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RESEARCH ARTICLE

Development of a Care Model for Patients with Uncontrolled Diabetes Mellitus at Ban Uthaiwan Subdistrict Health Promoting Hospital, Lak Lueam Subdistrict, Namon District, Kalasin Province

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Abstract

This research and development study aimed to 1) explore the situation and problems in caring for patients with uncontrolled diabetes mellitus, 2) develop a care model, and 3) evaluate the model at Ban Uthaiwan Subdistrict Health Promoting Hospital, Namon District, Kalasin Province, from October 2024 to September 2025. Phase 1 involved 45 purposively selected key informants. Phase 3 was a quasi-experimental two-group pretest-posttest study of patients with type 2 diabetes and HbA1c ≥ 7%, with 30 patients each in the experimental and comparison groups. Instruments were the care model, interview guides, a self-management behavior questionnaire, and a laboratory record form. Data were analyzed using content analysis, descriptive statistics, paired t test, independent t test, and chi-square test.

Of 186 registered patients, 63.44% (118) had uncontrolled diabetes; key problems were high consumption of glutinous rice and fruits, incorrect medication use, and missed appointments. The model had six steps: assessment and shared goal setting, goal review, education and self-management support, follow-up by home ward and telemedicine, barrier evaluation, and continuous follow-up by community partners. After the intervention, the experimental group had higher self-management scores (difference 14.43, 95% CI 11.45-17.41, $p < .001$) and lower HbA1c (difference -1.03, 95% CI -1.57 to -0.49, $p < .001$) than the comparison group. The proportions achieving HbA1c < 7% were 36.67% and 10.00% ($\chi^2 = 5.96$, $p = .015$). The model was associated with better behavior and HbA1c.

Keywords: type 2 diabetes mellitus, uncontrolled blood glucose, self-management

Nexus of Thai Health Sciences
Vol. 1 No. 1 January – February 2026

Introduction

Diabetes mellitus is a chronic non-communicable disease and a major public health problem worldwide. The International Diabetes Federation (IDF) reported that in 2024, 589 million adults aged 20-79 years, or about 1 in 9, were living with diabetes, and that the number is projected to rise to 853 million by 2050; diabetes causes more than 3.4 million deaths each year. In Thailand, there are approximately 6.36 million adults with diabetes.[1] The diabetes mortality rate has been rising, at 21.25, 22.68, and 24.43 per 100,000 population in 2021-2023, respectively, and the morbidity rate increased from 1,392.98 to 1,563.02 and 1,692.43 per 100,000 population, respectively.[2] Controlling blood glucose through proper self-care reduces disease severity and complications such as chronic kidney failure, stroke, blindness, coronary artery disease, and peripheral neuropathy, thereby helping to prevent disability, reduce mortality, and lessen the economic burden on the health system.[3]

In Kalasin Province, approximately 60,000 patients with diabetes were registered for treatment in fiscal year 2024, and only 25-30% had good glycemic control (the Health Data Center [HDC] indicator for good glycemic control uses the same definition as the Namon District data below), which is lower than the Ministry of Public Health target of 40%.[4] In Namon District, the incidence of new diabetes cases in fiscal years 2022-2024 was 211.18, 228.92, and 246.10 per 100,000 population, respectively, rising every year, while the proportion of patients with good glycemic control was only 13.42%, 14.61%, and 10.93%, respectively. Patients also experienced acute complications from hypoglycemia or hyperglycemia, as well as chronic complications, including stroke, coronary artery disease, diabetic retinopathy, chronic kidney disease, and chronic foot ulcers.[5] In the catchment area of Ban Uthaiwan Subdistrict Health Promoting Hospital (SHPH), 186 patients with diabetes were registered, of whom 118 (63.44%) had uncontrolled glucose (HbA1c ≥ 7%). A preliminary analysis found that some patients could not control their diet, particularly eating large amounts of glutinous rice and seasonal fruits; took medication or injected insulin incorrectly; forgot to take medication; adjusted their doses on their own; missed appointments; and stopped taking medication.

Effective diabetes control requires health behavior modification, namely dietary control, exercise, emotional management, and correct medication use, with the goals of an HbA1c of 7% or less and a pre-meal or fasting plasma glucose of 80-130 mg/dL.[3] Orem's self-care concept explains that self-care is a deliberate, goal-directed action that can be developed through learning, teaching, and supervision.[6] Factors affecting glycemic control include personal factors (age, sex, health status, duration of illness, and experience) and external factors (lifestyle, food culture, and family economic status), as well as the health service system and support from family, neighbors, and health personnel.[7] In addition, depression among patients with diabetes affects self-care,[8] and the capacity of community caregivers plays an important role in

the care of patients with chronic diseases.[9] Although the Ministry of Public Health has guidelines for operating quality chronic non-communicable disease clinics,[10] most previous studies were conducted in district hospitals or higher-level facilities. Care models for patients with uncontrolled glucose at the SHPH level that integrate self-management, follow-up visits through a Home ward and Telemedicine system, and community network partners, within the Northeastern Thai context of glutinous rice and seasonal fruit consumption, remain limited.

Given these problems and their importance, the author was interested in developing a care model for patients with uncontrolled diabetes mellitus in the catchment area of Ban Uthaiwan SHPH, Lak Lueam Subdistrict, Namon District, Kalasin Province, by applying self-care and behavior modification concepts together with the participation of a multidisciplinary team, network partners, and the community, so that patients can care for themselves to achieve glycemic control, reduce complications, and have a good quality of life. The findings are intended to provide a guide that staff and network partners can implement easily and conveniently under a single standard, and that can be scaled up to other SHPHs with similar contexts.

Research Objectives

1. To study the situation and problems in the care of patients with uncontrolled diabetes mellitus in the catchment area of Ban Uthaiwan SHPH, Lak Lueam Subdistrict, Namon District, Kalasin Province
2. To develop a care model for patients with uncontrolled diabetes mellitus in the catchment area of Ban Uthaiwan SHPH, Lak Lueam Subdistrict, Namon District, Kalasin Province
3. To evaluate the outcomes of using the care model for patients with uncontrolled diabetes mellitus in the catchment area of Ban Uthaiwan SHPH, Lak Lueam Subdistrict, Namon District, Kalasin Province

Methods

This study used a research and development (R&D) design and was conducted in the catchment area of Ban Uthaiwan SHPH, Lak Lueam Subdistrict, Namon District, Kalasin Province, from October 2024 to September 2025. It was divided into three phases: Phase 1, preparation (October-December 2024), studying the context and analyzing problems; Phase 2, implementation (January-March 2025), developing the model and preparing practitioners; and Phase 3, evaluation (April-September 2025), piloting and evaluating the model using quasi-experimental research with a two-group pretest-posttest design, without randomization between areas and without blinding. The program lasted 12 weeks (April-June 2025), and July-September 2025 was devoted to data analysis, summarizing results, and returning the findings to the area. The details are as follows:

Population

Phases 1-2 comprised patients with diabetes, family caregivers, public health personnel, the multidisciplinary team of Namon

Hospital, and village health volunteers (VHVs) in the area. Phase 3 comprised 118 patients with type 2 diabetes registered for treatment at Ban Uthaiwan SHPH whose glucose was uncontrolled (HbA1c ≥ 7%), and approximately 110 patients with type 2 diabetes and uncontrolled glucose at the comparison SHPH.

Sample

Phases 1-2: The 45 key informants comprised 20 patients with diabetes, 10 family caregivers, 5 public health personnel and multidisciplinary team members, and 10 VHVs, selected by purposive sampling. Phase 3: The sample size was calculated using G*Power[11] with an effect size of 0.80, a significance level of .05, and power of .80, yielding 26 per group; adding 15% to allow for attrition gave 30 per group (26 × 1.15 = 29.90), for a total of 60 (two-tailed test; the primary outcome was post-intervention HbA1c, with the effect size defined from a clinically important between-group difference in HbA1c of approximately 1%, which is associated with a reduced risk of microvascular complications,[12] and a standard deviation of HbA1c of 1.21 from patients in the area in Phase 1, giving d = 1.00/1.21 = 0.83, so a conservative value of 0.80 was set). The experimental group was selected from patients at Ban Uthaiwan SHPH by simple random sampling, drawing lots from a list of 82 eligible patients, of whom 30 were selected (52 were not selected). The comparison group was selected from Non Sri Sawat SHPH in Namon District, which has a similar context, and was matched by sex, age (± 5 years), and HbA1c level (a difference of no more than 0.5%).

Inclusion Criteria

1) Type 2 diabetes, aged 35-75 years (to reduce the risk of hypoglycemia in very old adults and to enable participation in the activities), diagnosed at least 1 year earlier; 2) most recent HbA1c between 7.0% and 12.0%; 3) able to communicate in Thai and without dementia; 4) having a contactable telephone (own or a relative's); and 5) willing to participate in the study

Exclusion Criteria

1) Severe complications requiring hospital treatment, such as stage 4-5 chronic kidney disease, and 2) pregnancy. The discontinuation criteria were moving out of the area, withdrawing during the study, or attending fewer than 80% of the activities. Data were analyzed by intention-to-treat, and no participants discontinued.

Research Instruments

The instruments comprised 1) the experimental instruments, namely the six-step care model for patients with uncontrolled diabetes, a care practice manual for staff and network partners, and a patient self-management logbook; and 2) the data collection instruments, namely in-depth interview and focus group guides, a general information questionnaire, a 20-item self-management behavior questionnaire with a 4-point rating scale (maximum score 80), a record form for HbA1c and fasting blood sugar (FBS), a 15-item satisfaction questionnaire with a 5-point rating scale completed by patients in the experimental group, and a 15-item knowledge test on glycemic control for patients (true/false;

passing criterion 80%) with a KR-20 of 0.78. Content validity was verified by three experts, yielding an IOC of 0.67-1.00, and the instruments were piloted with 30 patients with characteristics similar to the sample, yielding Cronbach's alpha coefficients of 0.85 for the self-management behavior questionnaire and 0.89 for the satisfaction questionnaire.

Data Collection

In Phase 1, data were reviewed from the Health Data Center (HDC) database, with observation, in-depth interviews, and focus group discussions. In Phase 2, workshops were held with the multidisciplinary team of Namon Hospital, network partners, and the community to design the model, prepare the manual, and assess its congruence, appropriateness, and feasibility. In Phase 3, the researcher and research assistants collected self-management behavior and HbA1c data in both groups before the intervention (week 1) and after the intervention (week 12). The comparison group received the usual care of the chronic non-communicable disease clinic. The data collectors were the researcher and research assistants, who knew each patient's group allocation (unblinded).

Data Analysis

Qualitative data were analyzed using content analysis. Quantitative data were analyzed using descriptive statistics, namely frequency, percentage, mean, and standard deviation. Mean scores within groups were compared using the paired t test, mean scores between groups were compared using the independent t test, and the proportions of patients achieving HbA1c control were compared using the chi-square test. Statistical significance was set at .05, two-tailed. Normality was checked with the Shapiro-Wilk test (if the data were not normal, the Wilcoxon signed-rank test and the Mann-Whitney U test were used). The primary outcome was post-intervention HbA1c. Data were analyzed using SPSS for Windows version 26.

Research Ethics

This study adhered to the principles of research ethics for human participants. The author explained the objectives, procedures, and benefits of the study to participants, who gave written informed consent. Data were kept confidential and presented in aggregate. Participants could withdraw at any time without any effect on their treatment, and the comparison group would receive the manual and care according to the model after the study ended.

Results

1. Situation and problems in the care of patients with uncontrolled diabetes mellitus

1.1 General information The key informants in Phase 1 numbered 45. There were 186 patients with diabetes registered at Ban Uthaiwan SHPH, of whom 118 (63.44%) had uncontrolled glucose. The general information of the 118 patients with uncontrolled glucose (separate from the 45 key informants) showed that most were female, 81 (68.64%), with a mean age of 61.25 years (S.D. = 8.73), a mean duration of diabetes of 8.42 years (S.D. = 4.16), and a mean

HbA1c of 8.86% (S.D. = 1.21). Of these patients, 22.03% received insulin injections.

1.2 Problems in patient care Problems were found in three areas: 1) Patients: some patients could not control their diet, particularly eating large amounts of glutinous rice and seasonal fruits; took medication and injected insulin incorrectly; forgot to take medication; adjusted their doses on their own; missed appointments; and stopped taking medication. 2) Family and community: the culture of sharing meals from a common tray within the family without separating food for the patient, and economic constraints on food choices. 3) Health service system: the lack of a unified standard of practice, incomplete coverage of continuous home follow-up, and limited participation by community network partners in patient care.

2. Results of developing the care model for patients with uncontrolled diabetes mellitus

2.1 Components of the model The model, developed through workshops with the multidisciplinary team of Namon Hospital, SHPH staff, network partners, and the community, comprises a six-step process: 1) assessing readiness, behaviors, and health status and jointly setting blood glucose control goals; 2) reviewing self-management goals, with patients choosing what they want to change; 3) providing education and self-management support; 4) follow-up visits through the Home ward and Telemedicine system; 5) assessing barriers to self-management; and 6) continuous follow-up of self-management by community network partners. Experts rated the appropriateness of the model at the highest level ($\bar{x}$ = 4.56, S.D. = 0.42; five experts; interpretation criteria: 4.51-5.00 = highest), as shown in Table 1 and Figure 1.

Nexus of Thai Health Sciences
Vol. 1 No. 1 January – February 2026

Table 1 Activities according to the care model for patients with uncontrolled diabetes mellitus, Ban Uthaiwan SHPH (**12-**week program)

Week	Activities/content	Tools used	Duration	Academic rationale
1	Step 1 Assess readiness, behaviors, and health status (HbA1c, FBS, BMI) and jointly set blood glucose control goals	Self-management behavior questionnaire; self-management logbook	60 minutes	Orem's self-care concept; shared goal setting
2	Step 2 Review goals; patients choose the behaviors they wish to change (diet, medication, exercise, emotions)	Individual self-management planning form	45 minutes	Self-management
3-4	Step 3 Education and skills training: portions of glutinous rice and seasonal fruits, taking medication and injecting insulin, exercise, stress management	Diabetes care manual; food models; demonstration insulin pen	90 minutes/session	Clinical practice guideline for diabetes
5-10	Step 4 Follow-up visits through the Home ward and Telemedicine system with VHVs every 2 weeks	LINE application; fingertip glucose meter; home visit record form	30 minutes/session	Continuity of care in the community
11	Step 5 Assess barriers to self-management and adjust individual plans	Barrier record form	45 minutes	Reflection and problem solving
12	Step 6 Continued follow-up by community network partners (VHVs, relatives, community leaders) and post-intervention evaluation	Behavior questionnaire; HbA1c results; satisfaction questionnaire	60 minutes	Social support and community participation

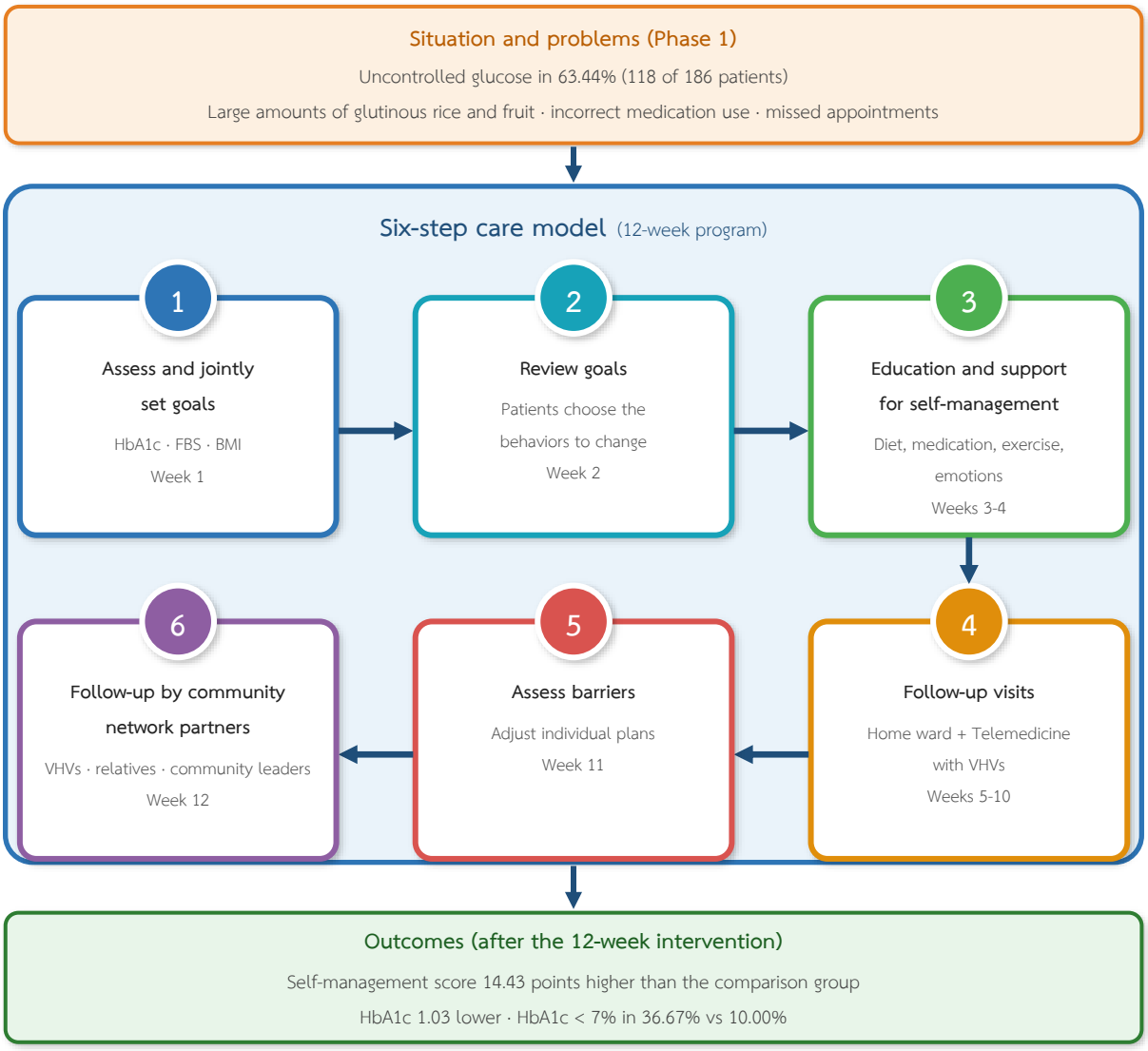


Figure 1 Care model for patients with uncontrolled diabetes mellitus, Ban Uthaiwan SHPH (six steps)

2.2 Implementation of the model A policy on the care of patients with uncontrolled diabetes was established; workshops were held to explain the model and prepare practitioners; the model was demonstrated; a flowchart of the procedures was posted; and patients and relatives were informed. Of the 5 trained staff and 20 VHVs, those whose knowledge and understanding of patient care met the criterion numbered 5 of 5 (100.00%) and 17 of 20 (85.00%), respectively (assessed with a 20-item diabetes care knowledge test; passing criterion 80%, or a score of 16 or higher).

3. Results of evaluating the use of the care model for patients with uncontrolled diabetes mellitus

3.1 Within-group comparison After the intervention, the mean self-management behavior score of the experimental group increased from 48.27 (S.D. = 6.12) to 63.53 (S.D. = 5.48) (mean difference 15.26, 95% CI 12.87-17.65, $t(29) = 13.06$, $p < .001$), and the mean HbA1c decreased from 8.92% (S.D. = 1.14) to 7.68% (S.D.

Nexus of Thai Health Sciences
Vol. 1 No. 1 January – February 2026

= 0.96) (mean difference 1.24, 95% CI 0.93-1.55, t(29) = 8.18, p < .001). The comparison group showed only small changes (behavior p = .100; HbA1c p = .219), and the confidence intervals included zero, so no change could be concluded, as shown in Table 2.

Table 2 Comparison of mean self-management behavior scores and HbA1c before and after receiving the care model, by group (n = 30 per group)

Variable	Group	Before		After		Level	$\bar{d}$	95%CI	t	p-value
		$\bar{x}$	S.D.	$\bar{x}$	S.D.					
Self-management behavior (maximum score 80)	Experimental	48.27	6.12	63.53	5.48	-	15.26	12.87-17.65	13.06	<.001*
Self-management behavior (maximum score 80)	Comparison	47.83	6.35	49.10	6.02	-	1.27	-0.26 to 2.80	1.70	.100
HbA1c (%)	Experimental	8.92	1.14	7.68	0.96	-	-1.24	-1.55 to -0.93	-8.18	<.001*
HbA1c (%)	Comparison	8.85	1.08	8.71	1.12	-	-0.14	-0.37 to 0.09	-1.26	.219

*Statistically significant, p-value < .05

3.2 Between-group comparison Before the intervention, the two groups did not differ in mean self-management behavior score or HbA1c (p = .786 and .808). After the intervention, the experimental group had a higher mean self-management behavior score (difference 14.43, 95% CI 11.45-17.41, t(58) = 9.71, p < .001) and a lower mean HbA1c than the comparison group (difference -1.03, 95% CI -1.57 to -0.49, t(58) = -3.82, p < .001). Comparing the changes from before the intervention, the between-group difference was 13.99 for behavior (95% CI 11.21-16.77) and -1.10 for HbA1c (95% CI -1.48 to -0.72) (the S.D. of the change scores was back-calculated from the confidence intervals of the paired t test), as shown in Table 3.

Table 3 Comparison of mean self-management behavior scores and HbA1c between the experimental and comparison groups

Variable	Experimental group		Comparison group		Level	$\bar{d}$	95%CI	t	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.					
Self-management behavior, before (maximum score 80)	48.27	6.12	47.83	6.35	-	0.44	-2.78 to 3.66	0.27	.786
Self-management behavior, after (maximum score 80)	63.53	5.48	49.10	6.02	-	14.43	11.45-17.41	9.71	<.001*

Nexus of Thai Health Sciences
Vol. 1 No. 1 January – February 2026

Variable	Experimental group		Comparison group		Level	$\bar{d}$	95%CI	t	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.					
HbA1c, before (%)	8.92	1.14	8.85	1.08	-	0.07	-0.50 to 0.64	0.24	.808
HbA1c, after (%)	7.68	0.96	8.71	1.12	-	-1.03	-1.57 to -0.49	-3.82	<.001*
Self-management behavior, change	15.26	6.40	1.27	4.10	-	13.99	11.21-16.77	10.08	<.001*
HbA1c, change	-1.24	0.83	-0.14	0.62	-	-1.10	-1.48 to -0.72	-5.83	<.001*

*Statistically significant, p-value < .05

3.3 Glycemic control status After the intervention, 11 patients (36.67%) in the experimental group achieved an HbA1c below 7%, higher than the 3 patients (10.00%) in the comparison group (proportion difference 26.67 percentage points, 95% CI 6.35-46.98; $\chi^2(1) = 5.96$, p = .015; Fisher's exact p = .030), as shown in Table 4.

Table 4 Comparison of HbA1c control status after the intervention between the experimental and comparison groups

HbA1c control status	Experimental group n (%)	Comparison group n (%)	χ^2	p-value
Controlled (HbA1c < 7%)	11 (36.67)	3 (10.00)	5.96	.015
Uncontrolled (HbA1c ≥ 7%)	19 (63.33)	27 (90.00)		

3.4 Outcomes by success indicators In the experimental group, 25 patients (83.33%) passed the criterion for knowledge of glycemic control (assessed with the 15-item knowledge test; passing criterion 80%) (target 80%). Satisfaction with the model was at the highest level ($\bar{x}$ = 4.52, S.D. = 0.48), with 93.33% (28 of 30 experimental-group patients) satisfied at a high level or above (target 90%). No acute complications requiring hospital admission occurred in the experimental group (0 of 30; 95% CI 0-11.57). Hypoglycemia data were not collected, and no such data are available for the comparison group.

Discussion

The situation analysis found that most patients with diabetes in the area had uncontrolled glucose, which is consistent with Namon District data showing that only 10.93-14.61% of patients had good glycemic control.[5] The key problems arose from the consumption of glutinous rice and seasonal fruits, which is a way of life in Northeastern communities, together

with incorrect medication use, self-adjustment of medication, and missed appointments. This is consistent with previous studies finding that dietary behavior, medication use, and social support were associated with uncontrolled glycated hemoglobin.[7] In addition, the culture of sharing meals from a common tray within the family, economic constraints, and patients' psychological conditions[8] all make behavior change difficult, so a care model that takes account of the specific context of the area is necessary.

The developed model is appropriate because it was developed from the actual problems of the area, with the participation of the multidisciplinary team, SHPH staff, network partners, and the community, and it applied Orem's self-care concept, which aims to develop self-care ability through learning, teaching, and supervision.[6] The six-step process begins with assessment and shared goal setting, which lets patients choose the behaviors they wish to change themselves, thereby generating motivation and responsibility for self-management. Meanwhile, follow-up visits through the Home ward and Telemedicine system together with VHVs and family caregivers ensured continuity of care at home, which is consistent with the guidelines for operating quality chronic non-communicable disease clinics[10] and with developing the capacity of community caregivers of patients with chronic diseases.[9] These results are consistent with the development of an integrated, community-participation care model for patients with uncontrolled diabetes at Nong Phalan SHPH, in which HbA1c decreased after 3 months of activities,[13] and with a telenursing model for patients with type 2 diabetes, in which the experimental group had better health behaviors and lower HbA1c than the control group.[14]

After the model was used, the experimental group's self-management behavior scores increased and its HbA1c decreased, and both were better than in the comparison group. This may be explained by education aligned with local lifestyles, such as setting portions of glutinous rice and seasonal fruits and training in medication use and insulin injection, together with close follow-up and support from community network partners, which likely helped patients sustain their behaviors; this is associated with lower blood glucose approaching the targets in the clinical practice guidelines.[3] The mean HbA1c reduction in the experimental group of about 1.24% (a net effect of about 1.10 relative to the comparison group) may be clinically important for delaying microvascular complications, since each 1% reduction in HbA1c is associated with a 37% lower risk of microvascular complications.[12] However, the effect sizes for behavior (Cohen's d = 2.51) and HbA1c (d = 0.99) were rather large and may have been influenced by self-reporting, the lack of blinding, and differences between areas, so the results should be interpreted with caution.

The limitations of this study were as follows: it was unblinded and the data collector was the researcher; the behavior indicators were self-reported; medication adjustment and seasonality were not controlled; the follow-up period was rather short (12 weeks); the comparison group

came from a different area and was not randomized; and the sample was small and from a single area. In addition, the sample size was calculated with an effect size of 0.80, which is higher than the mean HbA1c difference in a systematic review of self-management education and support (0.76 percentage points, or d ≈ 0.63),[15] so the power would be about 67% if the true effect size were at that level. Therefore, caution is needed in generalizing the results to other populations.

Conclusion

Most patients with diabetes in the Ban Uthaiwan SHPH catchment area had uncontrolled glucose, owing to consumption behaviors typical of the Isan way of life, incorrect medication use, and a lack of continuous follow-up. The care model developed has six steps, emphasizing joint goal setting, self-management support, follow-up through the Home ward and Telemedicine system, and the participation of community network partners. Use of the model was associated with better self-management behavior and a lower HbA1c than in the comparison group, but causal conclusions cannot be drawn because this was a non-randomized, unblinded quasi-experimental study.

Recommendations

1. Recommendations for applying the findings: 1) SHPHs and the Namon District health service network should establish a policy and implement the model in chronic non-communicable disease clinics, adapting it to the context of each area; 2) the capacity of VHVs and family caregivers should be developed so that they can follow up patients continuously; and 3) equipment and communication systems for Telemedicine follow-up should be supported.

2. Recommendations for future research: 1) long-term follow-up of at least 6-12 months should be conducted to assess the sustainability of behavior and the occurrence of complications; 2) randomized controlled studies should be conducted in multiple areas; and 3) the costs and effectiveness of the model should be studied.

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AI Disclosure

The author used an artificial intelligence tool (Claude, Anthropic) to assist in searching for academic sources and references. The author personally verified the accuracy of every reference before using it. The data analysis, interpretation of results, and discussion are

entirely the author's own work. Artificial intelligence did not participate as a co-author.

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