 17	4	4	3	3	4	1
Scale item 18	4	4	3	3	4	1
Scale item 19	3	3	4	4	4	1
Scale item 20	3	4	4	4	4	1
Scale item 21	4	3	4	4	4	1
Scale item 22	4	4	3	3	4	1
Scalei tem 23	3	3	3	4	4	1
					S-CVI/Ave	0.914

Statistical analysis. The *Statistical Package for the Social Sciences* (SPSS®) version 20.0 (IBM Corp., Armonk, NY, USA) was used to enter, edit and analyze the data. First, we calculated the percentage of each category of the socio-demographic variables. We also calculated the mean and standard deviation of Filipino-DKT.

The total knowledge score was determined by awarding one point for each correct answer and a zero for a wrong answer or no response. To determine the current level of understanding, the overall scores of all the participants were computed as the participant's scores over the total number of items: (*n*/14) for those on a diet or oral hypoglycemic drugs and (n/23) for those who were on insulin. Scores for each part were computed: Subscale 1 (*n*/14) and Subscale 2 (*n*/9). All were reported in percentage. Known group validity was assessed by association with HbA1c levels (≥7% and <7%). The internal consistency was assessed

Table II. Internal consistency of the Total Scale of the Filipino-DKT

Item	Mean±SD	Average Inter-Item Correlation	Cronbach's alpha if an item is deleted
Item1	0.53±0.47	0.41	0.681
Item2	0.52±0.50	0.413	0.679
Item3	0.47±0.50	0.44	0.682
Item4	0.38±0.50	0.416	0.670
Item5	0.43±0.50	0.391	0.683
Item6	0.68±0.42	0.39	0.710
Item7	0.51±0.34	0.38	0.684
Item8	0.40±0.49	0.401	0.678
Item9	0.70±0.40	0.35	0.690
Item10	0.69±0.43	0.42	0.686
Item11	0.78±0.42	0.35	0.698
Item12	0.66±0.43	0.392	0.680
Item13	0.70±0.40	0.38	0.690
Item14	0.65±0.36	0.41	0.674
Item15	0.43±0.47	0.393	0.665
Item16	0.59±0.50	0.412	0.684
Item17	0.56±0.50	0.37	0.689
Item18	0.75±0.50	0.25	0.695
Item19	0.65±0.48	0.42	0.683
Item20	0.63±0.47	0.40	0.677
Item21	0.62±0.49	0.415	0.696
Item22	0.64±0.50	0.39	0.686
Item23	0.60±0.49	0.40	0.678

Overall Cronbach alpha = 0.70, ($p<0.001$)

Table III. Demographic Characteristics of Patients with Diabetes

Number of Patients	Total sample (n=112)	Insulin (n=55)	Oral (n=57)	*p*-value
Age (years, mean ± SD	57.9±12.2	60.6±11.6	55.2±12.2	0.020
Sex:Female	78(69.6%)	37(67.3%)	41(71.9%)	0.682
Educational Attainment				
Tertiary	105(93.8%)	52(94.5%)	53(93.0%)	1.000
Primary	7(6.3%)	3(5.5%)	4(7.0%)	
Diabetes Duration (years,mean ± SD)	7.9±6.6	9.4±7.7	6.4±4.9	0.014
HbA1c (%, Mean ± SD	8.4±1.9	9.0±1.9	7.8±1.8	0.001

Values expressed as mean ± SEM or frequency (%)

using Cronbach's alpha to test the reliability. The criterion for accepting Cronbach's alpha is a score of at least 0.7. Pearson correlation coefficient was used for test-retest reliability of the two versions [Filipino and English]. Fleiss Kappa, with a value of at least 0.75 to be considered excellent and 0.40 to 0.75 to be considered intermediate to good, was used in the inter-rater reliability of the four raters.

Results

Phase 1 Questionnaire Validation

To determine the cultural appropriateness and effectiveness of the Filipino version of the DKT2 in measuring the levels of knowledge of diabetes, assessment of the content of the translated instrument known as the Content validity index (CVI) was measured. The content validity analysis (*Table I*) showed that the I-CVI for each item in the Filipino-DKT instrument is between 0.833 and 1, with a mean S-CVI of 91, indicating strong agreement between the two versions. To be judged acceptable, the I-CVI should not be lower than 0.78 or 0.80.[25] Out of the 23 items, the two endocrinologists, nutritionists, and diabetes nurse educators agreed on 21 items. Item 20 was revised by the nurse educator, and item 2 was rephrased by the nutritionist. The rest of the items were in agreement. This leads to an overall agreement of 95.65%, leading to a Fleiss Kappa coefficient of 0.91, indicating excellent agreement of the four raters.

Reliability

Validity was tested based on internal consistency and test-retest reliability. Internal consistency was measured by measuring the value of Cronbach's alpha in each of the 23 total knowledge scores. (*Table II*) Cronbach's alpha test of internal consistency was 0.70 for the general knowledge and insulin subscale, which is within the recommended result of 0.70. The average inter-item correlation measures the correlation between an item and the rest of the questions in each subscale, requiring values between 0.30 - 0.70 for the questions to be acceptable with a significant intraclass correlation coefficient ($p<0.001$). This means that each of the items measures different entities. Its item to total correlation coefficient ranged from 0.25 – 0.44. The Filipino-DKT demonstrated an acceptable Cronbach's alpha of 0.70 and an acceptable average inter-item correlation of 0.40. (Table 2)

For test-retest reliability, responses of the patients in the pretest of the Filipino and English versions were all the same across the 23 items. Likewise, in the post-test, a Pearson coefficient r of 1.00 ($p<0.001$). Again, this indicates perfect reliability, both on pretest and posttest.

Phase 2

Clinical and Demographic data

A total of 120 patients were recruited in this study, but only 112 were included. The mean age of patients was 57.9 years old. This is consistent with the national study, which showed that the mean age of diabetes in Filipinos is 52.2 ± 11.3 years.[11] The majority were females at 69.6%. Only seven patients did not finish the tertiary level of education. The mean duration of their diabetes was 7.9 years, and the mean HbA1c level was 8.4%. (*Table III*) The mean age, diabetes duration, and HbA1c of patients

Table IV. Relationship between General Diabetes Knowledge Subscale and Glycemic Control Groups

Glycemic Group	Level of General Diabetes Knowledge (n, %)		
	Poor (<7)	Average (7-10)	Good (≥11)
Good Control HbA1c ≤ 7%	4(22)	26(33)	10(62)
Poor Control HbA1c > 7%	14(78)	52(67)	6(38)
Total	18(100)	78(100)	16(100)

***(p<0.001)*

Table V. Relationship between Insulin Knowledge Subscale and Glycemic Control Groups

Glycemic Group	Level of Insulin Knowledge (n, %)		
	Poor (<7%)	Average (7-10%)	Good (≥11%)
Good Control HbA1c ≤ 7%	4(13)	3(15)	3(75)
Poor Control HbA1c > 7%	27(87)	17(85)	1(25)
Total	31(100)	20(100)	4(100)

***(p<0.001)*

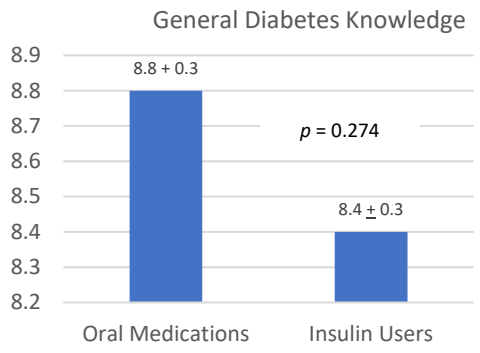

Figure 1. Adjusted Scores of Patients in General Diabetes Knowledge

requiring add-on insulin treatment were significantly higher than those taking oral treatment. Thus, age, diabetes duration, and HbA1C were used as a covariate in the following analysis.

Of the 112 patients with diabetes who answered the first part of the questionnaire, 18 (16.07%), 78 (69.64%), and 16 (14.29%) were in the poor, average, and good knowledge groups, respectively. A significant difference (*p<0.001*) was found between knowledge groups according to their HbA1c levels. (*Table IV*)

Fifty-five participants were on insulin; hence they also answered the second part of Filipino-DKT that measures insulin knowledge. Results showed that 31 (56%), 20 (36%), and 4 (7%) were in the poor, average, and good knowledge groups, respectively. (*Table V*) Participants who reported poor control of their diabetes (HbA1c >7%) also had lower levels of knowledge about diabetes and insulin use with the difference being statistically significant (*p<0.001*).

The knowledge of patients taking insulin and oral medication did not significantly differ (*p*=0.274), even when their scores were adjusted with age and diabetes duration as covariates. (*Figure 1*) The mean adjusted score for Insulin knowledge was 4.4 ± 1.7.

Filipino-DKT questions that were answered incorrectly were recorded. If a question was incorrectly answered by more than 50% of patients, the corresponding knowledge area was identified as representing a deficiency. (*Table VI*)

Discussion

The translation process of Filipino-DKT is crucial because it has to be adaptable and comprehensible. It followed the ISPOR guideline for translation.[37] The Filipino-DKT demonstrated an acceptable Cronbach's alpha of 0.70 and an acceptable average inter-item correlation of 0.40. A substantial number of patients included in the study did not receive formal diabetes education. A majority has been under the care of private practitioners who may not have enough time to explain all about diabetes care. Some have family members who have diabetes themselves and become their mentors.

Our study demonstrated that of the 112 patients with diabetes who answered the general knowledge, 16.07% had poor knowledge, 78.64% had average knowledge, and 14.29% had good knowledge. However, the overall mean knowledge score (9.0 ± 2.2) was still poor. Almost 94% of the participants had tertiary education, similar to the Greek study where patients with higher education demonstrated greater diabetes knowledge.[29] With the positive influence of education on knowledge in this study, this finding is probably explained by the fact that most of the participants in the above age group had attained tertiary education compared to the others.

Age was also associated with knowledge, with participants within the age group of 51-60 years, scoring higher than others, a result almost in line with another study which reported the best knowledge among the 40-59 years age group.[42] The mean age, diabetes duration, and HbA1c of patients requiring add-on insulin treatment were significantly higher than those taking oral treatment. There was no association between years since being diagnosed with diabetes, having a family history of diabetes, type of diabetes, and knowledge of diabetes.

A finding at variance with other studies have reported difference in knowledge by the number of years with diabetes. Nonetheless, our result is consistent with other studies that found no difference in knowledge by the duration of diabetes.[43] Thus, age, diabetes duration, and HbA1c were used as a covariate in the following analysis. Greek T2DM patients demonstrated poor disease knowledge (mean DKT score 8.3 ± 2.2) 14.0 and mean DKT as a percent of correct answers 59.6 (±15.8%).

Among subjects, no differences were observed between sex, place of residence, or glycemic control.[29] Surprisingly, in our study 56% of the subjects who are on

Table VI. Most Commonly Missed Questions on the Filipino-DKT

Item No.	Incorrect	Questions
15	87%	Ang mga sintomas ng "ketoacidosis" (DKA) ay: A. "tremors" B. Pagpapawis C. **Pagsusuka** D. Mababang blood sugar
23	70%	Alin sa mga ito ang magdudulot ng insulin reaksyon o pagbaba ng blood sugar: A. **Mabigat na ehersisyo** B. Impeksyon C. Sobrang pagkain D. Hindi nakapagturok ng insulin
3	68%	Alin sa mga sumusunod ang may pinakamataas na pagkaing taba? A. **Gatas na "lowfat'(2%)** B. Orange juice C. Mais D. Honey
4	60%	Alin sa mga sumusunod ang pagkaing walang kaloriya o "freefood"? A. **Mababa sa 20 kaloriya ang bawat takal** B. Walang asukal C. Walang protina D. Walang taba
2	58%	Alin sa mga sumusunod ang may pinakamataas na karbohidrata"? A. **Kamote** B. Kesong puti C. Nilagang manok D. Peanut butter
5	56%	Ang "HbA1c" ay ang sukat ng iyong asukal sa dugo o "blood sugar" sa nakalipas na: A. Araw B. Linggo C. **6–12 linggo** D. 6nabuwan
8	53%	Alin ang hindi dapat gamitin na panggamot sa mababang asukal sa dugo o "blood glucose"? A. 3 matigas na kendi B. ½ tasang orange juice C. **1 tasang "diet sopdrink"** D. 1 tasang gatas na walang taba
7	50%	Ano ang epektong hindi matamis na katas ng prutas (fruit juice) sa asukal sa dugo o "bloodglucose"? A. Pinabababa ito B. **Pinatataas ito** C. Walang epekto

insulin had poor knowledge, and only 7% had good knowledge. Although the subjects had diabetes for 7.90 ± 6.6 years and had been on insulin for 2.5 ± 2.0 years, their performance on the diabetes knowledge test was poor; even though they had learned about insulin, how to do insulin injection, and self-blood glucose monitoring. Participants who reported poor control of their diabetes (HbA1c > 7%) also reported lower levels of knowledge about diabetes and insulin use. A significant association was also found between the general knowledge of diabetes and diabetes control reflected by the HbA1c among those patients on oral hypoglycemic agents. This finding was consistent among insulin users.

Translation of the original DKT2 questionnaire has been a linguistic and cultural challenge. The Filipino language, which is based on Tagalog, is used nationally as the language of communication among ethnic groups. But our country has eight major dialects spoken by many Filipinos: Tagalog, Cebuano, Ilocano, Hiligaynon or Ilonggo, Bicolano, Waray, Pampango, and Pangasinense. According to the Philippine Census of 2000, 21.5 million Filipinos claim Tagalog as their first language, and 50 million Filipinos speak Tagalog as a second language. Apart from native Tagalog words, the Filipino language also includes modified words from the English and Spanish languages, for instance, *silya* to refer to a chair instead of using *salumpuwit. Thus, instead of using the word "sinagap" for skim milk, we used "gatas na walang taba."* Moreover, the Filipino language also recognizes the use of transliteration, or how a local spell a word, based on how they pronounce it. For example, in Filipino, it is acceptable for a driver to be spelled as *drayber*. Likewise, the juice is usually spelled as pronounce "dyus,"

so we opted to use the word juice itself.

The most commonly missed questions are listed in *Table VI*. A substantial number of subjects do not know "diabetes diet," "fatty food," "free food," the effect of unsweetened fruit juice on blood glucose, treatment of hypoglycemia, and the average duration of glycosylated hemoglobin (HbA1c) as measure of blood glucose. We have expected that many of our subjects would miss the question of the most common symptom of ketoacidosis (87%, n=97) because this complication is uncommon in T2D. But it was also a surprise that (70%, n=78) did not know that heavy exercise can cause low blood sugar nor that low-fat milk still has the highest fat content compared to orange juice, corn, and honey (68%, n=76). Sixty percent of the subjects failed to answer correctly the question on "free food." Their choice was free of sugar or fats, while the correct choice is any food with less than 20 calories per serving (60%). Though sweet potato is a common breakfast or snack fare for Filipinos, (58%, n=65) many failed to choose it as the food with the highest carbohydrate content compared to boiled chicken, peanut butter, and white cheese. They did not also know that HbA1c is a test used to measure the average blood glucose level for the past three months (58%, n = 65).

Even more worrisome was the observation that half of the subjects (56%, n=63) did not know that diet soft drinks should not be used to treat hypoglycemia or how they should treat those episodes. They are also ignorant that "unsweetened fruit juice" raises blood glucose (50%). This is lower than the 35% reported in the study of Murata et al.[21] This study has shown that many patients with diabetes who had fair HbA1C levels had poor knowledge of the disease hence are more likely to develop complications.

Those who have poor diabetes knowledge should be given a standard diabetes education. The Filipino–DKT had helped us distinguish patients with diabetes who needs individualized diabetes education program rather than a group education. The American Diabetes Association has adopted the ten standards concerning the structure and process of diabetes education programs. These recommendations include evaluating the educational needs of patients, developing individualized teaching plans, and periodically reassessing patient outcomes.[1] This is especially important in the Philippine setting, where people tend to adhere tenaciously to myths, beliefs, or misconceptions about diabetes handed down thru generations and the use of traditional herbals without scientific proof of treatment or cure. Usually, patients receive much of their instruction when the diagnosis is first made. Attention should also be given to the re-training of patients who have had diabetes for a number of years. However, there is uncertainty about how these patients should be selected or the topics reviewed.

The US Veterans' Health Administration recommends reassessing patient knowledge about diabetes at least three months after an educational intervention.[43] With the progressive increase in the country's adult population, so does the prevalence of diabetes toward an epidemic proportion in the western pacific region by 2030 as predicted. Thus, diabetic patients must have sufficient all-encompassing knowledge about the disease to ensure optimal self-management.

The patients seen at the Clinical Division Diabetes outpatient clinic in our hospital received free diabetes education, but private patients received the diabetes education modules for a fee. Diabetes education is delivered through several venues, including nutrition clinics, diabetes group classes, and individual teaching sessions. Nutrition classes provide instruction on basic principles, the content of foods, daily allowances, desirable weight ranges, and daily planning. The diabetes nurse educator provides individual blood glucose monitoring and insulin therapy training. The assessment of the effectiveness of diabetes education is made by administering a written or oral evaluation with each outpatient visit. However, this evaluation tool was never validated, and for future research, it would be more reliable when comparing different studies that use DKT2 rather than developing our scales. The Filipino-DKT scores can provide practitioners with valuable information that may prompt them to further teach patients about a specific self-care practice.

The literature has reported a lack of an association between metabolic control and patient knowledge.[50-53] Attitudes and beliefs highly influence the ability of patients to learn. Attitudes are more important during the initial training than they are for ongoing education. Better outcomes for diabetes classes might be achieved if patients were grouped according to their capacity to learn. The level of course materials should be lowered, or the training of a spouse or caregiver should be considered for those who have cognitive dysfunction.

The approach to diabetes education in the United States is based upon the ADA recommendation, which specifies the elements and topics to be covered. Considerable variability in the methods is accepted and even encouraged, and individualization of instruction is emphasized. In contrast, the European approach tends to be more structured and emphasizes group education.[20] Our study reinforces the ADA recommendations for periodic re-assessment of patient knowledge and the use of educational strategies that are matched to the patient's abilities.

Conclusion

We have shown that the Filipino-DKT is an acceptable, reliable, and valid measure of diabetes knowledge that can be used in our Sto Tomas Diabetes Center, clinical practice, and research. Our results show that the Filipino diabetic knowledge of their disease is poor and not related to age, sex, and duration of diabetes.

Strengths and limitations of the study. The strength of this study is that it was carried out in a tertiary teaching hospital setting, where patients with T2D of different backgrounds were represented. The Filipino-DKT can be useful for group comparisons and assessing knowledge

over time. However, the study was conducted in a single center and therefore limited the generalization of its findings. A larger sample would provide more power to detect significant relationships between the study variables and differences between groups. However, the diabetes knowledge test can be used alone to assess if patients can perform appropriate self-care. An ongoing study will determine this test's usefulness as an outcome measure for educational interventions.

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APPENDIX
KAALAMAN SA DIABETES (DKT-Fil)

Pangalan: _____ Edad: _____ Kasarian: _____

Gamot: _____ Ilang Taon ka nang may Dyabetis? _____

_____ 1. Ang pagkain para sa may diabetis ay:
A. Pagkain na kinakain nang karamihan ng mga Pilipino
B. Malusog na pagkain para sa karamihan ng tao
C. Pagkain na mataas sa karbohidrata para sa karamihan ng tao
D. Pagkain mataas sa protina para sa karamihan ng tao

_____ 2. Alin sa mga sumusunod ang may pinakamataas na karbohidrata"?
A. Nilagang manok
B. Kesong puti
C. Nilagang kamote
D. Peanut butter

_____ 3. Alin sa mga sumusunod ang may pinakamataas na "fat" o taba?
A. Gatas na mababa ang taba (2%)
B. Orange juice
C. Mais
D. Honey

_____ 4. Alin sa mga sumusunod ang pagkaing walang kaloriya o "free food"?
A. Ano mang pagkain na hindi matamis
B. Ano mang pagkain na may nakatatak na walang taba
C. Ano mang pagkain na may nakatatak na walang asukal
D. Ano mang pagkain na mas mababa pa sa 20 kaloriya ang bawat takal ng pagkain

_____ 5. Ang "HbA1C" ay ang sukat ng iyong karaniwang asukal sa dugo o "blood glucose" sa nakalipas na:
A. Araw
B. Linggo
C. 6 – 12 linggo
D. 6 na buwan

_____6. Alin ang pinakamagaling na paraan ng pagsusuri ng asukal sa dugo o "blood glucose" kapag nasa bahay?
A. Pagsusuri ng ihi
B. Pagsusuri gamit ang "glucometer"
C. Parehong magaling ang 2 paraan

_____ 7. Ano ang epekto ng hindi matamis na katas ng prutas (fruit juice) sa asukal sa dugo o "blood glucose"?
A. Pinabababa ito
B. Pinatataas ito
C. Walang epekto

_____ 8. Alin ang hindi dapat gamitin na panggamot sa mababang asukal sa dugo o "blood glucose?"
A. 3 matigas na kendi
B. 1/2 tasa ng orange juice
C. 1 tasa ng diet soft drink
A. 1 tasa ng "skim milk" o gatas na walang taba

_____ 9. Para sa taong may mahusay na pagkontrol sa asukal sa dugo o "blood glucose", ano ang epekto ng pag-eehersisyo sa asukal sa dugo?
A. Pinabababa ito
B. Pinatataas ito
C. Walang epekto

_____ 10. Ano ang magiging epekto sa asukal sa dugo o "blood glucose" ng isang taong may Impeksyon?
A. Pinabababa ito
B. Pinatataas ito
C. Walang epekto

_____ 11. Ang pinakamagandang paraan ng pangangalaga sa iyong mga paa ay:
A. Siyasatin at hugasang mabuti ang mga ito araw-araw
B. Punasan ang mga paa gamit ang alkohol
C. Ibabad sa tubig ng isang oras ang mga ito araw-araw
D. Bumili ng sapatos na mas malaki kaysa karaniwan

_____ 12. Ang pagkain na konti ang taba ay nakakabawas sa panganib na magkaroon ng:
A. Sakit sa mga ugat ng nerbiyos
B. Sakit sa bato
C. Sakit sa puso
D. Sakit sa mata

_____ 13. Ang pamamanhid at panginginig ay maaaring sintomas ng:
A. Sakit sa bato
B. Sakit sa mga ugat ng nerbiyos
C. Sakit sa mata
D. Sakit sa atay

_____ 14. Alin sa mga sumusunod ang karaniwang hindi patungkol sa diabetis?
A. Problema sa paningin
B. Problema sa bato
C. Problema sa mga ugat ng nerbiyos
D. Problema sa baga

_____ 15. Ang mga palatandaan ng "ketoacidosis" (DKA) ay kinabibilangan ng:
A. Pangangatal
B. Pagpapawis
C. Pagsusuka
D. Mababang asukal sa dugo o "blood glucose"

_____ 16. Kung ikaw ay may trangkaso at walang ganang kumain, kailangan mong:
A. Bawasan ang insulin
B. Bawasan ang pag-inom ng tubig
C. Dagdagan ang pagkain ng protina
D. Dalasan ang pagsusuri ng asukal sa dugo o "blood glucose"

_____ 17. Kung nagturok ka ng "Intermediate-acting insulin", maaaring magkaroon ka nang mga sintomas ng mababang asukal ng dugo sa loob ng:
A. 1-3 oras
B. 6-12 oras
C. 12-15 oras
D. Higit pa sa 15 oras

_____ 18. Naisip mong bago mananghalian na nakalimutan mong magturok ng insulin sa almusal. Ano ang dapat mong gawin?
A. Huwag mananghalian upang mapababa ang iyong asukal sa dugo
B. Magturok ng insulin na karaniwan mong tinuturok sa almusal
C. Magturok ng insulin na doble ang dami sa karaniwan mong itinuturok sa almusal
D. Suriin ang asukal mo sa dugo upang makapagpasya kung gaano karami ang insulin na iturok

_____ 19. Kung nagsisimula kang magkaroon ng mga sintomas ng mababang blood sugar, kailangan mong:
A. Mag-ehersisyo
B. Mahiga at magpahinga
C. Uminom ng juice
D. Magturok ng "rapid-acting insulin"

_____ 20. Ang mga sintomas sa mababang asukal sa dugo o "blood glucose" ay maaaring dahilan ng:

A. Sobrang insulin
B. Kulang sa insulin
C. Sobra sa pagkain
D. Kulang sa ehersisyo

_____ 21. Kung nagtuturok ka ng insulin sa umaga ngunit hindi nag-aalmusal, ang asukal mo sa dugo ay karaniwang:

A. Tumataas
B. Bumababa
C. Mananatiling pareho

_____ 22. Maaaring dahilan ng pagtaas ng asukal sa dugo o "blood glucose" ang:

A. Hindi sapat na insulin
B. Hindi pagkain sa takdang oras
C. Hindi agad nakakapagmeryenda
D. Hindi pag-ehersisyo

_____ 23. Alin sa mga ito ang magdudulot ng insulin reaksyon o pagbaba ng asukal sa dugo o "blood glucose":

A. Mabigat na ehersisyo
B. Impeksyon
C. Sobrang pagkain
D. Hindi pagtuturok ng iyong insulin