PREDICTING DIABETIC SELF-CARE MANAGEMENT BASED ON THE THEORY OF PLANNED BEHAVIOR AMONG ELDERLY WITH TYPE 2 DIABETES IN THAILAND

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BACKGROUND: Type 2 diabetes, especially in the elderly, continues to plague the world. Thailand – a developing country – is not immune to these ravage effects and their distressing upsurge in health and economic societal burdens. Self-care management is an essential strategy to prevent complications and reduce type 2 diabetes complications.

AIM: This study aimed to examine the treatment outcome and factors predicting diabetes self-care behaviors among elderly in Thailand.

METHODS: A cross-sectional correlative predictive design using multiple linear regression models to evaluate data in elderly type 2 diabetics in Thailand (August through December 2017) to assess perceived behavioral control on diabetic self-care management. One hundred thirty-four participant's data were collected via questionnaire along with individual health records becoming the foundation of this study.

RESULTS: Most patients controlled glycemic outcome (77.9 %) through self-care behaviors at moderate rates (majority – 55.9%). Subjective norms and perceived control strongly correlated with behavioral intention and self-care behaviors. Perceived behavioral control was the most important factor predicting intentions (β 4.025, $p < .01$) and self-care management behavior (β15.258, $p < .001$). Patients responding to items regarding self-care behavior for diet, exercise and medication adherence showed favorable outcomes.

CONCLUSION: More than half of the patients had moderate levels in self-care management and the majority had good glycemic outcomes. From the analysis, we find that perceived behavioral control is critical to predicting behavioral intention and diabetic self-care behavior among the elderly.

KEYWORDS: diabetic self-care management; perceived behavioral control; glycemic control; elderly; Thailand

ПРОГНОЗИРОВАНИЕ САМОКОНТРОЛЯ У ПАЦИЕНТОВ С САХАРНЫМ ДИАБЕТОМ НА ОСНОВЕ ТЕОРИИ ПЛАНИРУЕМОГО ПОВЕДЕНИЯ СРЕДИ ПОЖИЛЫХ ЛЮДЕЙ С ДИАБЕТОМ 2 ТИПА В ТАИЛАНДЕ

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АКТУАЛЬНОСТЬ. В мире продолжает расти заболеваемость диабетом 2 типа, особенно у пожилых людей. Таиланд, будучи развивающейся страной, не застрахован от этого разрушительного заболевания, а также его тревожащего роста в сфере общественного здоровья и экономического бремени для общества. Самостоятельный контроль за показателями гликемии представляет собой важную стратегию для предотвращения и уменьшения осложнений диабета 2 типа.

ЦЕЛЬ. Данное исследование направлено на изучение результатов лечения, а также факторов, прогнозирующих самоконтроль у пациентов с сахарным диабетом среди пожилых людей в Таиланде.

МЕТОДЫ. Был проведен перекрестный коррелятивный прогностический анализ с использованием моделей множественной линейной регрессии для оценки данных у пожилых пациентов с сахарным диабетом 2 типа в Таиланде (с августа по декабрь 2017 года) для оценки самостоятельного контроля за уровнем гликемии. Данные 134 участников исследования были получены путем заполнения опросника, а также анализа медицинских карт.

РЕЗУЛЬТАТЫ. Большинство пациентов самостоятельно контролировали уровень гликемии (77,9%), причем у большинства показатели были умеренными (55,9%). Субъективные нормы и воспринимаемый контроль тесно связаны с намерениями пациентов. Наиболее важными факторами, определяющими намерения, были воспринимаемый поведенческий контроль (β4,025, $p<0,01$) и поведение по самоконтролю (β15,258, $p<0,001$). У пациентов, которые отвечали на вопросы, касающиеся поведения по самоконтролю за диетой, физическими упражнениями и режимом приема лекарств, наблюдались благоприятные результаты.

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ЗАКЛЮЧЕНИЕ. Более чем у половины пациентов отмечались умеренные уровни самоконтроля, и у большинства были хорошие гликемические показатели. В результате анализа было выявлено, что воспринимаемый поведенческий контроль имеет решающее значение для прогнозирования поведенческих намерений и поведения по самоконтролю за диабетом среди пожилых людей.

КЛЮЧЕВЫЕ СЛОВА: самоконтрольпри диабете; воспринимаемый поведенческий контроль; гликемический контроль; пожилые люди; Таиланд

The global diabetes prevalence has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population [1]. The number of people with diabetes has climbed from 108 million to 422 million in 2014 and expeditious increasing in low and middle income countries [2]. The WHO declared the condition as epidemic and this dramatic prevalence has occurred in both rural and urban areas, predominantly in developing countries [2]. More than2.2 million deaths were attributable to poor diabetic control, causing increased morbidity and mortality [3] and an exorbitant global health expense estimated at $673 Billion (USD), particularly affecting poorer regions [2,4].It is estimated that in 2045 almost half (49.7%) of all people will be living with undiagnosed diabetes [5].Policy makers need to take urgent action to mitigate the effects of diabetes [6].

Previous studies have shown around one third of Asian patients had adequately controlled T2DM, with glycemic hemoglobin (A1C) levels < 7%, as recommended by the American Diabetes Association(ADA). In Thailand (2016) the prevalence of diabetes in adults was reported at 8.3% [1] and is facing increasing numbers of T2DM due to unhealthy diets, high obesity rates and an aging society [7]. Age-adjusted prevalence of diabetes increased to 9.9% in 2014 and only 23% of T2DM patients showed controlled outcomes (A1C < 7) [8]. T2DM in Thailand is in the top 3 causes of illness with a rate 1,050.05 (2013) 1,081.25 (2014) 1,233.46 (2015) per 100,000 of population [9]. Diabetes self-management education (DSME) has not yet been standardized and a multidisciplinary team approach is not widely utilized[10].

Diabetes prevalence in Nakhon Si Thammarat province also had continuity increased that showed T2DM patients from 2015 (4,409 cases), 2016 (4,797 cases) and 2017 (5,015 cases) per 100,000 population respectively [9]. Diabetic patient's proportions that controlled A1C for these years were: 2015 (25.37%), 2016 (38.06%), and 2017 (43.28%) [9]. The death rate of diabetes from 12 regions in Thailand averaged 18.44%, with a reported rate at Nakhon Si Thammarat Province of 15.42% [9].

The Theory of Planned Behaviors (TPB: see Fig.1) was developed by Ajzen, I. (1991) [11]), explaining that perceived behavioral control (PBC) and behavioral intentions (BI) are the most important determinantsof how people perform to behavior. Previous study, Puthhong S., et.al conducted effective TPB intervention improved T2DM self-care behaviors [12]. Zomahoun HT used grounded theory to predict the future non-insulin antidiabetic drug adherence in adults with type 2 diabetes [13].However, Diabetes self-management education (DSME) has not yet been standardized and a multidisciplinary team approach is not widely utilized [4], particularly in TPB constructive application [7] and more evidence from high-quality studies is required to support future self-management programs [14]. This study determined the relationship between predictors and continuity to predict diabetes self-management by behavioral intention and perceived control, providing a more useful tool and healthcare providers to achieve better treatment outcomes for elderly with T2DM in Thailand.

AIM

This study is aimed to examine diabetic self-care management (DSCM) among elderly with T2DM, to analyze the correlated factors and to clarify DSCM by behavioral intention (BI) and perceived behavioral control (PBC).

METHODS

Research design

A cross-sectional descriptive-relative correlational design was conducted to examine a diabetic self-care management practice of 212 T2DM patients. The study sample includes patients previously diagnosed with T2DM who attended and registered at the Pak Phanang Health Center, Nakhon Si Thammarat, Thailand for routine care and follow-up.

Tools: All interviews were conduct at a health center and Thai language was used in a hard copy that divided into 3 parts including: 1) characteristics and personal health records, 2) applied TPB constructs in attitude toward behavior (AB), subjective norm (SN), perceived behavioral control (PBC) and behavioral intention (BI) and 3) diabetic self-care management behaviors (DSCM).

Conceptual Frame Work: A conceptual frame work of this study can be presented and applied with TPB construct by Ajzen, I. (1991) as in Fig. 1(3.6).

Statistical plan: Data were analyzed by using descriptive statistics, Pearson's Product Moment Correlation, and multiple regression analysis.

Conformity criteria

The inclusion criteria were elderly diagnosed with T2DM attendance at a regional DM-clinic treatment for at least 1 year, with laboratory data confirming their state, despite being treated with anti-diabetic medication for at least 6 months. Participants were excluded if they were under the age of 55 or had incomplete data.

Research facilities

This present study was performed at Pak Panang Community Health Center in Pak Phanang subdistrict,Pak Phanang district of Nakhon Si Thammarat province. The health personal record was received under the Director Decision and ethical consideration.

Research duration

This research project was conducted between December 2017 and September 2018.Data was collected after January 15, 2017 after the research project was

approved by the Ethics Committee.Participants were selected to form specific criteria and enrolled in the study in February 2017. The data were collected until May 2017 then analyzed in July 2017, the final results were reported in September 2017.

Medical procedure description

The main method of conducting this research, participants will be interviewed about their diabetic self-management behavior, which was developed by the researcher according to The Theory of plan behavior. The results of the treatment and the blood test results were not conducted in this research, but were allowed to apply the treatment results from the main unit which has been regularly performed.

The main research outcome

1) To assess diabetic self-care management (DSCM) among T2DM cases.

2) To examine the correlated factors between DSCM and explanatory variable based on The Theory of Planed Behavior (TPB).

3) To predict DSCM by behavioral intention and perceived behavioral control.

Methods for registration of outcomes

All participants were asked and interviewed by questionnaire with 3 parts including:

1) The characteristics and personal medical records included gender, age, occupation, marital status, education level, income, care-givers, BMI, duration of illness, comorbidities, complications, follow up with treatment plan and the treatment outcome.

2) A self-administered questionnaire included 11 items with a 3-point rating scale about the TPB construct of AB, SN, PBC and BI (Fig. 1) were employed highlighting the concept of diabetic self- management. Here, Cronbach's Alpha measured medium in level (about 0.76).

3) A self-administered questionnaire was developed consisting of 16 Itemswith a 3-point rating scale for DSCM (Diet control, physical activity and medicinal adherence). Here, Cronbach's Alpha measured strong (about 0.89).

The focus group discussion in DSCM was collected and analyzed.

Ethical review

All patients were informed that their participation was voluntary and that they could withdraw from the research at any time (Human Ethics Research Committee, Nakhon Si Thammarat Provincial Health Office – EC: NSTPH 016/2017 by the date Jan 15, 2017).

Statistical analysis

All 450 elderly patients with type 2 diabetes have been attended at The west and The East community health centers in Pakpanung subdistrict, each center have a similar amount of T2DMaround 220 cases and alsosimilarin the cultural and lifestyle. The Pak Phanang community health center was selected by cluster area sampling and 212 patients were attended, then 134 samples were selected purposively by eligible criteria.

All data were analyzed using programmed calculations (SPSS version 11.5) where percentages, means, and standard deviations were used to describe all continuous variables. A Pearson correlation (r) was conducted to explain the association between variables. Pearson correlation coefficient (R) and Correlation of Determinants (R^2) were analyzed to identify factors associated with diabetic self-care. Using the structural equation modeling technique, measurement and structural regression models were developed for both diabetic self-behavior intention and self-care behavior to predict glycemic control (Enter - MRA). All statistical analysis, $p < 0.05$ was considered significant for both models.

RESULTS

Research sample (participants/respondents)

Population of 212 T2DM patients, who attended at the Pak Phanang Health Center, Nakhon Si Thammarat, Thailand. Participants of 134 elderly were purposive sampling at age over 55 years old, good oriented, be able to communicate, be able to read the Thai language, had the latest A1C result within 6 months.

Primary findings

Descriptive analysis in demographics

Medical data among the 134 (out of 152 cases - 88.16%) older subjects with T2DM showed: about 73.1% were female with average age of 64.8 (Standard Deviation - SD 9.41) years. Most were married 64.9% and have a life partner (53.0%) to care for and the other (minor) was divorced and had children and caregivers (32.1%). Most of them were non-working or housewives (49.7%), business owners (26.9%) and gardeners (20.9%) – respectively. 32.8% of the cases had incomes between 5,001-10,000 baht and 26.1% had incomes less than 5,000 baht – on a monthly basis, as shown in Table 1.

The results of treatment outcome with glucose controlled (A1C <7, about 77.9 %) and uncontrolled (A1C ≥7, about 21.1%). Diabetic Self–Care Management (DSCM) were divided into 3 classes (levels) – with mean score of medium level at 55.9% and minorities showing in both high level (DSCM > 41.94) at 20.89% and low (DSCM < 29.88) level at 23.14%.

Assessing the level of perceived control for this sample population,this research focused on the trend to care for T2DM in the long term by a term in grounded theory. This findings showed that most participants had higher proportion in exercise and anti-diabetic adherence than eating healthy food. In opposite way the results was shown the stronger intention in their healthy food than exercise and medicinal adherence. Therefore, the descriptive results about perceived behavioral control (PBC) and behavioral intention (BI) mean score in all items were determined to be a high level, as shown in table 2.

The Correlation Between Variables

The Pearson correlation coefficient (r) indicated that all TPB constructs were significantly correlated with intentions. Pearson Correlation (r) analysis of paired variables showed strong correlation: Attitude-Perceive Control (r .327, $p < .01$) Self-care Management-Perceive Control (r .317, $p < .01$), Subjective Norm-Perceive Control (r .275, $p < .01$). Behavioral

Table 1. Personal medical record in cases: percentage, mean and standard deviation

Characteristic	Min Mean SD	Max	Case (n=134)	%
Sex				
Male			36	26.9
Female			98	73.1
Age (years)	**Min 26.0**	**Max 91**	**Mean 64.9**	**SD 9.4**
≤60			36	26.9
61–70			61	45.5
≥71			37	27.6
BMI	**Min 17.3**	**Max 53.0**	**Mean 26.4**	**SD 4.9**
<18.5			1	0.7
18.5-24.9			31	23.1
25.0-29.9			25	18.7
>30.0			77	57.5
Duration Of DM(years)	**Min1**	**Max 30**	**Mean 12.42**	**SD 6.4**
<5			20	14.9
5.1-10			43	32.1
11-15			34	25.4
>15			37	27.6
Comorbidity				
None			18	13.4
HT, CVD, or DLP			116	86.6
Eye Check up				
Non Diabetic retinopathy			113	84.3
Diabetic retinopathy			18	13.4
No check up			3	2.2
Diabetic Foot				
Normal			116	86.6
Abnormal			18	13.4
Follow up				
Every1 month			87	64.9
Every2 month			31	23.1
Every3 month/miss			16	11.9
Treatment Outcome				
FBS≤125, BP≤139/89, A1C<7			45	33.6
FBS=126-154, BP=140/90-159/99, A1C <7			58	43.3
FBS=155-182, BP=160/100-179/109, A1C 7-8			18	13.4
FBS≥180, BP≥180/110-159/99, A1C >8			13	9.7

Table 2. Perceived Behavioral Control and Behavioral Intention in cases; percentage, min, max, mean and standard deviation. (n=134)

Variables			Cases	%
Perceived Behavioral Control				
Plan a healthy diet	**Min1**	**Max 3**	**Mean 2.28**	**SD 0.75**
Disagree			24	17.9
Not sure			49	36.6
Agree			61	45.5
Plan to join exercise	**Min2**	**Max 3**	**Mean 2.97**	**SD 0.17**
Not sure			4	3.0
Agree			130	97.0
Plan to perform medical adherence	**Min2**	**Max 3**	**Mean 2.90**	**SD 0.31**
Not sure			14	10.4
Agree			120	89.6
Behavioral Intention				
Intend to eat healthy diet	**Min2**	**Max 3**	**Mean 2.78**	**SD 0.41**
Not sure			29	21.6
Agree			105	78.4
Intend to join exercise	**Min1**	**Max 3**	**Mean 2.48**	**SD 0.59**
Disagree			6	4.5
Not sure			58	43.3
Agree			70	52.2
Intend to perform medicaladherence	**Min1**	**Max 3**	**Mean 2.48**	**SD 0.59**
Disagree			6	4.5
Not sure			58	43.3
Agree			70	52.2

Intention - Perceive Control (r .198, p < .05), respectively. Perceived Control was significantly correlated with other variables, prominently (Table 3).

Results of the preliminary test of the regression equation

The 6 assumptions were tested according to the preliminary agreement to MRA with the following results

1. *One or more independent variables:*model 1 and model 2 are normally distributed (tested by scatter plot with standardized residual) - these explain both dependent variables by analysis of variance BI (F 4.325, P < .01) and DSCM (F 8.099, P < .001)).
2. *Variance proportion(VP)*: in this study, both parameters did not exceed 0.30 and 0.90 respectively. (If condition index > 0.30 and VP > 0.90 multicollinearity problem would exist with the independent variables.)
3. *Effects of the others predictors (Intra-linear correlation):* tests were performed using indication multicollinearity diagnostics by Tolerance (Tolerance approaching 1 indicated for both models (Model 1: BI and Model 2: DSCM). Variance Inflation Factor (VIF) of 5 or 10 recommend by Hair, et al (1995) [15]. The residual independence for BI prediction was found in both models (Durbin-Watson approached 2), which followed the agreement for multicollinearity.

Therefore, the assumptions were correctly tested and can explain the dependent variables (BI and DSCM) and their significance and strength in influence on self-care management.

To predict Behavioral Intention and DSCM by predictor

This study analyzed and provided both models through multiple regression analysis, with multicollinearity not influencing the elementary agreement.

Multiple correlation coefficient (R) - Coefficient of determination (R^2)

In deriving the predictive equation through regression methods, calculations of the coefficient of correlation for behavioral Intention (R .301, F 4.325, P < .01, Table 4) were determined and the coefficient of determination (R^2 -.091), which is the variance of the explanatory variables in describing the variables, considering the weight and power of the predictor in the multiple regression equations.

A predictive equation for DSCMwas also derived by PBC and BI, with the results of (R .332, F 8.099, P < .001, Table 4) and the coefficient of determination (R^2 .110). PBC was found to be a stronger predictor for SCM than BI - as shown in table

Table 3. Pearson Correlation(r) n =134

Pearson Correlation	AB	SN	PBC	BI	DSCM
Attitude toward DSCM (AB)	1				
Subjective Norm support DSCM (SN)	.520**	1			
Perceived Behavioral Control to DSCM (PBC)	.327**	.275**	1		
Behavioral Intention (BI)	.136*	.270**	.198*	1	
Diabetes Self –care Management (DSCM)	.215*	.141*	.317**	.159*	1

Notes: **, * Correlation is significant at the 0.01 level, and 0.05 level (2-tailed) respectively.

4. However, the regression models were weak predictors for this research, overall.

The coefficient of determination (R^2 -.091, P < .01) in the multiple regression equation predicts BI. The results show that AB, SN, and PBC variables shape Behavioral Intentions about 9.10%; BI, PBC and the coefficient of determination (R^2 .110, P < 001). The 2 variables together describe DSCM about 11%.

The interpretation of the beta coefficient (β), and the regression equation for BI

Results demonstrated that AB, SN, and PBC can explain the variables forBI (Model 1) as AB (β -0.91, 4.20%), SN (β .490, 25.3%) and PBC (β .229, 14.2%) – respectively. The variable SN with standardized coefficients (β.253, P<.01) is a significant predictor for BI (Table 5). It is important to note that there was at least one variable that can be described in terms of the variance of the variables. Also, the same results were found for the Coefficient of determination (R^2) for DSCM. PBC (Model 2) had explained outcomes about 29.7% (β.297, p<.001) BI about 10.0 %. Therefore, PBC is a significant predictor for explaining DSCM (Table 5).

Model predicting factors related with diabetic self-care management

Results revealed that attitude (AB), subjective norm (SN), and perceived behavioral control (PBC) involved predicted behavioral intentions in diabetic patients (Model 1) - focusing on emphasizing dietary control, exercise and medicinal adherence. The regression equation is as follows:

Model 1 (BI): 4.025-AB 0.091+SN 0.490+PBC 0.229

Model 2 demonstrated that Perceived Behavioral Control is a significantly strong predictor for predicting DSCM behaviors and is expressed as follows:

Model 2 (DSCM): 15.258+ PBC 2.174+ BI 0.457

The Framework and the findings in Diabetic Self Care Management (DSCM) from this research is better understood by Fig. 1.

THE HIGHLIGHT OF THIS STUDY

Most of (76.9%) of participants in this present study had controlled the glycemic outcome (A1C < 7) and few of them (22.1%) had uncontrolled.

The proportion in PBC means score in «plan for healthy diet» showed: disagree-1, not sure -2, and agree-3, which differs from the exercise and drug adherence that was similar proportion; not sure -1, and agree-9.

The proportion in BI means score in «intend for healthy diet» showed: not sure -2, and agree-8, which differs from the exercise and drug adherence that was similar proportion; disagree-1, not sure -4, and agree-5.

Subjective Norm (SN) was highly significantly correlated with all variables. All predictors: AB, SN, PBC had the influence to predict intention to perform diabetic self-management behaviors and PBC was a highest significant predictor in both regression model.

DISCUSSION

This result is a direct benefit for elderly patients with diabetes in encouraging awareness and compliance with structured behavioral patterns in order to be able to plan behaviors based on perceived problems, obstacles, and benefits in controlling type 2 diabetes.

In addition, this research has resulted in the development of care systems for diabetics and health service providers in evaluating and improving better T2DM self-management outcomes.

Table 4. The Coefficients of Multiple Correlation (R) for Behavioral Intention (BI), and Diabetic self-care management (DSCM)

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics					
					R^2 Change	F Change	df1	df2	Sig. F Change	Durbin-Watson*
1	.301[a]	.091	.070	1.34815	.091	4.325	3	130	.006	2.232
2	.332[a]	.110	.096	6.04422	.110	8.099	2	131	.000	1.759
a. Predictors: (Constant), PBC, SN, AB					b. Dependent Variable: BI (model 1)					
a. Predictors: (Constant), BI, PBC					b. Dependent Variable: DSM (model 2)					

Table 5. Predicting Behavioral Intention (BI), and Diabetic self-care management (DSCM)

Variable	F (t)	B[7]	Standard E of β[8]	P-value	R[5]	Adjusted R[26]	95.0% CI[9] for B
Model 1	4.325	4.025	1.34815	.006	.301[a]	.070	.762 - 7.287
AB[1]	(-.413)	-.091	-.042	.680			(-.528 -.345)
SN[2]	(2.559)	.490	.253	.012			(.111 -.868)
PBC[3]	(1.592)	.229	.142	.114			(-.056 -.513)
Model 2	8.099	15.258	6.04422	.000	.332[a]	.096	4.736 - 25.780
PBC	(3.531)	2.174	.297	.001			(.956 - 3.392)
BI[4]	(1.195)	.457	.100	.234			(-.300 - 1.214)

a. Predictors: (Constant), PBC, SN, AB, BI b. Dependent Variable: BI (Model 1)

a. Predictors: (Constant), BI, PBC b. Dependent Variable: DSCM (Model 2)

[1]AB Attitude toward behavior, [2]SN Subjective Norm, [3]PBC Perceived Behavioral Control,
[4]BI Behavioral Intention ,[5]R *Multiple correlation coefficient (R)* - correlation
[6]R^2 *Coefficient of determination (R^2),* [7] - [8]*beta coefficient (β),*
[9]statistically significant when 95% Confidence Interval does not include 0

Summary of the primary research results

The reatment outcome among elderly with T2DM

The entire elderly population living with diabetes was stable in distribution for at least 5 years and sustained for more than 15 years and is similar with previous studies [15]. Patient mean ages were similar: 64.9 years vs. 63.6 year and 64.2 years [16], but different in male-to-female ratio: 1:2.7, follow-up rate: 71.1% vs. 64.9%. Most cases displayed good sick role behaviors, explaining that the long term T2DM patients were educated on self-care management from the health care team that consequence with widespread diabetes continues to grow in the Thai population, predominantly in individuals with lower educational achievement [9]. The data revealed that most cases had multiple comorbidities (86.6%) due to the fact that DM cannot be cured but only controlled and, unfortunately, these cases will likely have a long duration in illness likely with multiple diabetic associated complications.

This study compared treatment outcome among controlled and uncontrolled patients at a 4:1 ratio, respectively, consequently with the percentages of controlled slightly improved among men (45.9%) but not among women (36.4%) [9]. For example as shown, the proportion of normal foot care to abnormal foot care is 1:6. Likewise, the same ratio among non-diabetic retinopathy and diabetic retinopathy is found. However, unfavorable ratios of good outcome have been found between non-comorbidity and comorbidity: 1:6.

Discussion of the primary research results

Results demonstrated that more than half the patients can manage their T2DM health without complications, but the remainder had high risk in renal insufficiency and/or cerebral-vascular disease – serious complications and the main cause of diabetic death. This finding is similar with others where the participants (36%) suffer from diabetes

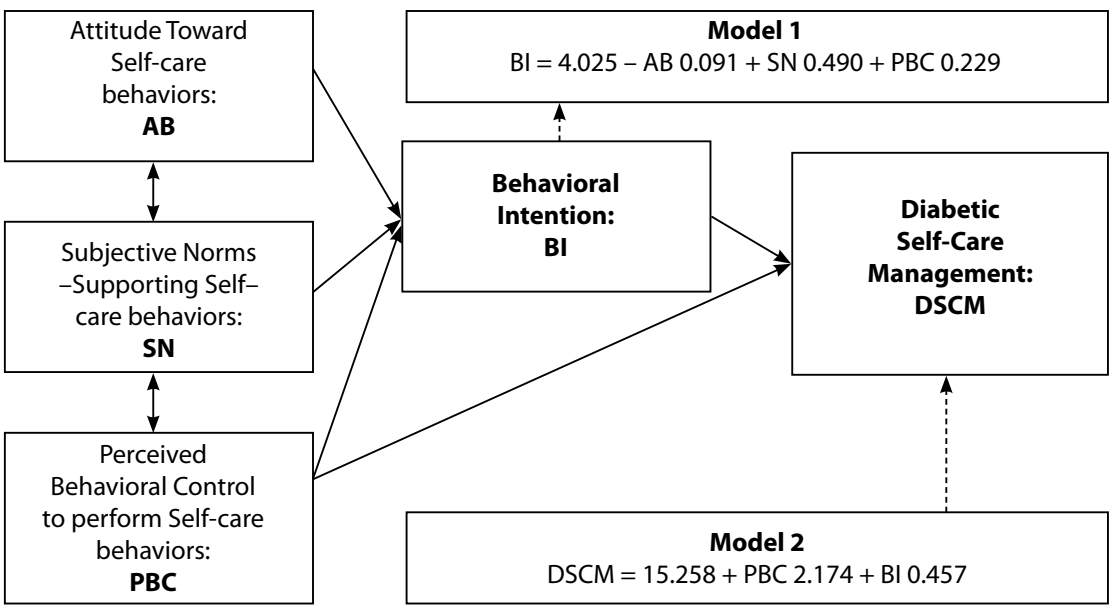

Fig. 1. The Conceptual Frame Work and The Results in Predicting Factors in Regression Model

complications especially neuropathy [17]. High levels of self–care behavior, attitude, and perceived control (with all variables relative to one another) support good T2DM outcomes. It was found that most diabetic patients had attitudes, perceived control of behaviors in accordance with their illnesses – where the majority moderate self-care (55.97%) and the minority showed similar in both high level (23.14%) and low level (20.89%) in the self-care management (due to the approach of a standard medical treatment).

The correlation between TPB variables

Predicted variables by attitude, key reference group(s) encourages planned behavioral control, appropriately. As a result, the behavior of the patients was found to be relatively high. This means that patients with similar demographic features have a similar life context, having attitudes and behaviors in like direction. In fact, there is little variance in the sample group as is noted.

Behavioral control correlates with other variables quite clearly. Consistent with the other TPB constructs [13] - significant correlations were found between all TPB constructs and both dependent variables. Healthy diet and exercise behaviors were relative, showing that patients had good behavioral control, resulting in good behavior [15]. The present findings are consistent when participants exercised and followed a planned diet and could explain by TPB constructs [16].

Factors related with diabetic self-care management

This research explored the explanatory variables focused on diabetic self-care management;

Dietary pattern, Physical Activities, and Drug Adherence*:* T2DM being a chronic disorder requires multiple therapeutic approaches including;

Dietary pattern; the patient intention to manage behavior according to doctor's advice, reduced blood sugar levels and complications [15]. The T2DM should increase intake of a healthy diet such as non-glutinous rice more servings of non-sweet fruit, vegetables, and avoid high sugar content intake that increase blood sugar levels rapidly. However, this study found seasonality of fruits and vegetables available at low cost caused patients to lose control of healthy diet behaviors leading to overweight and increased glycemic levels (uncontrolled and well controlled was 2:1 (66.4% vs 33.6%)). Most in the uncontrolled group managed to eat less/more unhealthy food at their next meal when hyperglycemia/hypoglycemia occurs but not sustaining in long term carefully eating reverting back to old habits where the glycemic results are better, similar with the previous study [17].

Physical Activities; results indicate that TPB-based interventions including planning strategies may encourage physical activity among older people with diabetes. The previous study shows nearly 87% of the variance in exercise behavior and 72% of the variance in healthy eating behavior were explainable by TPB constructs [13,14]. The frequency of regular exercise benefits patients, reducing long term monitored blood glucose. The types of exercise should be easy and appropriate for elderly - such as arm swing exercises, small and short step exercises and mild to moderate intensity aerobic exercises [16,19].

Drug adherence; in contrast to other studies, the results obtained reported high medication adherence over previous studies showing the rate of non-adherence to the treatment prescription being high as compared to other studies that reported moderate adherence levels to medication [17,20]. Similar findings reported that suboptimal medication adherence leads to negative consequences, such as suboptimal metabolic control, increased risk of diabetes complications and hospitalizations, and additional healthcare expenditures [14]. According to the TPB model in this study, patients have high intentions towards performing drug adherence behaviors. Because of the effectiveness of the family doctor service system in the Primary Care Cluster (PCC) of Pak Phanang Hospital, model knowledge about medicine for elderly patients and caregivers in DM-clinic and Home Health Care visiting, strengthening and recommending has been developed and firmly deployed.

This result consequently clarified that all 3 variables predisposed patient intention to accomplish their self-care behaviors. To apply the model to changing lifestyle requires focus on perceived behavioral control, and subjective norms - such as planning to prepare healthy food, planning to exercise or perform slight physical activities (even activities in gardens or housing keeping help), monitoring and empowerment regularly from family members and doctors or other paramedical practitioners. Being concerned with self-management support may improve self-care activities and A1C in patients with comorbid diabetes [15].

Social support (Subjective norms)

The referral groups such as medical providers, nurses, and caregivers (subjective norms) were the main predictors of behavioral intention in model 1. The results showed that life partners or children make patients trust and adhere to all those behaviors, resulting in good behavioral outcomes. Results in medical treatment planning, such as annual year biochemistry and eye checkup, were strong, only 2.2 % were missed. Most patients had healthy eating patterns, physical activity and drug adherence consistent with doctor-patient relationships. Concern by family members support strong predicting with behavioral control for patients to perform self-care behaviors (these variables explained 30% of the common variance). It is important for the health care provider to assess sources of social support and integrate the results of this assessment to ensure the empowerment of the patient during diabetes education [18,20].

The study data presented obstacles such as poor ability of elderly patients and lack of education by caregivers to conduct accurate glucose monitoring. Unrealistic perceptions of cost of test strips and needles, lack of basic knowledge due to the absence of diabetes self-management educational programs [15,20]. Not only absence of education but also lack in skills to perform, lack of home health care provider support, fear of testing and associated pain and preference for traditional medicine overwhelmed the sample group [19]. In this study, family support and physician trust had a great influence on the acceptance and performance of DSCM and is critical to further improvements. This results might be due to most participants had strong relative between their subjective norm and their attitude toward eating healthy food, good

exercise, and medication adherence, which results in strong perception, then they might have highly intention to perform their behaviors.

Perceived Behavioral Control and Behavioral Intention

Increased ability to adjust medication dosages, dietary intake and physical activity depended on Perceived Control and Intention. The patients who have strong intention to perform self-care behaviors should have a good plan and appropriate time to change their life style. The significance of both predictors serves greatly to control blood sugar. The perception of behavior control has a distinct effect followed by conclusions, in accordance to the reference group [14].

Diet behavior was most important for determining lifestyle modification. Therefore, most patients should have learned by peer group discussion through role models who have well-controlled and uncontrolled storylines about the health benefits or multiple complications.

Research limitations

The limitation in tested outcome that the A1C can diagnose pre-diabetes and diabetes, but is not recommended for screening for diabetes in Thai people due to high costs And standardized laboratories Certified by NGSP and standards are still low when referring to the Diabetes Control and Complications Trial reference assay (DCCT) [11].

CONCLUSION

The results showed patients had a moderate level in self-care management, consistent with their treatment outcome. It was noted that behavioral intention and diabetic self-management behaviors are being managed by perceived behavioral control for predicting model and health-related diabetic self-care management. The perceived control is a helpful guide in managing obstacles in long-term health benefits among elderly T2DM. Further research to identify the barriers with self-efficacy, possibly through building patient empowerment skills and a deeper perceived quality of life among populations with diabetes, should be undertaken.

ADDITIONAL INFORMATION

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СПИСОК ЛИТЕРАТУРЫ | REFERENCES

1. WHO. Global report on diabetes [Internet]. WHO; 2016. Available from: https://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257_eng.pdf;jsessionid=E6DC5D9B3C6B30128992CF99469360C6?sequence=1.
2. Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration. Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: a comparative risk assessment. *Lancet Diabetes Endocrinol.* 2014;2(8):634–647. doi: https://doi.org/10.1016/S2213-8587(14)70102-0.
3. Ogurtsova K, da Rocha Fernandes JD, Huang Y, et al. IDF diabetes atlas: global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes Res ClinPract.* 2017;128:40–50. doi: https://doi.org/10.1016/j.diabres.2017.03.024.
4. IDF Diabetes Atlas, 8th edition [Internet].International Diabetes Federation; 2017[cited 2018 December 31]. Available from: https://diabetesatlas.org/resources/2017-atlas.html.
5. Cho NH, Shaw JE, Karuranga S, et al. IDF diabetes atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res ClinPract.* 2018;138:271–281. doi: https://doi.org/10.1016/j.diabres.2018.02.023.
6. Bommer C, Sagalova V, Heesemann E, et al. global economic burden of diabetes in adults: projections from 2015 to 2030. *Diabetes Care.* 2018;41(5):963–970. doi: https://doi.org/10.2337/dc17-1962.
7. Reutrakul S, Deerochanawong C.Diabetes in thailand: status and policy. *CurrDiab Rep.* 2016;16(3):28. doi: https://doi.org/10.1007/s11892-016-0725-7.
8. Aekplakorn W, Chariyalertsak S, Kessomboon P, et al. Prevalence of diabetes and relationship with socioeconomic status in the thai population: national health examination survey, 2004–2014.*J Diabetes Res.* 2018;2018:1654530. doi: https://doi.org/10.1155/2018/1654530.
9. Number and death rate of non-communicable diseases Year 2016–2017[Internet]. Bureau of non-communicable disease, Ministry of Public Health; 2018[cited 2019 April 19]. Available from: http://www.thaincd.com/2016/mission/documents-detail.php?id=13486&tid=32&gid=1-020.
10. Guideline Contact for diabetes 2560[Internet]. Clinical Practice Guideline for Diabetes; 2017. Available from: https://www.dmthai.org/attachments/article/443/guideline-diabetes-care-2017.pdf.
11. Ajzen I. The theory of planned behaviour: reactions and reflections. *Psychol Health.* 2011;26(9):1113–1127. doi: https://doi.org/10.1080/08870446.2011.613995.
12. Phutthong S. Predictive factors on the Plasma Glucose Level in Type 2 Diabetes Mellitus client: Relative analysis under the theory of planned behavior in Surat Thani Hospital. Region 11 *Medical Journal.* 2018;31(1):83-96.
13. Zomahoun HT, Moisan J, Lauzier S, et al. Predicting noninsulin antidiabetic drug adherence using a theoretical framework based on the theory of planned behavior in adults with type 2 diabetes: a prospective study. *Medicine (Baltimore).* 2016;95(15):e2954. doi: https://doi.org/10.1097/MD.0000000000002954.
14. Zimbudzi E, Lo C, Misso ML, et al. Effectiveness of self-management support interventions for people with comorbid diabetes and chronic kidney disease: a systematic review and meta-analysis. *Syst Rev.* 2018;7(1):84. doi: https://doi.org/10.1186/s13643-018-0748-z.
15. Hair JF, Anderson RE, Tatham RL, Black WC. Multivariate data analysis, 3rd edn. Macmillan, New York; 1992.
16. Ohta R, Mukoyama C. Improvements in self-care among patients with diabetes in a remote island in Japan: a pilot study Journal of rural medicine. *JRM* 2018;13(2):134–140. doi: https://doi.org/10.2185/jrm.2942.
17. Mikhael EM, Hassali MA, Hussain SA, Shawky N. Self-management knowledge and practice of type 2 diabetes mellitus patients in Baghdad, Iraq: a qualitative study.*Diabetes MetabSyndrObes.* 2018;12:1–17. doi: https://doi.org/10.2147/DMSO.S183776.
18. Mogre V, Abanga ZO, Tzelepis F, et al. Adherence to and factors associated with self-care behaviours in type 2 diabetes patients in Ghana.*BMC EndocrDisord.* 2017;17(1):20. doi: https://doi.org/10.1186/s12902-017-0169-3.
19. Jannoo Z, Mamode Khan N. Medication adherence and diabetes self-care activities among patients with type 2 diabetes mellitus. *Value Health Reg Issues.* 2019;18:30–35. doi: https://doi.org/10.1016/j.vhri.2018.06.003.
20. Wanna J, Terathongkum S, Thipsuwannakool V. Effect of arm swing exercise programe on HbA1c and nutritional status in adults with type 2 diabetes in community. *BKK Med J.*2018;14(1):23–28. doi: https://doi.org/10.31524/bkkmedj.2018.02.005.

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