Original Article

Factors Predicting Adequate Glycemic Control after Participation in Diabetes Self-Management Education and Support Program: The Role of Behavioral Change

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Objective: To explore the predictors of achieving adequate glycemic control at a 6-months follow-up in patients with type 2 diabetes (T2D) who participated in the diabetes self-management education and support (DSMES) program.

Materials and Methods: A retrospective cohort study of T2D patients who completed the DSMES program (an initial visit and a 3-month follow-up) at Ramathibodi Hospital between 2014 and 2017 was conducted. Behavioral goals were set at the initial visit and whether these were achieved by the patients was assessed at a 3-month follow-up. Diabetes history, baseline, and 6-month hemoglobin A1C (HbA1c) values were collected. Multiple logistic regression analyses were performed to determine independent predictors of adequate glycemic control at 6-month, defined as HbA1c of less than 7% or less than 7.5% in those younger than 65 years or those 65 years or older, respectively.

Results: Ninety-two patients were included, with a mean (SD) age 60.7 (10.9) years, an average diabetes duration of 9.1 (9.5) years and 51.1% were using insulin. Seventy-six patients (82.6%) reported that they achieved behavioral goals as set at the initial visit, and 56.5% had adequate glycemic control at 6-month. Multiple regression analysis adjusting for age, baseline HbA1c, and insulin use revealed that behavioral goal achievement at three months was independently associated with HbA1c achievement at six months (OR 3.473, 95% CI 1.005 to 12.001), while higher baseline HbA1c was associated with a lower likelihood of achieving adequate glycemic control (OR 0.727, 95% CI 0.540 to 0.979).

Conclusion: Behavioral goal achievement was an independent predictor of adequate glycemic control in participants of the DSMES programs, suggesting that adherence to behavioral changes can improve clinical outcomes. Goal setting skills should be adopted by diabetes educators and incorporated as a key part of DSMES process.

Keywords: Factors predicting glycemic control, Diabetes self-management education, Behavioral goal achievement, Diabetic educators

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The International Diabetes Federation estimated that 451 million people worldwide had diabetes in 2017, and the number is expected to rise to 693 million by 2045[1]. In Thailand, the prevalence of diabetes from the data of Thai National Health Examination Surveys has risen from 7.5% in 2009 to 8.9% in 2014[2,3]. Unfortunately, the proportion of undiagnosed diabetes in Thailand has risen from 31.2% to 43.1% during the same period[3]. Glycemic control in those with diagnosed diabetes has been suboptimal with adequate control found in only 28.5% in 2009, and the number seemed to decline to 23.5% in 2014[3]. Adequate glycemic control is one of the cornerstones in preventing diabetes complications, especially microvascular complications[4].

In addition to medication use, Diabetic Self-management Education and Support (DSMES) is an essential component of diabetes care. This empower and enhance self-care skills in people with diabetes[5]. In the United States, National Standards for DSMES have been suggested by the American Diabetes Association and the American Association of Diabetes Educators (AADE)[6]. The concept of AADE7™ framework is related to the seven self-care behaviors, including healthy eating, being active, self-monitoring, taking medications, health coping, reducing risk, and problem solving[7]. The

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DSMES program incorporates AADE7 along with a goal setting for the purpose of behavioral changes in people with diabetes. Study by Dao-Tran et al showed the direct positive impact of diabetes knowledge on behavioral changes. For each rise in score in the diabetes knowledge scale, there was an increase in adherence to diet, blood glucose monitoring, and regular exercise[8]. DSMES has been shown to be cost effective and improve glycemic control[9]. In Thailand, however, currently there is no formal accreditation of the DSMES programs, therefore, curriculums are not standardized and the cost of DSMES delivery is not currently reimbursed. A recent survey of 470 hospitals in Thailand revealed that most educators (67%) either never evaluated the outcomes of their DSMES programs or were uncertain of the outcomes[10].

The authors' previous work evaluating the DSMES program at the Faculty of Medicine Ramathibodi Hospital in Bangkok, operated according to a set of ten standards, found a reduction in A1C by 0.8% by three months, along with a decrease in diabetes medication cost of approximately 186.21 USD/person/program over the 2-year period[11]. However, not all participants in the program could achieve the desired glycemic control. Therefore, the aim of the present study was to explore the predictors of achieving adequate glycemic control at a 6-months follow-up in patients with diabetes who participated in the DSMES program at Ramathibodi Hospital. The results will provide insights and lead to further improvement of the program in enabling self-care in people with diabetes.

Materials and Methods

Study population

The present study was a retrospective cohort study of type 2 diabetes (T2D) participants that attended the class of DSMES program at Ramathibodi Hospital between 2014 and 2017, had a follow-up at 3-months, and had valid HbA1c values at 6-months. The purpose of the present study was to explore the predictors of achieving adequate glycemic control at 6-months. Participants who completed the 3-months visit with complete data at 6-months were included. The study protocol was approved by the Committee on Human Rights Related to Research involving Human Subjects, Faculty of Medicine Ramathibodi Hospital, Mahidol University (Ethical approval (COA.MURA2018/1066).

DSMES program: The DSMES program consisted of two visits, with the goals of educating and empowering patients to enhance self-care, bring about behavioral changes, and improve glycemic control (Figure 1). The core curriculum targeted seven self-care behaviors (AADE7) including healthy eating, being active, problem solving, taking medication, healthy coping, monitoring, and reducing risks[7]. The education team consisted of health professionals from multiple disciplines including endocrinologists, advanced practice nurses (APN), nurses, pharmacists, and dieticians.

The first visit, which lasted approximately four hours, included the following components:

1. General diabetes knowledge with a lecture format by physicians or APN that lasted about 20 to 30 minutes, including the importance of glycemic control and complications.
2. Education on foot care, through a 20-minute VDO session
3. Exercise session lasting 20 minutes, led by APN
4. Meal planning including healthy eating and meal timing by dieticians that lasted about 15 to 20 minutes. Evaluations and individualized recommendations for each participant were performed.
5. Explanation on taking medications given by nurses or pharmacists that lasted 15 to 20 minutes. Medication compliance and insulin injection techniques, if applicable, was assessed and recommendations were made.
6. Self-monitoring blood glucose (SMBG) and hypoglycemia assessments by nurses or APNs lasting 15 to 20 minutes. These include educating and evaluating SMBG techniques, recording and interpreting the data, and recognizing and treating hypoglycemic symptoms. Glucometers were provided as clinically indicated. Patients were asked if they had hypoglycemic symptoms or had confirmed home glucose of less than 70 mg/dL in the past three months. Foot examination and risk assessment was explained by nurses for about 10 minutes. Referrals were made, if needed, to surgical clinic specialized in diabetic foot care.
7. Goal setting: at the end of the first visit, each participant, mutually with the education team, set two behavioral goals according to the problems and their priorities explored in the sessions above, focusing on AADE7 skill set. Goal setting was composed of the concept of SMART goal, which included specific, measurable, achievable, relevant and time-specific. Each goal setting was utilized into an action plan using the concept of specificity, reasonableness, patient-centered, and meaningfulness[12]. Then, patients were asked to rate their confidence in achieving these goals,

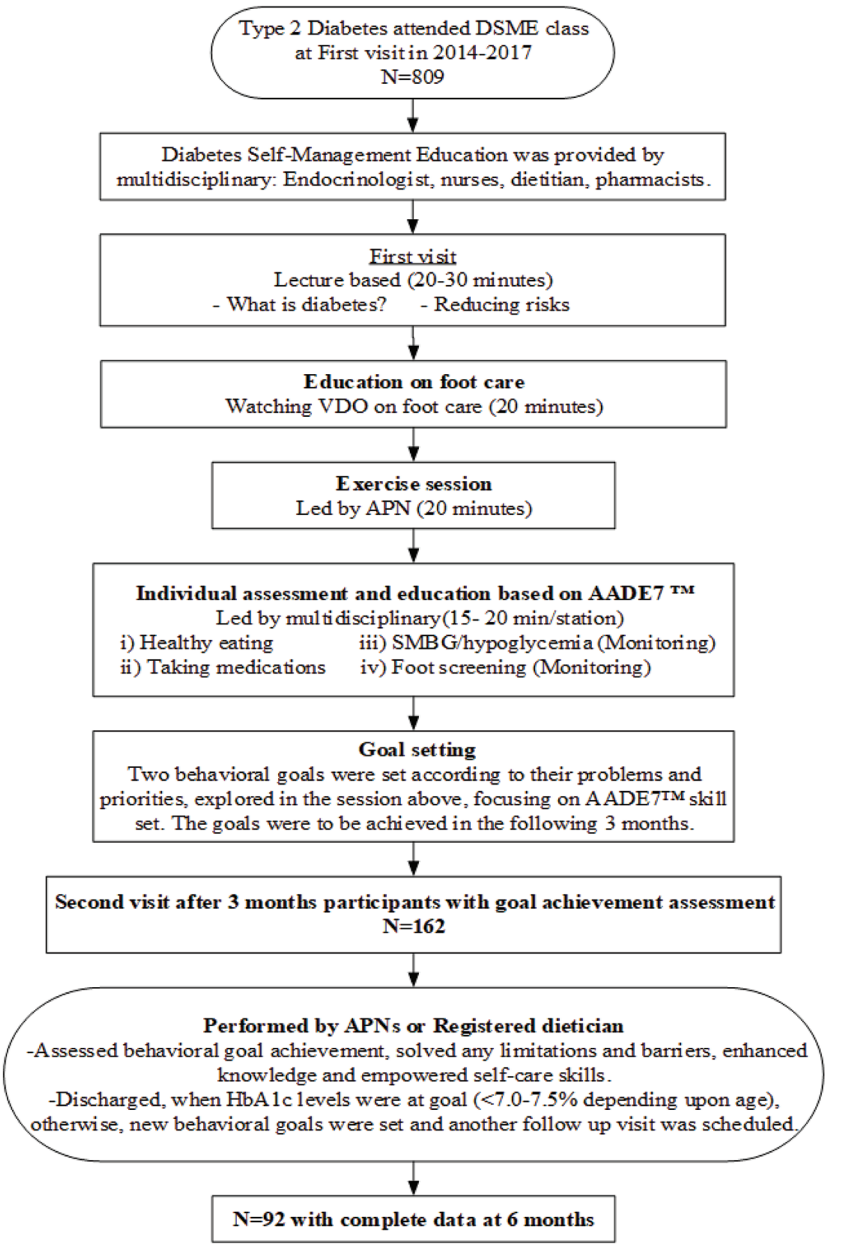

Figure 1. Diabetes-Self Management Education and Support Program.

using the score of 1-10, with 10 being most confident. Educators then discussed any obstacles perceived to reduce the patients' confidence and alternatives to overcome these obstacles. In general, the goals were to be achieved in the following three months.

The second visit lasted approximately 30 minutes. After three months, generally coinciding with the participants' follow-up visits with their physicians, they came back for a follow-up with the DSMES program. The purpose of this visit, performed by APNs or registered dieticians, was to assess the behavioral goal achievement, solving limitations, and barriers that may arise, and enhance knowledge and self-care skills. Participants were considered to successfully achieve behavioral goals if they could accomplish one of the goals set in the first visit. If HbA1c levels were at goal of less than 7.0% to 7.5% depending upon age, then, they were discharged from the program and continue to follow-up with their physicians. Otherwise, new behavioral goals were set,

and another follow-up visit was scheduled.

Data collection and outcome measures: Data were obtained from the Ramathibodi's Diabetes Self-Management Education record form, which was routinely used in the DSMES program. Demographic information included gender, body mass index (BMI, kg/m^2) educational levels with more than high school or high school or less, and marital status as married or others, were collected. Diabetes related variables included diabetes duration, insulin use as yes or no, performing SMBG as yes or no, and self-reported hypoglycemia as yes or no. Participants' ability to achieve behavioral goal was collected from the second visit. Participants were included if they had complete data on the above variables at six months, with exception of the SMBG data. Other variables also collected and considered were estimated glomerular filtration rate (eGFR) as mL/minute/1.73 m^2, self-reported exercising at baseline as yes or no, current smoking as yes or no, history of hypertension as yes or no, history of retinopathy as yes or no, and history of cardiovascular disease or stroke as yes or no. HbA1c levels, at the program start or within the last year and six months after the first visit were collected from medical records. HbA1c assays at Ramathibodi Hospital were performed using the Turbidimetric inhibition immunoassay method, which has been certified by the National Glycohemoglobin Standardization Program (NGSP). Adequate glycemic control, as HbA1c achievement at 6-months, was defined as having HbA1c of less than 7% in participants younger than 65 years, and less than 7.5% in those of 65 years or older.

Table 1. Characteristics of the participants (n=92)

Characteristics of the participants	Results; n (%)
Demographics	
Age (years); mean±SD	60.7±10.9
Female	46.0 (50.0)
BMI (kg/m^2); mean±SD	27.88±5.27
Education	
• High school or less	40 (43.7)
• More than high school	52 (56.3)
Married	66.0 (71.7)
Reported exercising at baseline (n=91)	56 (61.5)
Current smoker (n=87)	3 (3.44)
History of hypertension	58 (63)
Diabetes characteristics	
Diabetes duration (years); mean±SD	9.1±9.5
HbA1c at baseline (%); mean±SD	8.13±.87
eGFR (mL/minute/1.73 m^2) (n=81); mean±SD	80.18±31.43
Insulin use	47.0 (51.1)
Reported experiencing hypoglycemia	39.0 (42.4)
History of retinopathy (n=80)	28 (35.0)
History of cardiovascular disease or stroke (n=89)	11 (13.41)
Characteristics at follow-up visits	
Behavioral goal achievement at 3 months	76.0 (82.6)
HbA1c levels at 3 months (n=83); mean±SD	7.21±0.95
HbA1c levels at 6 months (all participants); mean±SD	7.12±1.02
HbA1c achievement at 6 months	52 (56.5)
• Age <65 (n=59): HbA1c <7%	30 (50.8)
• Age ≥65 (n=33): HbA1c <7.5%	22 (66.7)

BMI=body mass index; SD=standard deviation

Performing SMBG data were calculated from 74 (80.4%) participants

Statistical analysis

Data were presented as mean and standard deviation (SD) or frequency (%). Simple logistic regression analyses were performed to explore associations between demographic and diabetic characteristics with HbA1c achievement at six months. Independent predictors of HbA1c achievement at six months were determined by logistic regression analysis, with variables that had p-values less than 0.05 from simple regression analyses being entered into the final analysis. The analyses were performed by IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). The p-values of less than 0.05 were considered statistically significant.

Results

Eight hundred nine patients completed the first visit, of these, 162 completed the second visit with assessments of goal achievement, and 92 had complete data at 6-months (Figure 1). Table 1 shows the characteristics of these participants (n=92). Mean (SD) age was 60.7 (10.9) years, and 50% were female. Average diabetes duration was 9.1 years and 51.1% were using insulin. Of the participants, 63% reported as having hypertension, 13.41% had a history of cardiovascular disease or stroke, and 35% having retinopathy. At the 3-month visit, 82.6% of the participants stated that they achieved at least one of the behavioral goals set during the first visit. At 6-months, 56.5% of the participants had achieved their HbA1c goals.

Table 2 shows the logistic regression analysis. In the univariate analyses, being older (odds ratio [OR] 1.055, 95% confidence interval [CI] 1.011 to 1.100, p=0.013), and ability to achieve behavioral goal at

Table 2. Logistic regression analysis predicting HbA1c achievement at 6 months

Variables	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age	1.055 (1.011 to 1.100)	0.013	1.043 (0.997 to 1.090)	0.065
Female	0.838 (0.367 to 1.912)	0.674	-	-
Education, more than high school	1.021 (0.345 to 2.141)	0.962	-	-
Married	1.163 (0.467 to 2.897)	0.745	-	-
Diabetes duration	1.004 (0.961 to 1.049)	0.857	-	-
Baseline HbA1c	0.678 (0.511 to 0.899)	0.007	0.727 (0.540 to 0.979)	0.036
Performing SMBG	0.650 (0.240 to 1.759)	0.396	-	-
Insulin use	0.365 (0.155 to 0.857)	0.021	0.536 (0.205 to 1.399)	0.203
Hypoglycemia	0.992 (0.431 to 2.285)	0.985	-	-
Behavioral goal achievement at 3 months	3.566 (1.124 to 11.306)	0.031	3.473 (1.005 to 12.00)	0.049

OR=odds ratio; CI=confidence interval

3-months (p=0.031) were significantly associated with HbA1c goal at 6-months, while those using insulin were less likely to achieve HbA1c goal (p=0.021). In addition, those with higher baseline HbA1c were also less likely to achieve glycemic goal (p=0.007). Other variables, including BMI, eGFR, smoking status, exercise, history of hypertension, retinopathy, or cardiovascular disease or stroke, were not significantly associated with adequate glycemic control (p-values all >0.05). Multiple regression analysis adjusting for age, baseline HbA1c, and insulin use revealed that the ability to achieve behavioral goals at 3-months was independently associated with HbA1c achievement at 6-months (OR 3.473, 95% CI 1.005 to 12.001), while higher baseline HbA1c was associated with a lower likelihood of achieving adequate glycemic control (OR 0.727, 95% CI 0.540 to 0.979).

Discussion

The present study aimed to explore the predictor of adequate glycemic control in patients with diabetes that participated in the DSMES program. The authors found that, ability to achieve at least one of the behavioral goals mutually set during the education process was associated with a 3.4-fold increase in the likelihood of achieving a goal HbA1c at 6-month follow-up, after adjusting for multiple covariates. As expected, patients with higher baseline HbA1c levels were less likely to achieve the glycemic goal. These results support the importance of behavioral changes as a pathway to improve metabolic control in patients with diabetes.

The authors believe that the key strategies used in goal setting was a significant contributor to the success of the patients. A previous study showed that the effective goal setting that emphasized on being specific, measurable, achievable, and time-specific (SMART) based on individual 'needs was relevant to the high rate of goal achievement[13]. The National Standards for Diabetes Self-Management Education suggested that goal setting was one of the important process besides the assessment, education, and evaluation or monitoring of the participants in the DSMES program[14]. Goal setting is defined by the AADE as the measurable terms that are related to behavioral objectives and should be mutually accepted between healthcare professional and persons with diabetes[15]. Furthermore, the concept of goal written agreement that includes action planning should be collaboratively established among patients and educators. The action plan should incorporate the 5 Ws and 1 H as who, what, when, where, why and how to make this concrete and easy to follow[16]. Study by Trevisan et al, described that the component of action planning as when, where, how to, is effective in improving behavioral adherence towards goal achievement, which in this case is medication use. The researchers helped participants create individualized specific action plan according to their lifestyle and daily routine, which was followed for 15 weeks. The study showed a 0.5% reduction in HbA1c level[17]. These data support the importance of behavioral goal setting utilizing specific strategies as a part of DSMES.

In addition to the SMART goal setting, supporting patient's autonomy and enhance their self-efficacy also improved glycemic outcomes. Self-efficacy refers to the belief in one's capabilities to take courses of action to achieve their goals in particular situations[18]. A previous study stated that self-efficacy had an indirect effect on glycemic

control through diabetes self-management[19]. The study by Wichit et al showed the improvement of self-efficacy, self-management, and quality of life when diabetes patients received support from their family and healthcare teams[20]. Study by William et al found that higher scores of patient's autonomy support were positively associated with the patients' perceived competency and negatively associated with depression and glycemic level[21]. Similarly, the study by Lee et al found higher level of self-care behavior correlated with higher self-efficacy ($r=0.833$, $p<0.001$) and better glycemic control[22]. Although the authors did not comprehensively evaluate self-care behavior or self-efficacy at a follow-up visit in the present study, choosing mutually-agreed behavioral goals likely supported the patient's autonomy in their diabetes self-care, contributing to glycemic improvement.

In the present study, participants using insulin were less likely to achieve adequate glycemic control, reflecting on the more severe diabetes. Insulin use, however, was not an independent predictor of HbA1c achievement at 6-months after adjusting for other variables. Older age was borderline associated with good glycemic control. This is in agreement with a previous systemic review by Abrahim[23] in which 10 out of 11 studies found a positive correlation between self-care and age. Similarly, a study by Munir et al found that older participants, aged 50 to 69 years, had higher scores in carrying out of self-management behaviors and adhere more to healthy foods, medications, and exercise than younger participants[24]. While the present study has strengths in exploring the importance of behavioral changes in improving glycemic control in a real-life practice, there are several limitations. There was a significant number of participants whose data were missing. In comparing these two groups, their baseline HbA1c levels were not different (8.35% versus 8.13%, $p=0.319$). In addition, age, diabetes duration, educational and marital status, insulin use, and hypoglycemia reporting were not different. However, compared to the excluded participants, those included in the analyses were more likely to be male ($p=0.045$), performing home SMBG ($p=0.015$), and had lower HbA1c levels at 6-months (7.12% versus 7.65%, $p<0.001$). This suggested that the included participants might have been more compliant and health-conscious than those who were excluded, thus the results may not be generalizable to all patients with diabetes. There could be other factors contributing to the glycemic control that were not considered, such as psychological factors such as anxiety or depression[25]. As the present study was retrospective and data were obtained from routine clinical practice, sample size calculation was not performed beforehand. However, using the data from a previous study comparing structural diabetes education to usual care[26] a sample size of 90 participants yielded a power of 65% (two side, $\alpha=0.05$)[27]. To increase power to 80%, a sample size of 127 would be required. Thus, the present study is limited by the number of participants and a larger study should be performed to reproduce the results. Behavioral changes were self-reported and not objectively measured. As a result, the program currently implements telehealth program in follow-up sessions to improve access to care and enhance a follow-up process. DSMES via Telehealth by diabetes educators and dietitians has been shown to significantly reduce HbA1c levels in a rural population[28]. The effectiveness and acceptability of this program will be evaluated soon.

In conclusion, behavioral goal achievement was an independent predictor of adequate glycemic control in participants of DSMES programs. Along providing knowledge and empowering self-care skills to improve self-efficacy and competencies, adherence to behavioral changes can improve clinical outcomes. Goal setting skills should be adopted by diabetes educators and incorporated as a key part of the DSMES process.

What is already known on this topic?

DSMES is known to improve glycemic control. However, not all participants in the program could attain such results. This study aimed to explore the predictors of achieving adequate glycemic control after attending a DSMES program.

What this study adds?

This study found that the ability to achieve behavioral goals, which were mutually set between participants and diabetes educators, was an independent predictor of adequate glycemic control after attending a DSMES program. Behavioral goal setting should be incorporated in the DSMES programs.

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Conflicts of interest

The authors declare no conflict of interest.

References

1. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, et al. IDF diabetes atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract 2018;138:271-81.
2. Aekplakorn W, Chariyalertsak S, Kessomboon P, Sangthong R, Inthawong R, Putwatana P, et al. Prevalence and management of diabetes and metabolic risk factors in Thai adults: the Thai National Health Examination Survey IV, 2009. Diabetes Care 2011;34:1980-5.
3. Aekplakorn W, Phakcharoen H, Thaikla K, Satheannoppakao W. Report of the survey of Thai population health by physical examination No. 5, 2014 [Internet]. Nonthaburi: Health System Research Institute; 2016 [cited 2020 Jan 6]. Available from: https://kb.hsri.or.th/dspace/handle/11228/4626?show=full&locale-attribute=en.
4. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. Lancet 1998;352:837-53.
5. Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, Fischl AH, et al. Diabetes self-management education and support in type 2 diabetes: A joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. J Acad Nutr Diet 2015;115:1323-34.
6. Mensing C, Boucher J, Cypress M, Weinger K, Mulcahy K, Barta P, et al. National standards for diabetes self-management education. Task Force to Review and Revise the National Standards for Diabetes Self-Management Education Programs. Diabetes Care 2000;23:682-9.
7. Burke SD, Vannice A. Diabetes self-management education: The art and science of disease management. In: Mensing C, McLaughlin S, Halstenson C, editors. The art and science of diabetes self-management education desk reference. 2nd ed. Chicago, IL: American Association of Diabetes Educators; 2011. p. 3-15.
8. Dao-Tran TH, Anderson D, Chang A, Seib C, Hurst C. Factors associated with self-management among Vietnamese adults with type 2 diabetes. Nurs Open 2018;5:507-16.
9. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: A systematic review of the effect on glycemic control. Patient Educ Couns 2016;99:926-43.
10. Preechasuk L, Sriussadaporn P, Likitmaskul S. The obstacles to diabetes self-management education and support from healthcare professionals' perspectives: a nationwide survey. Diabetes Metab Syndr Obes 2019;12:717-27.
11. Tachanivate, P, Phraewphiphat, R, Tanasanitkul, H, Jinnawaso, R, Areevut, C, Rattanasila, R, et al. Effectiveness of diabetes self-management education in Thais with type 2 diabetes. Pac Rim Int J Nurs Res 2019;23:74-86.
12. DeCoste K, Maurer L. The diabetes self- management education process. In: Mensing C, McLaughlin S, Halstenson C, editors. The art and science of diabetes self-management education desk reference. 2nd ed. Chicago, IL: American Association of Diabetes Educators; 2011. p. 21-69.
13. Adiseshiah M. Effective care of patients with type 2 diabetes and dyslipidemia: a nurse's perspective. Diabetes Res Clin Pract 2005;68 Suppl 2:S23-7.
14. Funnell MM, Brown TL, Childs BP, Haas LB, Hosey GM, Jensen B, et al. National standards for diabetes self-management education. Diabetes Care 2009;32 Suppl 1:S87-94.
15. American Association of Diabetes Educators. AADE Guidelines for the practice of diabetes self-management education and training (DSME/T). Diabetes Educ 2009;35(3 Suppl):85S-107S.
16. Gollwitzer PM. Goal achievement: The role of intentions. Eur Rev Soc Psychol 1993;4:141-85.
17. Trevisan DD, São-João T, Cornélio M, Jannuzzi F, de Sousa MR, Rodrigues R, et al. Effect of an 'implementation intention' intervention on adherence to oral anti-diabetic medication in Brazilians with type 2 diabetes. Patient Educ Couns 2020;103:582-8.
18. Bandura A. Exercise of personal and collective efficacy in changing societies. In: Bandura A, editor. Self-efficacy in changing societies. Vol.1. Cambridge, NY: University Press; 1995. p. 1-45.
19. Lin K, Park C, Li M, Wang X, Li X, Li W, et al. Effects of depression, diabetes distress, diabetes self-efficacy, and diabetes self-management on glycemic control among Chinese population with type 2 diabetes mellitus. Diabetes Res Clin Pract 2017;131:179-86.
20. Wichit N, Mnatzaganian G, Courtney M, Schulz P, Johnson M. Randomized controlled trial of a family-oriented self-management program to improve self-efficacy, glycemic control and quality of life among Thai individuals with type 2 diabetes. Diabetes Res Clin Pract 2017;123:37-48.
21. Williams GC, McGregor HA, King D, Nelson CC, Glasgow RE. Variation in perceived competence, glycemic control, and patient satisfaction: relationship to autonomy support from physicians. Patient Educ Couns 2005;57:39-45.
22. Lee SK, Shin DH, Kim YH, Lee KS. Effect of diabetes education through pattern management on self-care and self-efficacy in patients with type 2 diabetes. Int J Environ Res Public Health 2019;16:3323.

23. Abrahim M. Self-care in type 2 diabetes: A systematic literature review on factors contributing to self-care among type 2 diabetes mellitus patients [thesis]. Växjö, Sweden: Linnaeus University; 2011.
24. Munir F, Khan HT, Yarker J, Haslam C, Long H, Bains M, et al. Self-management of health-behaviors among older and younger workers with chronic illness. Patient Educ Couns 2009;77:109-15.
25. Thaneerat, T, Tangwongchai, S, Worakul, P. Prevalence of depression, hemoglobin A1C level, and associated factors in outpatients with type-2 diabetes. Asian Biomed (Res Rev News) 2010;3:383-90.
26. Yang YS, Wu YC, Lu YL, Kornelius E, Lin YT, Chen YJ, et al. Adherence to self-care behavior and glycemic effects using structured education. J Diabetes Investig 2015;6:662-9.
27. Demidenko E. Sample size and optimal design for logistic regression with binary interaction. Stat Med 2008;27:36-46.
28. Davis RM, Hitch AD, Salaam MM, Herman WH, Zimmer-Galler IE, Mayer-Davis EJ. TeleHealth improves diabetes self-management in an underserved community: diabetes TeleCare. Diabetes Care 2010;33:1712-7.