

## IC-012

### The Association between Social Support, Self-care Behavior, and Glycemic Control Level of Elderly Patients with Type 2 Diabetes Mellitus in Bangkok, Thailand

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#### ABSTRACT

**Background:** Type 2 Diabetes Mellitus is a non-communicable disease that occurs when the body is unable to use insulin effectively or when the pancreas cannot produce enough insulin. Type 2 DM has become a major health problem in many countries. World Health Statistics report, more than 400 million adults worldwide have been diagnosed with diabetes in 2018. 1.6 million deaths were caused by diabetes (WHO, 2023). Type 2 DM is a significant public health issue in Thailand. In 2019, 14,025 cases of Type 2 DM received healthcare services at 68 Public Health Centers, Bangkok Metropolitan Administration. Out of the total patients, 7,283 (52%) had uncontrolled blood sugar with HbA1C  $\geq$  7%, while 6,742 (48%) patients had a controlled blood sugar level with HbA1C <7% (BMA, 2019).

**Objective:** This study aims to determine the proportion of uncontrolled and controlled level of glycemic control, to explore levels of self-care behaviors, and social support, and to identify the influencing factors on glycemic control level among elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand. Last, this study aims to describe which social support channels that the elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand acquires.

**Method:** A Cross-sectional analytic study design was used in this study. 284 participants (the elderly with type 2 DM) from 5 Public Health Centers, Bangkok Metropolitan Administration (BMA) were conducted in this study by face-to-face interview based on the questionnaire. Participants' characteristics were described using descriptive statistics while simple logistic regression was used to identify the association between glycemic control and other variables (crude odd ratio); p-value < 0.2 from the bivariate analysis were selected into the multivariable model (binary logistic regression). This study used a multivariable model (binary logistic regression analysis) to identify factors associated (an adjusted odds ratio and 95% CI) with the dependent variable (glycemic control level) with a p-value  $\leq$  of 0.05.

**Result:** The proportion of glycemic control level, the most of participants in this study had controlled glycemic level (HbA1C <7%) 153(53.9%). While 131(46.1%) of the participants had uncontrolled glycemic level (HbA1C  $\geq$  7%). 119(41.9%) of participants had medium self-care behaviors. 200(70.4%) of participants had moderate social support. The crude odd ratio of poor glycemic control increased with the duration of Type 2 DM >10 years, alcohol drinking, self-care behaviors, and social support. Poor glycemic control (HbA1C <7%) increased with low self-care behaviors, medium self-care behaviors, and low social support.

**Conclusion:** The results of this study can be used to measure blood glucose levels and compare them with the diabetes management key performance indicators. The findings can also be used to create a health promotion handbook for self-care behaviors and to develop an intervention program focusing on self-care behaviors and social support for elderly patients with Type 2 diabetes, their caregivers, and public health volunteers at Public Health Centers in Bangkok. Furthermore, these findings could also be used to guide future research aimed at improving diabetes management strategies, enhancing patient outcomes, and reducing the impact of Type 2 diabetes on individuals and the healthcare system in Bangkok.

**Keywords:** Type 2 Diabetes Mellitus, Glycemic control, Self-care-behavior, and Social Support

## Introduction

Diabetes Mellitus (DM) is a chronic disease that is not transmissible. It is characterized by high blood glucose levels caused by defects in insulin secretion, insulin action, or both. The disease occurs when the body is unable to use insulin effectively or when the pancreas cannot produce enough insulin (WHO, 2018). According to the World Health Statistics 2018 report, more than 400 million adults worldwide have been diagnosed with diabetes. In 2016, 1.6 million deaths were caused by diabetes (WHO, 2023). The United Nations and the World Health Organization (WHO) have identified diabetes as a major global health concern due to its widespread prevalence. Type 2 diabetes has been described as the most significant non-communicable disease caused by an unhealthy modern lifestyle (Khodakarami et al., 2022). Diabetes Mellitus (DM) is a prevalent health concern affecting low and high-income countries (Goyal R, 2020; Lal, 2016). Sixty percent of individuals with Type 2 DM are mostly found in Southeast Asia. According to recent statistics, approximately 1.2 million Asians died from Type 2 Diabetes Mellitus in 2019. The prevalence of this disease is rapidly increasing in South Asia at a rate of around 150% from 2000 to 2035 (IDF, 2019). Type 2 Diabetes Mellitus (T2DM) is a public health concern in Thailand. Thailand has one of the fastest-aging populations in the world. Out of its 67 million people, 12 million are elderly, according to the latest national statistics report. It is projected that the proportion of elderly people in the country will increase to 28%, making Thailand a 'super-aged society' within the next decade (WHO, 2020). It is widely known that individuals over the age of 60 are at a higher risk of developing type 2 diabetes mellitus (T2DM) due to insulin resistance. As the population has aged over the past 50 years, there has been a significant increase in the prevalence of T2DM. Nearly half of all people with diabetes mellitus are older adults aged 65 years or older (Bellary et al., 2021; WHO, 2020) (IDF, 2019). Moreover, Type 2 diabetes mellitus (DM) can cause several severe symptoms like diabetic retinopathy, chronic kidney disease, cardiovascular disease, stroke, and diabetic foot ulcers. These symptoms can harm the quality of life and economic status of the patients, their families, and the country (DAT, 2017).

The management of glycemic control levels is one of the Key Performance Indicators (KPI) for the Ministry of Public Health and the Bangkok Metropolitan Administration in Thailand to follow up on the success of Diabetes management in 13 health services areas, and Bangkok. This parameter aims to ensure that patients with Type 2 Diabetes Mellitus maintain their blood sugar levels at a minimum of 40%. The prevalence of controlled and uncontrolled Type 2 Diabetes Mellitus in Thailand: Out of 2,944,296 patients in the 13th Area Health, only 747,518 (25.39%) were able to achieve their blood sugar level in the 2019 fiscal year (HDC, 2020). In 2019, a total of 14,025 cases of Type 2 Diabetes Mellitus received healthcare services across 68 Bangkok Public Health Centers under the Bangkok Metropolitan Administration. According to the registered cases of Type 2 DM, there were 7,283 (52%) had uncontrolled blood sugar with HbA1C levels of  $\geq 7\%$ , while 8,256 (48%) cases had controlled blood sugar levels with HbA1C levels of  $< 7\%$  (BMA, 2019).

Health promotion involves individuals' decisions and actions to address health problems or maintain good health, known as self-care behavior. There are 5 dimensions of self-care behaviors including a healthy diet, physical activity, medication, continuous care, and emotional. Social support refers to the perception of receiving support from one's social network. The concept has been studied in various populations and consists of primary and secondary sub-scales. There are four dimensions of social support: emotional support, information support, instrumental support, and appraisal support. Despite these concepts and strategies have been studied in many countries for many years. There has been limited research on Type 2 DM patients in Bangkok despite the global use of these concepts and strategies. Moreover, Type 2 diabetes mellitus remains highly prevalent in Bangkok, Thailand with more than 64,000 individuals affected. There were 14,025 registered cases of Type 2 DM received healthcare services at 68 Public Health Centers. The highest prevalence area zones in Bangkok are the North and South Thonburi Zones (BMA, 2019).

## Purposes

- 1) To determine the proportion of uncontrolled and controlled level of glycemic control among the elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand.
- 2) To explore levels of self-care behaviors, and social support among the elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand.
- 3) To identify the influencing factors on glycemic control level among the elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand.
- 4) To describe which social support channels that the elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand acquires.

## Conceptual Framework

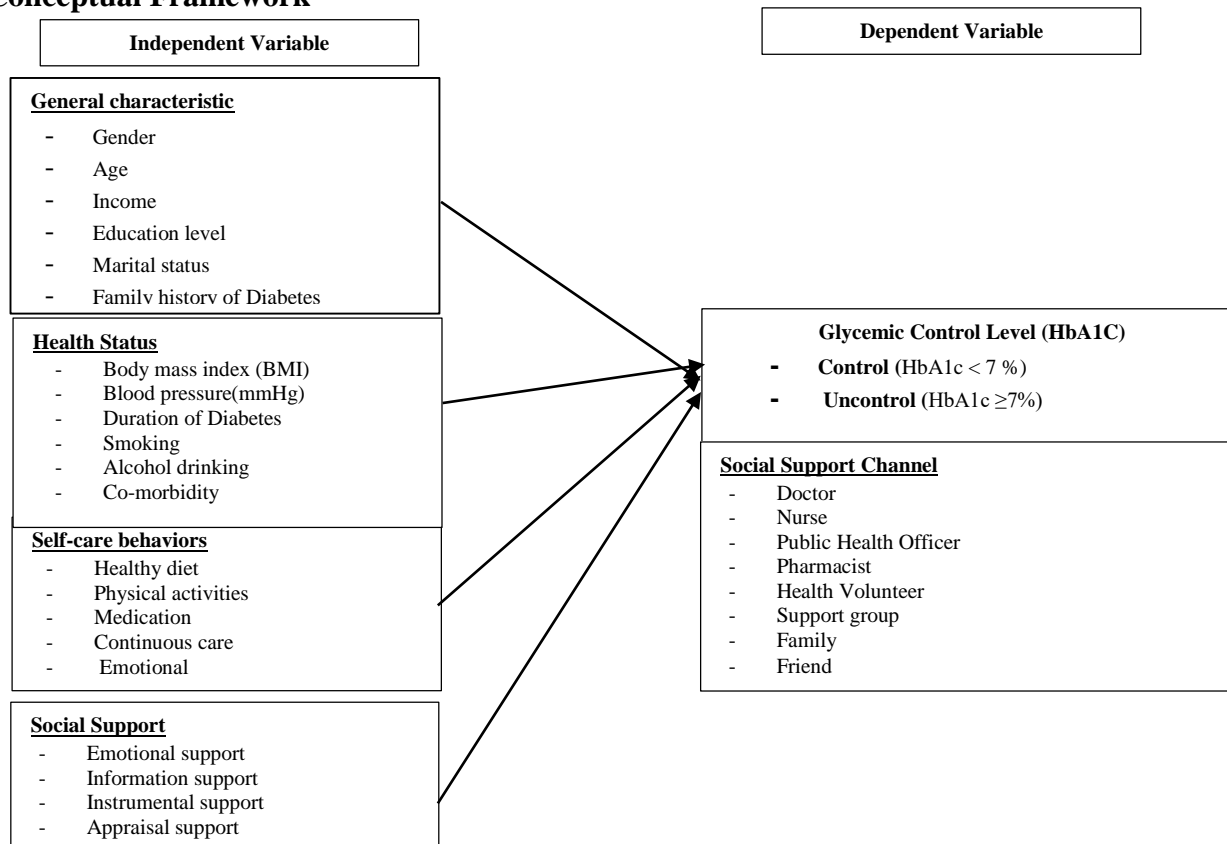


Figure 1: Conceptual framework

## Research Methodology

**Study design:** A cross-sectional analytic study design was conducted to identify the factors associated with glycemic control level in elderly type 2 diabetes mellitus patients (registered cases) at Public Health Centers in Bangkok, Thailand. The research also aimed to evaluate the level of self-care behaviors, and social support among these patients. The study utilized the most recent HbA1C test conducted within the past three months from the laboratory report. Moreover, this study aims to describe which social support channels that Type 2 DM patients at Public Health Centers in Bangkok, Thailand acquire.

**Sample Size,** the Finite population Proportion Formula determined the sample size determined the sample size. From June to September 2022, the elderly patients with Type 2 DM who came to receive healthcare services at these Public Health Centers voluntarily participated in this research (n=284).

$$n = \frac{Np(1-p)z_{1-\frac{\alpha}{2}}^2}{d^2(N-1) + p(1-p)z_{1-\frac{\alpha}{2}}^2}$$

Equation 1: The Finite Population Proportion Formula

Population Size (N) = 4,759 (Patients diagnosed with Type 2 DM at 5 Public Health Care Centers, Bangkok Metropolitan Administration). Proportion (p) = 0.23 Type 2 DM patients registered cases at 5 Public Health Care Centers, Bangkok Metropolitan Administration had uncontrolled blood sugar level (BMA, 2019). Z (0.975) = 1.96, Error(d) = 0.05. Sample Size = 258: Increasing the sample size by 10% for missing data resulted in 284 participants required.

**Sampling technique,** there were 6 zones of services area with 68 Public Health Centers in Bangkok. North Krungthong and South Zone had the highest prevalence of Type 2 DM which included 20 Public Health Centers in these services area. The top 5 Public Health Centers with the highest prevalence of Type 2 DM were selected through purposive sampling to reach the population following the inclusion criteria as shown in Figure

2. Secondly, this study utilized simple random sampling to select elderly individuals with type 2 diabetes from the registration list, who are interested and willing to participate in this research.

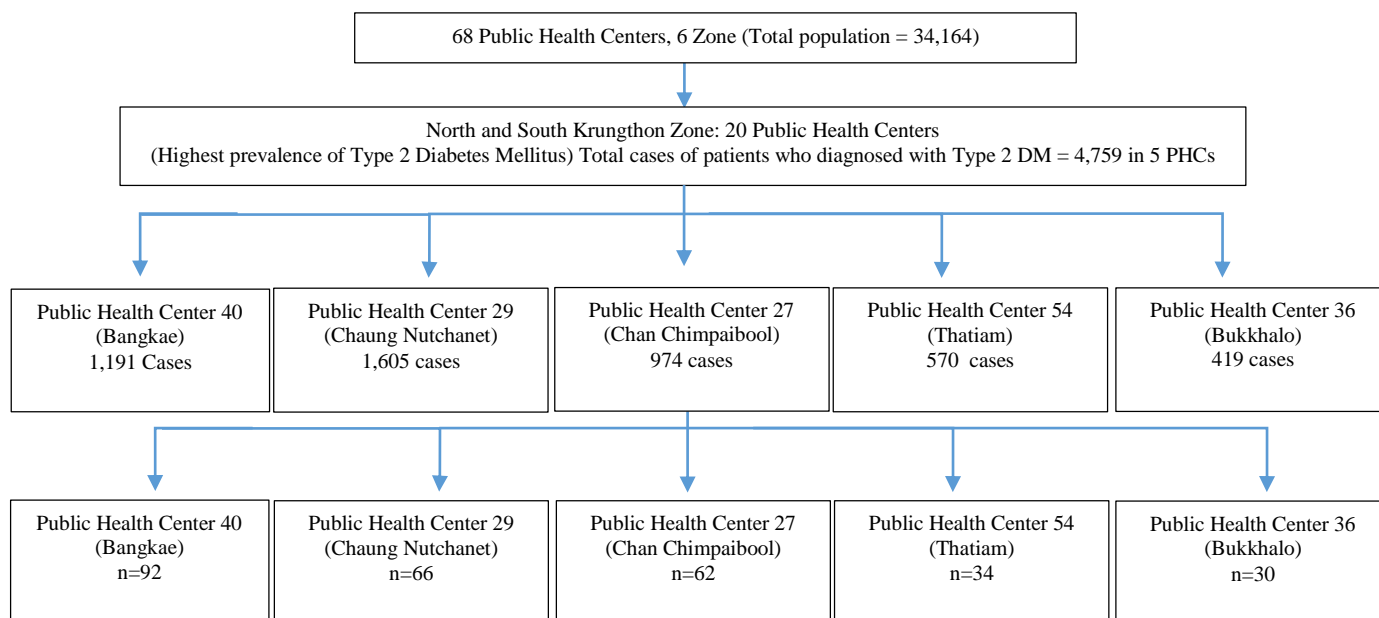


Figure 2: Sampling Technique Flow Diagram at from 5 Public Health Care Centers

**Inclusion Criteria:** Type 2 DM patients (registered cases) age  $\geq 60$  years old who received treatment services at Type 2 DM Clinic at Public Health Centers under The Health Department, Bangkok Metropolitan Administration (BMA). All of the participants were able to read and speak Thai and voluntarily join this research. The latest HbA1C test should be conducted within three months of the previous laboratory report.

**Exclusion Criteria:** Participants who had an illness, severe illnesses such as loss of consciousness, being bedridden, chronic kidney disease stage 4-5, or participants with cognitive impairment, and mental disabilities were excluded from this study.

**Data collection and Research instrument:** The research instrument used in this study comprised five parts of a questionnaire.

**Part 1: General Characteristics and Health Status Questionnaire:** The first part encompassed general characteristics and health status. The general characteristics included gender, age, income, education level, marital status, and occupation. The health status included body mass index (BMI), blood pressure (mmHg), duration of diabetes, smoking and alcohol drinking, complications, and family history of diabetes.

**Part2: Self-care behaviors questionnaire:** Self-care behaviors, the current study measured self-care behaviors that were modified from a standard questionnaire by the Type 2 DM Clinic of Singhanakorn Hospital, Songkhla Province (Siangdang, 2019). The questionnaire consisted of 20 questions distributed to 5 different dimensions including healthy diet (questions 1-5), physical activities (questions 11-12), medication (questions 6-10), continuous care (questions 17-20), and emotional well-being (questions 13-16). Self-care behaviors consisted of positive and negative questions. This study used a Likert's scale ranging from "always " to "never " with scores of 2 to 0 for positive questions. On the other hand, this study used a Likert's scale ranging from “always to never” with 0 to 2 for negative questions. For calculating Self-care behaviors, the cut-off point was summed up for the total score and varied from 0 to 40. The cut-off point of self-care behaviors level were categorized by the mean score's standard deviation: Low self-care behaviors (score  $\leq 24$ ), Medium self-care behaviors level (score 25-33), Good self-care behaviors level (score  $\geq 34$ ).

**Part 3: Social support questionnaire:** Part 3.1: This part of the questionnaire mentioned about social support. This instrument was adapted from the concept of social support by House in 1981 and it was modified by Thai researchers (Sittikarnkaew, 2012). The questionnaire consisted of 17 questions across 5 dimensions including emotional support 3 questions, information support 2 questions, medication 5 questions, instrumental

support 3 questions, and appraisal support 2 questions. The statements in the questionnaire were rated using the Likert scale ranging between 1 to 5, with responses varying from "strongly disagree" to "strongly agree". For calculating social support scores, the cut-off point was mean scores standard deviation. All respondents' answer scores of 17 questions were summed up and calculated mean and standard deviations. The score ranges from 17-85. The social support level classified as follow; Low social support (score  $\leq 56$ ), Moderate social support (score 57–70), Good social support level (score  $\geq 71$ ).

**Part 3.2: Social support channel:** This part of the questionnaire described which social support channels the elderly Type 2 DM patients at Public Health Centers in Bangkok, Thailand acquire. There are 8 multiple choices including doctor, nurse, public health officer, pharmacist, health volunteer, support group, family, and friends. **Part 4: it is necessary to provide the HbA1C test results obtained from a laboratory report carried out within no longer than three months.**

**Validity and reliability:** The content validity of the questionnaire was evaluated by three experts, including two experts from the College of Public Health Science at Chulalongkorn University and one expert from the director of the General Administration Subdivision at Public Health Center 21 Wat That Thong (BMA). The questionnaire's validity was assessed using the Index of Item-Objective Congruence (IOC). The Index of Item-Objective Congruence (IOC) for this study is 0.81. To ensure the reliability of the questionnaire used in the study, a pre-test pilot was conducted among patients with Type 2 diabetes (registered cases) who were 60 years of age or older and received treatment at Public Health Centers (for tryout n=30). The results indicated high reliability for self-care behaviors, the Cronbach's alpha coefficient was 0.7. The Cronbach's alpha t for the social support questionnaire was 0.84.

**Data collection:** The data for this research were collected through a one-time face-to-face interview based on the questionnaire at five Public Health Centers under the Department of Health in Bangkok, Bangkok Metropolitan Administration (BMA), which typically takes 20-25 minutes and does not require any follow-up. The elderly Type 2 DM patients who participate in research can withdraw from the research at any time without penalty or loss of benefits that should be received according to the right to receive treatment. The details of the research were provided by the researcher and researcher assistants. Before participating in the research, the elderly Type 2 DM patients were given informed consent to collect data by conducting interviews and reviewing their latest HbA1C results from the laboratory (up to 3 months). During the COVID-19 pandemic, researchers are taking precautions to maintain social distancing during the data collection process. The researchers, researcher assistants, and participants wear face masks and face shields throughout the study and express gratitude to participants for completing the questionnaire. Additionally, the researcher provided masks and 75% alcohol spray for participants as a gesture of appreciation and to promote safety.

**Data analysis:** The questionnaire was filled out manually before entering data into a computer. To ensure accuracy, the data entry process was carried out through a double-entry method. For data analysis, this study used SPSS software version 22 for Windows, which was received from Chulalongkorn University. This study used descriptive statistics to outline the features of the participants. Mean and standard deviation were applied for continuous data, while percentage and frequency were used for categorical data. Furthermore, this study utilized inferential statistics to make inferences about the population based on the sample data. The bivariate analysis was used to identify factors associated (a crude odds ratio) with the dependent variable (glycemic control level). The variables with p-value  $< 0.2$  from the bivariate analysis were selected into the multivariable model (binary logistic regression). This study used a multivariable model (binary logistic regression analysis) to identify factors associated (an adjusted odds ratio) with the dependent variable (glycemic control level) with a p-value  $< 0.05$ .

**Ethical issues:** The Ethical was approved by Chulalongkorn University Research Ethics Committee and the Bangkok Metropolitan Administration Human Research Ethics Committee (BMAHREC). The main ethical issue was confidentiality. All the participants were informed about the process of studying and voluntarily signed the consent form before participating in this study. They can refuse to join this study without any effects. However, the following steps were taken into consideration to ensure that participants' confidentiality was not breached. Data were used for research purposes only.

## Results

Table 1 presents about general characteristics and health status among the elderly Type 2 DM patients (n = 284). The most of participants were female 187(65.8%), aged 60-60 years old 149(52.5%). Education level, the most of participants graduated from primary school, high school, and vocational certificate 242(85.2%). The most of participants were married 176(62.0%), and unemployed 170(59.1%). 229(60.2%) of participants had income  $< 10,590$  Thai baht per month The minimum wage in Bangkok is 353 THB per day or 10,590 THB per

month by The Ministry of Labour of Thailand, Thai government gazette) (MOL, 2022). Health status, most of the participants 113(39.8%) had a Body Mass Index (BMI) of Obese ( $\geq 25$ ). 208 (73.2%) of patients living with Type 2 DM  $\leq 10$  years. 241(59.9%) of patients had co-morbidity. 271(95.4%) of patients were not drinking alcohol and no smoking 270(95.1%).

**Table 1 General Characteristics and Health Status of the Elderly of Type 2 DM Patients (n = 284)**

General Characteristic	Number (Total = 284)	Percentage
<b>Gender</b>		
Male	97	34.2
Female	187	65.8
<b>Age</b>		
60-69	149	52.5
$\geq 70$	135	47.5
Mean $\pm$ SD = 69.29 $\pm$ 6.5 Range = 60 – 98 years old		
<b>Education Level</b>		
No education	27	9.5
Primary school, High school, and Vocational Certificate	242	85.2
Bachelor degree and others	15	5.3
<b>Marital Status</b>		
Single, Divorce, Widow	108	38.0
Married	176	62.0
<b>Occupational</b>		
Unemployed	170	59.1
Employment	114	40.1
<b>Income level<sup>a</sup></b>		
< 10,590 Thai baht per month	229	60.2
$\geq 10,590$ Thai baht per month	113	39.8
<b>Health Status</b>	<b>Number (Total = 284)</b>	<b>Percentage</b>
<b>Body Mass Index</b>		
Under weight (<18.5)	15	5.3
Normal weight (18.5-22.9)	92	32.4
Overweight (23-24.9)	64	22.5
Obese ( $\geq 25$ )	113	39.8
Mean $\pm$ SD = 25.16 $\pm$ 5.51 ; Range = 15.51-50.17		
<b>Duration</b>		
$\leq 10$ years	208	73.2
> 10 years	76	26.8
Mean $\pm$ SD = 10.06 $\pm$ 8.3 ; Range = 1- 40 years		
<b>Co-morbidity</b>		
Yes	241	59.9
No	43	40.1
<b>Hypertension</b>		
Yes	216	76.1
No	68	23.9
<b>Dyslipidemia</b>		
Yes	171	60.2
No	113	39.8
<b>Smoking</b>		
Smoking	14	4.9
No smoking	270	95.1
<b>Alcohol Drinking</b>		
Drinking alcohol	13	4.6
No drinking alcohol	271	95.4
<b>Family history of Type 2 DM</b>		
Yes	143	50.4
No	141	49.6

<sup>a</sup> The minimum wage in Bangkok: 353 THB per day or 10,590 THB per month by The Ministry of Labour of Thailand, Thai government gazette) (MOL, 2022)

Table 2 presents about the level of Self-care behaviors, and social support among the elderly Type 2 DM patients (n = 284). 119(41.9%) of participants had medium self-care behaviors level (score 25-33). 200(70.4%) of participants had moderate social support (score 57–70). The proportion of glycemic control level, the most of participants in this study had controlled glycemic level (HbA1C <7%) 153(53.9%). While 131(46.1%) of the participants had uncontrolled glycemic level (HbA1C ≥ 7%).

**Table 2 The level of Self-care behaviors, and social support among the elderly Type 2 DM patients (n = 284)**

The level of Self-care behaviors, and social support	Number (Total = 284)	Percentage
<b>Self-care behaviors level: Classified into 3 level bases on standard questionnaire (Siangdang, 2019)</b>		
Low self-care behaviors (score ≤ 24)	81	28.5
Medium self-care behaviors level (score 25-33)	119	41.9
Good self-care behaviors level (score ≥ 34)	84	29.6
<b>Social support level: Classified into 3 level bases on standard questionnaire (Sittikarnaew, 2012)</b>		
Low social support (score ≤ 56)	50	17.6
Moderate social support (score 57–70)	200	70.4
Good social support level (score ≥ 71)	34	12.0
<b>The Proportion of glycemic control level</b>		
Controlled glycemic level (HbA1C <7%)	153	53.9
Uncontrolled glycemic level (HbA1C ≥ 7%)	131	46.1

Table 3: the bivariate analysis results in this study indicated associations between four independent variables and the dependent variable (glycemic control level). These variables included the duration of Type 2 DM, alcohol drinking, self-care behaviors, and social support. Variables with a p-value < 0.2 from the bivariate analysis were selected for inclusion in the multivariable model (binary logistic regression). The duration of type 2 DM, patients who had a duration of Type 2 DM > 10 years were 1.57 times more likely to uncontrol glycemic level (HbA1C ≥ 7%)(p-value = 0.06<sup>b</sup>). Alcohol drinking, the crude odds ratio of poor glycemic control of Type 2 DM patients who had drinking alcohol behavior was higher than patients who had no drinking alcohol behaviors: Crude odds ratio =1.92: 95% CI; 0.61-6.03 (p-value = 0.19<sup>b</sup>). Type 2 DM patients who had drinking alcohol behaviors were likely to uncontrol glycemic level (HbA1C ≥ 7%) 1.92 times than Type 2 DM patients who had no drinking alcohol behaviors. Self-care behaviors, the crude odds ratio of uncontrol glycemic level (HbA1C ≥ 7%) increased with the lower level of self-care behaviors. Patients with low level of self-care behaviors were 1066 times more likely to uncontrol glycemic level than patients with good level of self-care behaviors. Patients with medium level of self-care behaviors were 30.75 times more likely to uncontrol glycemic level than patients with good level of self-care behaviors (p-value <0.001<sup>b</sup>). Social support, the crude odds ratio of uncontrol glycemic level (HbA1C ≥ 7%) increased with the lower level of social support. Patients with low level of social support were 242.00 times more likely to uncontrol glycemic level than patients with good level of social support. Patients with moderate level of social support were 24.90 times more likely to uncontrol glycemic level than patients with good level of social support (p-value <0.001<sup>b</sup>).

**Table 3: The association between general characteristics, health status, self-care behaviors, and social support with glycemic control level among the elderly Type 2 DM patients (n = 284) by the bivariate analysis (p-value ≤ 0.2)**

General Characteristics	Uncontrolled HbA1C ≥ 7% (n=131)	Controlled HbA1C <7% (n=153)	Crude OR	95 % CI		P-value
				Lower	Upper	
<b>Gender</b>						
Male	46(47.4)	51(52.6)	1.08	0.66	1.77	0.75
Female	85(45.5)	102(54.5)	1			
<b>Age</b>						
60-69	66(44.3)	83(55.7)	1			
≥ 70	65(48.1)	70(51.9)	1.17	0.73	1.86	0.52
<b>Education Level</b>						0.21
No education	13(48.1)	14(51.9)	1.86	0.60	6.90	0.35
Primary school, high school, and vocational certificate	113(46.7)	129(53.3)	1.75	0.58	5.88	0.32
Bachelor degree and others	5(33.3)	10(66.7)	1			
<b>Marriage Status</b>						
Single, divorce, and, widow	46(42.6)	62(57.4)	1			
Married	85(48.3)	91(51.7)	1.26	0.78	2.04	0.35
<b>Occupational</b>						
Unemployed	76(44.7)	94(55.3)	1			
Employment	55(48.2)	59(51.8)	1.15	0.72	1.86	0.56
<b>Income level <sup>a</sup></b>						
< 10,590 Thai baht per month	109(47.6)	120(52.4)	1.36	0.75	2.48	0.31



Health Status	Uncontrolled HbA1C ≥ 7% (n=131)	Controlled HbA1C <7% (n=153)	Crude OR	95 % CI		P-value
				Lower	Upper	
<b>Body Mass Index</b>						0.22
Under weight (<18.5)	7(46.7)	8(53.3)	1.10	0.37	3.25	0.871
Normal weight (18.5-22.9)	42(45.7)	50(54.3)	1.06	0.61	1.84	0.882
Overweight (23-24.9)	32(50.0)	32(50.0)	1.26	0.68	2.33	0.413
Obese (≥ 25)	50(44.2)	63(55.8)	1			
<b>Duration of Type 2 DM</b>						
≤ 10 years	88(42.3)	120(57.7)	1			
> 10 years	43(56.6)	33(43.4)	1.57	0.98	2.51	0.06 <sup>b</sup>
<b>Co-morbidity</b>						
Yes	109(45.2)	132(54.8)	1			
No	22(51.2)	21(48.8)	1.269	0.66	2.43	0.47
<b>Smoking</b>						
Smoking	6(42.9)	8(57.1)	1.15	0.39	3.40	0.80
No smoking	125(46.3)	145(53.7)	1			
<b>Alcohol Drinking</b>						
Drinking alcohol	8(61.5)	5(38.5)	1.92	0.61	6.03	0.19 <sup>b</sup>
No drinking alcohol	123(45.4)	148(54.6)	1			
<b>Family history of Type 2 DM</b>						
Yes	66(46.2)	77(53.8)	1.002	0.63	1.60	0.99
No	65(46.1)	76(53.9)	1			
<b>Self-care behaviors</b>						
Low self-care behaviors (score ≤ 24)	78(96.3)	3(3.7)	1066	173.47	6552.0	<0.001 <sup>b</sup>
Medium self-care behaviors (score 25-33)	51(42.9)	68(57.1)	30.75	7.22	130.95	<0.001 <sup>b</sup>
Good self-care behaviors (score ≥ 34)	2(2.4)	82(97.6)	1			
<b>Social Support</b>						<0.001 <sup>b</sup>
Low social support (score ≤ 56)	44(88.0)	6(12.0)	242.00	27.78	2108.05	<0.001 <sup>b</sup>
Moderate social support (score 57 – 70)	86(43)	114(57.0)	24.90	3.33	185.61	<0.001 <sup>b</sup>
Good social support (score ≥ 71)	1(2.9)	33(97.1)	1			

<sup>b</sup> the independent variable at p-value <0.2 in bivariate analysis entered into binary logistic regression.

Table 4 presents the association between general characteristics, health status, self-care behaviors, and social support with glycemic control level among the elderly Type 2 DM patients (n = 284) by the multivariable model binary logistic regression analysis (p-value ≤ 0.05). The variables with p-value <0.2 from the bivariate analysis including duration Type 2 DM, alcohol drinking, self-care behaviors, and social support were selected into the multivariable model (binary logistic regression). Multivariable binary logistic regression analysis was used to identify an association between the independent variables and glycemic control (dependent variable). The current study findings indicated that self-care behaviors and social support were significant factors in glycemic control level among Type 2 DM patients. Self-care behaviors, the adjusted odds ratio of uncontrol glycemic level (HbA1C ≥ 7%) increased with the lower level of self-care behaviors (low self-care behaviors: adjusted odds ratio = 628.54: 95% CI 97.61-4047.30; p-value <0.001; medium self-care behaviors: adjusted odds ratio = 22.29: 95% CI 5.08-97.83; p-value <0.001). Self-care behaviors associated with glycemic control level; total p-value <0.001. Social support, the adjusted odds ratio of uncontrol glycemic level (HbA1C ≥ 7%) increased with the low social support (low social support: adjusted odds ratio = 14.52: 95% CI 1.46-144.64; p-value <0.02; moderate social support: adjusted odds ratio = 5.34: 95% CI 0.65-43.98). Social support associated with glycemic control level; total p-value 0.04. In summary, Elderly type 2 DM Patients with higher level of self-care behaviors, and social support were less likely to have uncontrolled glycemic levels (HbA1C ≥ 7%).

**Table 4: The association between general characteristics, health status, self-care behaviors, and social support with glycemic control level among the elderly Type 2 DM patients (n = 284) by the multivariable model binary logistic regression analysis (p-value ≤ 0.05)**

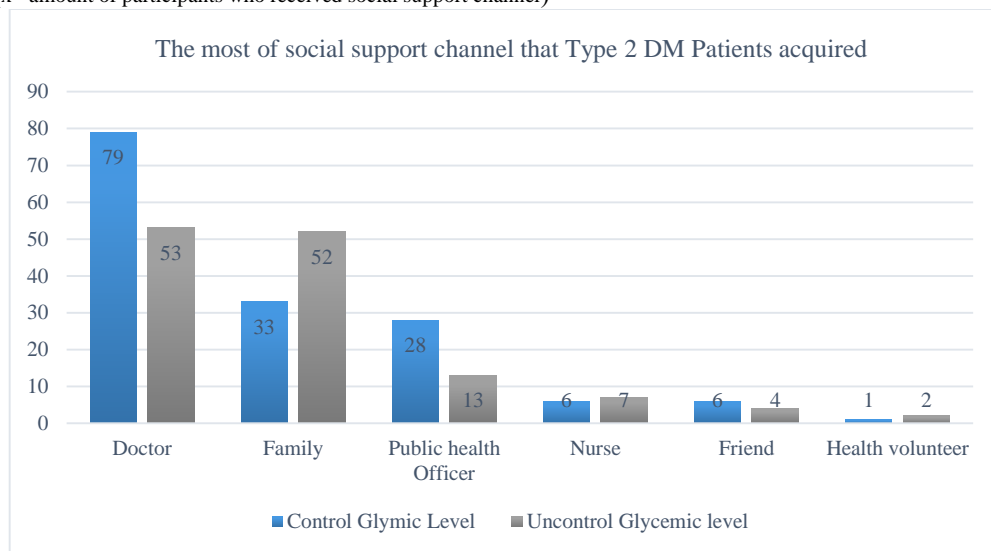
Variables	-B	SE	Glycemic control			P-value
			Adjusted OR	Lower	Upper	
<b>Duration of Type 2 DM</b>						
≤ 10 years			1			
> 10 years	0.56	0.36	1.76	0.87	3.58	0.11
<b>Alcohol Drinking</b>						
Drinking alcohol	1.04	0.80	1.72	0.58	13.51	0.19
No drinking alcohol			1			
<b>Self-care behaviors level</b>						
Low self-care behaviors (score ≤ 24)	6.44	0.95	628.54	97.61	4047.30	<0.001*
Medium self-care behaviors (score 25-33)	3.10	0.76	22.29	5.08	97.83	<0.001*
Good self-care behaviors (score ≥ 34)			1			
<b>Social Support</b>						
Low social support (score ≤ 56)	2.68	1.17	14.52	1.46	144.64	0.02
Moderate social support (score 57 – 70)	1.67	1.08	5.34	0.65	43.98	0.06
Good social support (score ≥ 71)			1			

\* is a significant level at p-value < 0.05 in binary logistic regression

Figure 2 presents the 1<sup>st</sup> social support channel that participants attained emotional support, information support medication support, instrumental support, and appraisal support. Firstly, there were 132 of type 2 DM patients who acquired social support channel from their doctors (secondary group of social support). There were 79(59.8%) of participants who acquired social support from the doctor with control glycemic level (HbA1C <7%). While 53 (40.2%) of the participants who acquired social support from the doctor with uncontrol glycemic level (HbA1C ≥7%). Secondly, there were 85 of type 2 DM patients who acquired social support channel from their family (primary group of social support). There were 33(38.8%) of participants who acquired social support from their family with control glycemic level (HbA1C <7%). While 52 (61.2%) of the participants who acquired social support from the their family with uncontrol glycemic level (HbA1C ≥7%). Third, there were 41 of type 2 DM patients who acquired social support channel from public health officers (secondary group of social support). There were 28(68.3%) of participants who acquired social support from public health officers with control glycemic level (HbA1C <7%). While 13(31.7%) of the participants who acquired social support from public health officers with uncontrol glycemic level (HbA1C ≥7%).

**Figure 2: The most social support channels that Type 2 DM patients at Public Health Care Centers acquired**

(x= amount of participants who received social support channel)



(y = support channel)

## Discussion

The result from the current study found the most of participants in this study had controlled glycemic level (HbA1C <7%) 153(53.9%). While 131(46.1%) of the participants had uncontrolled glycemic level (HbA1C ≥ 7%). It was comparable with related studies, including the study conducted in San Kamphaeng District, Chiang Mai Province. 47.9 % of Type 2 DM patients were unable to control their blood sugar level (Soontornsaratoon, 2021). The research of Evaluation of glycemic control and hypoglycemic among type 2 Diabetes mellitus study that collected data at 5 tertiary care hospitals in Thailand found that 47.5% achieved the glycemic goal (Satirapoj et al., 2020). In the national research conducted in Southeast Asia, more than 50% of research subjects show poor glycemic control. The awareness of glycemic control must be improved in type 2 diabetes mellitus patients (Nova & Virginia, 2023). Our study found that the majority of the elderly with type 2 diabetes have uncontrolled glycemic levels despite the presence of diabetes experts in active service at Public Health Care Centers located in the capital city Bangkok, Thailand. This is a major public health issue and a leading factor in the development of diabetic complications. It is crucial to implement a comprehensive strategy that includes both clinical and community health interventions to achieve glycemic control, minimize complications, and prevent premature mortality.

According to findings from our study, there were 4 independent variables and glycemic control level included the duration of Type 2 DM, alcohol drinking, self-care behaviors, and social support. Variables with a p-value < 0.2 from the bivariate analysis were selected for inclusion in the multivariable model (binary logistic regression). It was similar to the study in Ethiopia found that Patients with a longer duration of DM were 3.15 times more likely to have inadequate & poor glycemic control than patients with a duration of less than 10 years

(Abera et al., 2022). Patients with longer duration of diabetes may find it difficult to maintain good glycemic control due to impaired insulin secretion as a result of beta-cell dysfunction (American Diabetes, 2019). Alcohol consumption is inversely associated with glycemic control among diabetes patients. It has been found that excessive alcohol consumption can potentially harm the management of blood sugar levels among patients with type 2 diabetes in certain areas of China, regardless of whether they are taking anti-diabetes medication or not. This study carries significant implications for public health interventions in the area of type 2 diabetes management, particularly with regard to precision control of patients' blood sugar levels (Ye et al., 2024).

The current study found that the majority of elderly Type 2 DM patients had a medium level of self-care behaviors and moderate social support. The results of the bivariate analysis in this study showed that there are associations between the dependent variable (glycemic control level) and four independent variables, which are the duration of Type 2 DM, alcohol drinking, self-care behaviors, and social support. The result from the multivariable binary logistic regression, the association was declared significant at  $p$ -value  $< 0.05$ . The study conducted in Korea found that elderly patients with diabetes have shown low self-care levels in managing their symptoms and have difficulty adhering to self-care behaviors for long periods of time. The best way is to control blood glucose through proper self-care, which has been identified as crucial for keeping diabetes under control (Kim & Lee, 2019). It was similar to the study conducted in Sarab, Iran found that self-care behaviors were associated with glycemic control ( $p$ -value 0.001)(Babazadeh et al., 2022). Social support, the cross-sectional study collected data among Type 2 DM patients at primary healthcare in Egypt found that. A study conducted in Malaysia revealed that most of the participants had a moderate level of social support. To improve clinical outcomes, healthcare providers, family, and friends must strengthen their relationships with elderly patients with diabetes and provide them with more social support. This will help promote compliance with diabetic self-care activities (Babazadeh et al., 2022).

The current study findings indicated that self-care behaviors and social support were significant factors in glycemic control level among Type 2 DM patients. Participants who had low self-care behaviors, and medium self-care behaviors were more likely to uncontrol glycemic level ( $HbA1C \geq 7\%$ ). On the other hand, elderly patients with type 2 diabetes who exhibit medium, and good self-care behaviors and receive moderate, good social support are less likely to have uncontrolled glycemic levels ( $HbA1C \geq 7\%$ ). It was similar to the study about Type 2 DM in the Nakhonsawan Province which is located in the center region of Thailand. The majority of Type 2 DM were aged more than 60 years with 55.08 and they had uncontrol blood sugar level ( $HbA1C > 7\%$ ). Especially, they had a high level of self-care behaviors (Sroysong, 2020). Greater adherence to diabetes self-care behaviors was associated with better glycemic control ( $p < 0.001$ ). Diabetes self-care behaviors are vital strategies for effective T2DM management (Almomani & Al-Tawalbeh, 2022). For these reasons, the healthcare provider should encourage self-care behaviors such as monitoring blood sugar, controlling diet, and exercising to improve glycemic control and prevent diabetic complications. Social support, the study conducted in Kenya found an association between social support and glycemic control with  $p$ -value  $< 0.05$ ; OR 1.92. respondents receiving adequate informational; OR 1.92, emotional; OR 3.7 and tangible; OR 4.1 were more likely to have better glycemic control than those with inadequate social support (Jackline, 2023). The study was done in Southern Ethiopia also found factors associated with poor glycemic control based on multivariable analysis were, having comorbidity (AOR = 2.35, 95% CI (1.39–3.95). Research has shown that having more social support can lead to a decrease in HbA1c level (Dawite et al., 2023). Social support is important in helping patients with diabetes cope with the disease and improves treatment adherence. In Turkey, health providers must consider social support and empowerment when planning interventions to improve self-care behavior and glycemic control in type 2 diabetes patients (Arda Sürücü et al., 2018).

Most of the participants in the current study received social support channels including emotional support, information support medication support, instrumental support, and appraisal support from doctors, family, and public health officers. It was comparable to other studies. The study in Saudi Arabia found that T2DM patients received great social support from family and friends. Support from family and friends improves self-care adherence in diabetic patients and highlights the importance of communication. Family is a fundamental social unit that crucially influences individuals' behavioral patterns. Additionally, the patient's family members play a significant role in decisions regarding illness management and medication (El-Radad et al., 2023). Diabetes-related social support includes resources provided by family, friends, neighbors, work colleagues, peers, healthcare providers, and organizations to encourage coping behaviors and help patients manage their diabetes (El-Radad et al., 2023).

## Limitation

It is quite challenging to reach the target group and collect data using questionnaires due to limitations in data collection locations at the Public Health Centers. Since a large number of patients receive services at the Public Health Centers, it is not feasible to conduct interviews at the Outpatient Doctor (OPD) waiting point. Due to the global outbreak of the coronavirus disease 2019 (COVID-19), it has become difficult to collect data both worldwide and in Bangkok, Thailand. The request for academic documents and connection with government organizations has slowed down. Problem-solving, the researcher made arrangements for an interview room to guarantee the confidentiality of research participants. The interview was conducted after the patient had completed his examination and treatment or after seeing a doctor and receiving medication (In the case of not receiving medication, the interview can be completed after seeing the doctor) to prevent the interview from being interrupted and not interfering with the staff's work.

## Conclusion

The current study found that the majority of elderly Type 2 DM patients had a medium level of self-care behaviors and moderate social support. In terms of glycemic control, the proportion of glycemic control level, the most of participants in this study had controlled glycemic level (HbA1C <7%) 153(53.9%). While 131(46.1%) of the participants had uncontrolled glycemic level (HbA1C ≥ 7%). The results of the bivariate analysis in this study showed that there are associations between the dependent variable (glycemic control level) and four independent variables, which are the duration of Type 2 DM, alcohol drinking, self-care behaviors, and social support. The result from the multivariable binary logistic regression, the association was declared significant at p-value <0.05.

The current study findings indicated that self-care behaviors and social support were significant factors in glycemic control level among Type 2 DM patients. Social support, the adjusted odds ratio of uncontrol glycemic level (HbA1C ≥ 7%) increased with the low level, and moderate of social support. In summary, elderly patients with type 2 diabetes who exhibit medium, and good self-care behaviors and receive social support are less likely to have uncontrolled glycemic levels (HbA1C ≥ 7%).

## Recommendations

**Recommendation for program implementation**, the findings of this study can be utilized to measure blood glucose and compare with the diabetes management KPI, develop a self-care behaviors book to follow up, and record patients' behaviors, and their blood glucose. The result can inspire to create the health promotion and intervention programs on self-care behaviors and social support for elderly patients with Type 2 DM, caregivers, and public health volunteers at Public Health Centers in Bangkok. This program aims to improve awareness, knowledge, and glycemic control levels among the target groups. The majority of participants in this study answered the self-care behavior question no. 18 that I follow the advice of my doctors and nurses to keep myself healthy and prevent diabetes complications. According to the social support questionnaire, the majority said that they don't have an instrument for blood glucose measurement (Fasting blood sugar). It is important to note that many patients with high blood glucose levels may lack social support and live alone, which can make it difficult to follow up on proper treatment and HbA1C check-ups. Therefore, it is crucial to implement proactive strategies to address these challenges. Based on face-to-face interviews conducted through questionnaires, it has been discovered that many patients tend to lose track of their follow-up appointments, which can ultimately worsen the severity of their disease. The proactive strategies are important for visiting patients' homes, measuring blood glucose, following up on self-care behaviors, and providing knowledge and awareness about Type 2 DM.

**Recommendation for future research implementation**, design and implement an intervention program based on the study's findings. The program should aim to promote and record self-care behaviors and social support among elderly individuals with Type 2 diabetes mellitus (DM) on the handbook. The recommendation on health promotion should be provided to not only patients but also caregivers, and public health volunteers in Public Health Centers located in Bangkok. It is important to evaluate the effectiveness of an intervention program by conducting a comprehensive assessment using quantitative measures, such as before and after intervention assessments. For long-term evaluation, extend the evaluation period to assess the long-term impact of the intervention program on participants' self-care behaviors and glycemic control. By implementing these recommendations, future research can contribute to enhancing diabetes management strategies, improving patient outcomes, and reducing the burden of Type 2 diabetes on individuals and the healthcare system in Bangkok.

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