A Community Health Volunteer Involvement Program for Glycated Hemoglobin Reduction Among Thai Patients With Uncontrolled Type 2 Diabetes: A Mixed-Method Study

Penchan Sittipreechachan[1], Panan Pichayapinyo[1] (ID)**, Sunee Lagampan[1], and Rewadee Chongsuwat[1]**

Abstract

Background: Diabetes mellitus is increasing and a shortage exists of nurses to care for patients. Community health volunteers (CHVs) pose potential supportive networks in assisting patients to perform healthy behaviors. **Aim:** The study aimed to develop and investigate the effects of a CHV involvement program on reducing glycated hemoglobin (HbA_{1c}) levels among Thai patients with uncontrolled type 2 diabetes. **Methods:** This sequential mixed-method study was conducted from January to June 2019. Sixty patients with HbA_{1c} exceeding 7% were recruited from 2 communities assigned as the intervention and comparison groups. Using King's General Systems Framework as a basis to develop the program, the study initially explored the perceptions of diabetes and its management among patients, family members, and CHVs. Then, a quasi-experimental study with 2 groups pretest-posttest design was conducted and compared with usual care. The intervention included educational sessions, home visits, and activities created by CHVs including a campaign, broadcasting, and health food shops. Quantitative data were collected at baseline and 20-week follow-up and analyzed by descriptive statistics, Independent *t*-test, and paired *t*-test. **Results:** The intervention group exhibited a lower mean HbA_{1c} ($p < .001$) and reported significant, improvement concerning diabetes knowledge, self-efficacy, perceived support, and behavior compared with the comparison group at the end of the study (Cohen's $d > 1.0$, effect size large). **Conclusion:** Applying this framework to develop the program could benefit glycemic control among patients with uncontrolled diabetes residing in communities. Further studies should be conducted on a large sample to demonstrate the efficacy of the program.

Keywords

community health volunteer, glycated hemoglobin, King's General Systems Framework, mixed-method, type 2 diabetes

Introduction

Type 2 diabetes mellitus (T2DM) incidence is rising worldwide and in Thailand. Lifestyle modification (healthy eating, regular physical activity, and medication adherence) is strongly recommended in this population.[1,2] Diabetes self-management education (DSME) is provided by health personnel (dietitians, health educators, and nurses) in individual- or group-based education with follow-up and widespread support.[3,4] Additionally, family support is used to promote lifestyle change sustainability.[5,6] Despite programs with such available support, Thai patients with uncontrolled T2DM continue to increase.[7]

For patients' health, 3 interaction systems (personal, interpersonal, and social systems) are crucial. In King's General Systems Framework, personal systems emphasize individual interaction with the environment, and interpersonal systems are formed by the interaction of 2 or more

[1]Mahidol University, Bangkok, Thailand

Corresponding Author:
Panan Pichayapinyo, Department of Public Health Nursing, Faculty of Public Health, Mahidol University, 420/1, Rajavithi Road, Rajathewi, Bangkok 10400, Thailand
Email: panan.pic@mahidol.ac.th

individuals; people with common interests and goals create social systems.[8] In the interaction process, nurse-patient transactions can be influential when nurses elicit, interpret, and share information with patients, while patients share perceptions, concerns, and problems with nurses, leading to mutually set goals, exploration, and agreements on desired outcomes. Importantly, transactions should be established considering differences among human beings, families, and communities.

In Thailand, only 1 to 2 nurses per primary care setting take care of 4000 people in the population. With a shortage of nurses to care for patients in communities, community health volunteers (CHVs), providing a potential support network in the social system, have been recognized as a key success factor assisting health care providers to deliver interventions under specific contexts in community populations.[9-11] Several studies support that interventions by CHVs could improve HbA_{1c} levels by creating reinforced environments to sustain behaviors.[12-14] Noticeably, most diabetes studies involve CHVs as nurse assistants in providing education in diabetes-specific management, monitoring blood glucose levels, and making home visits.[12,15-17] As CHVs are community members, they serve as key individuals indicating community resources to support healthy practices in populations, and in implementing community solutions. Limited studies have investigated CHV involvement in decision-making and implementation to facilitate lifestyle change in communities. Therefore, this study purpose was two-fold, to: (1) develop a program to reduce glycated hemoglobin among Thai patients with uncontrolled T2DM based on the perceptions and barriers of glycemic control among patients, family members, and CHVs, and (2) evaluate a program created by CHVs to determine whether the program could improve glycated hemoglobin (HbA_{1c}) among patients with uncontrolled T2DM.

Methods

The study was conducted from January to June 2019. A two-phase, sequential mixed-method study design was employed. Phase 1 involved the program development using a qualitative approach to explore the diabetes control program. Phase 2 involved program implementation and evaluation. Initially, we randomly selected 2 communities located in 2 different sub-districts in Bangkok in order to prevent the intervention contamination between groups, and then randomly assigned those communities to intervention and comparison groups. Intervention group participants were randomly invited for interviews in phase 1 and informed about the opportunity to participate in phase 2.

Phase One: Program Development

This phase comprised program development, based on findings from two-rounds of semi-structured interviews.

In Round 1, three-focus groups were held separately, and each interview took approximately 60 min. Two researchers analyzed and coded the content to gain understanding of experiences involving the disease and required lifestyle changes. The main questions for patients focused on perceptions of glycemic control and barriers to control: (1) What do you think about diabetes? and (2) What are barriers to glycemic control? Moreover, the main questions in the family group were, "What are barriers to patient support in controlling diabetes?" and, "How to help them?" Also, in the CHVs group, the researcher assessed their perceptions of disease prevention, and potential community resources. The main foci of interviews were: (1) What do you perceive about diabetes? and (2) What would you like to have in your community to support patients' glycemic control?

After finishing the first round, approximately 2 weeks, all key informants were invited to the Round 2 interview, which took approximately 120 min. They heard the summary of the findings from all interviews for validation.

Phase Two: Program Implementation and Evaluation

This phase constituted a two-armed, 20-week, quasi-experimental study with baseline and postintervention assessments. Participants were 35 years and older, had T2DM with HbA_{1c} at least 7%, and took oral hyperglycemic medication. The sample size was calculated using G* power analysis software, with power set at 0.8 and an effect size of 0.8 as shown in prior research,[18] resulting in 25 participants in each group. We anticipated 20% attrition of participants, so 30 subjects were allotted to each group.

At Week 1, the researcher conducted a 3-h educational session for CHVs. During the session, CHVs received diabetes-specific information on knowledge about complications, symptom management, preferred lifestyle changes, and communication practice for emotional support and negotiation techniques for sustainability. Then they launched a campaign of diabetes prevention with healthful food choices, physical activity, and means to adhere the medical regimen. Also, disease warning posters were posted in the community. Moreover, CHVs and food sellers met to discuss how to provide food choices including vegetables in daily menus.

At Weeks 2 and 9, the researcher provided a 3-h educational session for patients on problem-solving and complications, the plate method,[19] food exchange techniques,[20] and meal planning practice led by a nutritionist. An expert in successful glycemic control conducted a discussion session to address how to eat fewer carbohydrates, sweetened fruits, and soft drinks, while adding vegetable selections. At the session's end, the researcher negotiated with patients to set goals and design personal action plans using a booklet about healthy diet based on such methods and

recommended physical activities. Further, the researcher trained family members to provide healthful foods at home and taught them how to negotiate and convince patients concerning proper diets, physical activity, and medication adherence.

At Weeks 3 and 4, CHVs provided community broadcasting for 20 min containing contents on diabetes and complications, benefits of daily diabetes management such as dietary control, physical activity, and medication adherence. The content of the broadcast was repeated on Weeks 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, and 18.

At Weeks 5 and 13, CHVs were accompanied by the researcher to conduct 30-min home visits to assess patients' goal achievements, discuss problems, negotiate goal-setting, and propose means to overcome barriers to maintain healthy behaviors.

In the comparison group, participants received usual care, and health education with fasting blood sugar (FBG) testing at the clinics, which is normally performed every 2 to 3 months. All usual care was provided by physicians and nurses at the clinics, and home visits might be provided by CHVs, as necessary.

After participants signed informed consent forms, they were asked to provide blood samples for HbA_{1c} and fasting blood glucose (FBG), as usual. Then all participants meeting the criteria were asked to complete self-report questionnaires as baseline data. At the 20-week follow-up, HbA_{1c} and FBG tests were conducted, and participants were asked to repeat self-report questionnaires at baseline. All questionnaires were initially evaluated by 3 experts including a physician, an instrumental nurse specialist, and a nutritionist regarding content accuracy and wording suitability. Content validity index (CVI) ranged from 0.92% to 1.0%, indicating the instruments measured the content of what was proposed to be gaged.

A diabetes knowledge questionnaire was developed to measure patients' understanding of signs and symptoms, complications, treatment, medications, diet, and exercise for effective diabetes control. The questionnaires contained 24 items with 3 choices (yes, no, and uncertain). Correct responses were given 1 point, while incorrect/uncertain responses were given 0 points. High scores indicated greater levels of understanding. The KR-20 coefficient was .80.

Self-efficacy in glycemic control measure was developed to evaluate patients' beliefs in the ability to change behaviors. It contained 15 items with a 5-point Likert scale ranging from 1 to 5 (1 = extremely not confident, 5 = extremely confident). Mean scores ranged from 15 to 75 with high scores indicating more confidence in performing behaviors. Cronbach's alpha coefficient was .87.

The perceived family and CHV support questionnaire was developed to evaluate patients' perceptions of family and CHVs in assisting with emotional, informational, instrumental, and appraisal support for glycemic control. It contained 15 items with a 3-point scale ranging from 0 to 30 (0 = never, 1 = sometimes, 2 = regularly). Higher scores indicated more perceived family and CHV support. Cronbach's alpha coefficient was .90.

The glycemic control behavior measure was a self-reported questionnaire to evaluate patients' behaviors on dietary consumption, physical activity, and medication adherence. Questions included, "How often do you add sugar to food? How frequently do you perform physical activity such as walking or biking for at least 30 min/time? and How often do you take antihyperglycemic drugs as prescribed?" This questionnaire contained 15 items (diet = 5 items, physical activity = 4 items, and medication adherence = 6 items), with a 4-point scale (0 = never, 1 = sometimes, 2 = often, and 3 = regularly). Scores ranged from 0 to 45 with high scores indicating more appropriate behavior. Cronbach's alpha coefficient was .82.

We conducted an analysis using SPSS for Windows, Version 23 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics was used to summarize patient characteristics and health status (percentage, mean, and standard deviation), and the Kolmogorov-Smirnov test was used to assess normal distribution. Chi-square test was used to analyze differences between groups for categorical variables. Independent *t*-test and paired *t*-test were used to analyze the difference between the mean scores of the outcomes between and within groups for normally distributed variables. Magnitude of intervention effects (Cohen's *d*) were calculated for between-group effects based on the observed means. For all analyses, a $p < .05$ was considered to be statistically significant.

Results

Phase One: Program Development

Key informants who were willing to participate in phase 1 recruited from the intervention group totaled 7 patients with T2DM, 7 family members, and 4 CHVs. Six patients were married and had finished secondary school education. Their ages ranged from 50 to 75 years with mean of 65.3 years and mean diabetes duration of 3.6 years. According to the interview, most patients had misunderstandings about the disease and insufficient knowledge about adverse outcomes: "*I thought I was regularly taking medicine, so I didn't reduce carbohydrate and sweet intake.*" "*Sweet fruit does not cause diabetes, so I often eat 5 to 6 oranges.*" "*Whenever I feel like my blood sugar is not high, I reduce my diabetes medication dose from the regular twice daily.*" Moreover, they usually ate as they pleased, "*I can't control myself not to eat dessert when I see it in front of me.*" "*I've tried exercising as recommended, but I could only do it for less than a month, because it was boring, so I quit.*" Lastly, unavailability of healthy diet in the community was mentioned:

"Most food sold in the community is oily, sweet, and salty." "If we need healthy food, we buy it at the markets outside the community." "Diabetes diets are very expensive and difficult to find in our community."

Also, 5 of 7 family members were female and their ages ranged from 30 to 70 years with mean 49.7 years. Three were spouses, and the rest were relatives. Most were employed. All took responsibility to prepare food and medication and accompany them to the appointed doctor visits. The findings revealed that most mentioned the greatest barrier to assisting patients was their perceptions of the disease: *"I felt that patients with uncontrolled type 2 diabetes perceived the signs and symptoms of diabetes are simple such as dizziness, faintness, and palpitations. Just have some sweets, and these symptoms would be gone."* They mentioned the need for skills to communicate with patients effectively and persuade them to adhere to desired behaviors: *"I prepared dishes with vegetables for my husband, but he threw them out. He never eats vegetables. What should I do?" "My older sister never does what I say, especially about reducing carbohydrates per meal." "I want to learn how to communicate with patients with uncontrolled type 2 diabetes to believe or follow my suggestions."*

In the CHV group, all were female. Their ages ranged from 55 to 80 years with mean 66.8 years. Their years of experience serving the community ranged from 10 to 25 years with mean 17.8 years. All took responsibility to monitor and report patients' problems when necessary and use community resources. The findings revealed no signs or symptoms and no control for patients: *"I noticed that when I gave the example of diabetes cases who had a limb cut off or even died from diabetes to patients, they showed no interest."* Most CHVs noted less confidence concerning diabetes care and needed training and coaching from nurses: *"We've been trained on diabetes for over 10 years, so we have little knowledge to advise patients with diabetes."* They also reported lacking accessible community resources for glycemic control: *"This community has no shops with healthy food choices for patients with diabetes."*

In the second round of meetings, all patients and family members agreed with the CHVs plan for 3 activities to be created and implemented in the community. It included campaigns and posters focused on diabetes knowledge, food for glycemic reduction, desired behaviors, and community broadcasting with disease information. Also, 1 of 6 food shops in the community (16.7%) was willing to create food options with more vegetable ingredients for consumer choice.

For example, *"A diabetes campaign in this community is necessary and should be organized periodically. It will raise patients' awareness."* (*CHVs*). *"It would be very helpful to have diabetes campaigns organized by the CHVs in the community every three months"* (*patient*).

"Diabetic food is difficult to find in our neighborhood. Having a diabetic food shop in the community would help us to control blood sugar levels well" (*patient*). *"I need the community leaders to provide at least one diabetes food shop as an alternative support for us to have glycemic control"* (*patient*). *"A health food shop might be an alternative solution for patients with diabetes to control their blood sugar. It would succeed when community committees were the sponsors"* (*CHVs*).

Phase Two: Program Implementation and Evaluation

In all, 30 participants were assigned in each group. Table 1 revealed no significant differences in participants' characteristics across the intervention and comparison groups. The intervention group had a mean age of 65.6 (SD = 11.6) years; the majority of females were married and had finished primary school. Their average duration of diagnosis with diabetes was 14.6 (SD = 11.6) years, mean baseline HbA_{1c} was 7.6% (SD = 0.6), and mean fasting blood glucose was 148.0 (SD = 38.5) mg/dL. No significant differences were found between groups at baseline in mean HbA_{1c} ($P = .84$), overall behavior ($P = .76$), diabetes knowledge ($P = .97$), self-efficacy ($P = .77$), and perceived family and CHV support ($P = .98$).

As shown in Table 2, outcome improvement was observed in the intervention group. The mean HbA_{1c} in the intervention group significantly decreased by approximately .4% ($P < .001$), whereas those in the comparison group significantly increased by .3% ($P = .001$). The mean scores for knowledge, glycemic control behavior, self-efficacy, and perceived family and CHVs support significantly increased between baseline and 20 weeks in the intervention group ($P < .001$), greater than that of the comparison group ($P < .001$). Changes within-group were insignificant in the comparison group ($P > .05$), but a significant increase of HbA_{1c} level was observed ($P = .001$). Large effect sizes of at least a Cohen's $d = 1.0$ were found for all outcome measures, indicating a great improvement in the intervention group.

As shown in Figure 1, 83.3% of intervention group participants decreased HbA_{1c} and 23.3% reduced HbA_{1c} at least .5%, whereas 90% of comparison group participants showed no change or increased HbA_{1c}. All participants reported no change of diabetes medical prescriptions.

Discussion

The study findings demonstrated the success of applying diabetes self-management education (DSME) mainly created and delivered by CHVs in the community even with small numbers of participants. Outcome measures in the intervention group improved significantly and much greater than those in the comparison group with large effect sizes

Table 1. Baseline T2DM Patients' Characteristics.

Characteristics	Total (n = 60)	Intervention group (n = 30)	Comparison group (n = 30)	P
Female, n (%)	41 (68.3)	18 (60.0)	23 (76.7)	.27[a]
Age (years), n (%)				
35-60	15 (25.0)	8 (26.7)	7 (23.3)	.17[a]
>60	45 (75.0)	22 (73.3)	23 (76.7)	
Min-Max (mean ± SD)	38-80 (65.9 ± 9.9)	38-80 (65.6 ± 11.6)	48-80 (66.3 ± 8.1)	.27[b]
Married, n (%)	33 (55.0)	17 (56.7)	16 (53.3)	.82[a]
Education, n (%)				
Primary school	46 (76.7)	21 (70.0)	25 (83.4)	.36[a]
High school and greater	14 (23.3)	9 (30.0)	5 (16.6)	
Duration of DM (years), n (%)				
≤10	29 (48.3)	15 (50.0)	14 (46.7)	.79[a]
>10	31 (51.7)	15 (50.0)	16 (53.3)	
Min-Max (mean ± SD)	1-44 (14.9 ± 11.2)	1-35 (14.6 ± 11.6)	1-44 (15.2 ± 12.5)	.24[b]
HbA$_{1c}$ level (%), n (%)				
7-7.9	47 (78.3)	24 (80.0)	23 (76.7)	.75[a]
≥8	13 (21.7)	6 (20.0)	7 (23.3)	
Min-Max (mean ± SD)	7.1-9.2 (7.6 ± 0.6)	7.1-9.2 (7.6 ± 0.6)	7.1-9.0 (7.5 ± 0.6)	.84[b]
FBG level (mg/dL), n (%)				
80-129	20 (33.3)	12 (40.0)	8 (26.7)	.27[a]
≥130	40 (66.7)	18 (60.0)	22 (73.3)	
Min-Max (mean ± SD)	102-277 (146.9 ± 34.3)	102-277 (148.0 ± 38.5)	107-241 (145.8 ± 30.2)	41[b]
Diabetes knowledge		14.0 (3.1)	13.9 (4.0)	.97[b]
Self-efficacy for glycemic control		36.7 (10.0)	35.9 (9.9)	.77[b]
Perceived family and CHVs support		12.5 (5.4)	13.0 (4.0)	.98[b]
Behavior for glycemic control		21.7 (4.5)	21.3 (5.6)	.76[b]

Abbreviations: FBG, fasting blood glucose; SD, standard deviation.
[a]Chi-square test.
[b]Independent *t*-test.

(Cohen's *d* > 1.0). The intervention group participants exhibited the greatest significant improvement concerning diabetes knowledge (Cohen's *d* = 3.8) and overall behavior changes showed positive results with greatest effect sizes in diet consumption (Cohen's *d* = 2.7). These findings were consistent with studies concerning diabetes prevention and lifestyle changes supported by CHVs.[10,21,22]

Between-group comparison indicated great improvements in intervention group participants' perceptions of support from their family members and CHVs at the end of the study (Cohen's *d* = 2.2). This finding supports the success of the program in enhancing family members' confidence to communicate on the basis of their knowledge and perceptions. In the study, family members learned to develop skills and gain competence to interact with patients by observing their communication patterns, listening to information, and practicing to convey clear and consistent message. This process allowed patients the opportunity to express needs and emotions, resulting in sharing information, goals, and means to change behavior and improve glycemic control.

Short messages with specific-diabetes information conveyed through campaign and community radio broadcasting created by the CHVs contributed to positive behavior changes in this study, possibly because the campaign could initially draw attention, and increase awareness of disease severity and how to prevent adverse outcomes.[23] Also, community radio broadcasting was considered a reinforcement action reminding patients about glycemic control, motivating them to maintain behaviors changes.

This study demonstrated the benefits of King's General Systems Framework on program development. With the theory focused on an individual's perceptions and respect for the individuality of others, the researcher-patients-family members-CHVs transactions (bargaining, negotiating, and social exchange) were vital. In the first round of interviews, as the researcher explored and verified the perceptions of patients and families, their awareness of self- and others were observed. The interaction process helped to identify their problems and concerns. Additionally, when their perceptions differed from those of the researcher, they

Table 2. Study Outcomes Within and Between Groups.

Variables	Intervention group		Comparison group		MD (SD) between groups	P^b	Cohen's *d* between groups
	Mean (SD)	MD (SD) within group	Mean (SD)	MD (SD) within group			
Diabetes knowledge							
Baseline	14.0 (3.1)		13.9 (4.0)		0.1 (0.9)	.97	
20 weeks	22.9 (1.0)		14.1 (3.1)		8.8 (0.6)	<.001**	3.8
P^a	<.001**	8.9 (3.0)	.81	0.2 (3.7)			
Self-efficacy for glycemic control							
Baseline	36.7 (10.0)		35.9 (9.9)		0.8 (2.6)	.77	
20 weeks	56.8 (8.0)		35.3 (9.6)		21.5 (2.3)	<.001**	2.4
P^a	<.001**	20.1 (8.4)	.56	−0.6 (5.2)			
Perceived family and CHV support							
Baseline	12.5 (5.4)		13.0 (4.0)		−0.5 (1.2)	.98	
20 weeks	24.8 (6.0)		14.4 (2.9)		10.4 (1.2)	<.001**	2.2
P^a	<.001**	15.3 (5.7)	.24	0.9 (3.9)			
HbA$_{1c}$ level							
Baseline	7.6 (0.6)		7.5 (0.6)		0.1 (0.1)	.84	
20 weeks	7.2 (0.4)	−0.4 (0.4)	7.8 (0.7)	0.3 (0.4)	−0.6 (0.2)	<.001**	1.1
P^a	<.001**		.001**				
Behavior for glycemic control							
Baseline	21.7 (4.5)		21.3 (5.6)		0.4 (1.3)	.76	
20 weeks	35.4 (6.3)		21.0 (5.5)		14.4 (1.5)	<.001**	2.4
P^a	<.001**	13.8 (5.9)	.67	−0.3 (3.4)			
Diet							
Baseline	11.2 (2.0)		10.6 (2.9)		0.6 (0.6)	.38	
20 weeks	17.0 (2.6)		10.5 (2.2)		6.5 (0.6)	<.001**	2.7
P^a	<.001**	5.9 (2.2)	.85	−0.1 (1.9)			
Physical activity							
Baseline	8.5 (1.9)		7.4 (1.8)		1.1 (0.5)	.02*	
20 weeks	11.2 (2.4)		6.9 (1.8)		4.3 (0.6)	<.001**	2.0
P^a	<.001**	2.7 (2.3)	.14	−0.5 (1.9)			
Medication adherence							
Baseline	16.9 (2.7)		18.2 (2.6)		−1.3 (0.7)	.07	
20 weeks	22.2 (2.8)		18.6 (2.9)		3.6 (0.6)	<.001**	1.3
P^a	<.001**	5.2 (3.1)	.27	0.3			

Abbreviations: MD, mean difference; SD, standard deviation.
[a]Paired *t*-test.
[b]Independent *t*-test.
*P < .05. **P < .001.

were encouraged to express their opinions. Once participants' needs and goals were acknowledged in the second round of interviews, family members gained greater respect for patients as individuals and CHVs created a social system to provide an alternative environment for supporting their needs and behavior changes. This process supported King[24] who indicated that perception is perhaps the most basic determinant of behavior. This was consistent with related studies that succeeded in changing patients' behaviors after initially exploring perceptions before setting goals and the means for achieving them between patients and healthcare professionals.[25-27]

Despite the promising findings, generalization remains limited. First, most participants were elderly females. Secondly, the study was conducted in urban communities with unique lifestyles. These findings may differ from rural communities. Although our study was conducted for 20 weeks, which was sufficient to observe improved outcome measures and reduced HbA$_{1c}$, it might have been relatively short to demonstrate program sustainability, which should exceed 6 months. Lastly, due to the small sample size, supporting our positive findings with confidence would be difficult. Thus, further studies should investigate the program effects on patients' glycemic control using a large-scale controlled trial.
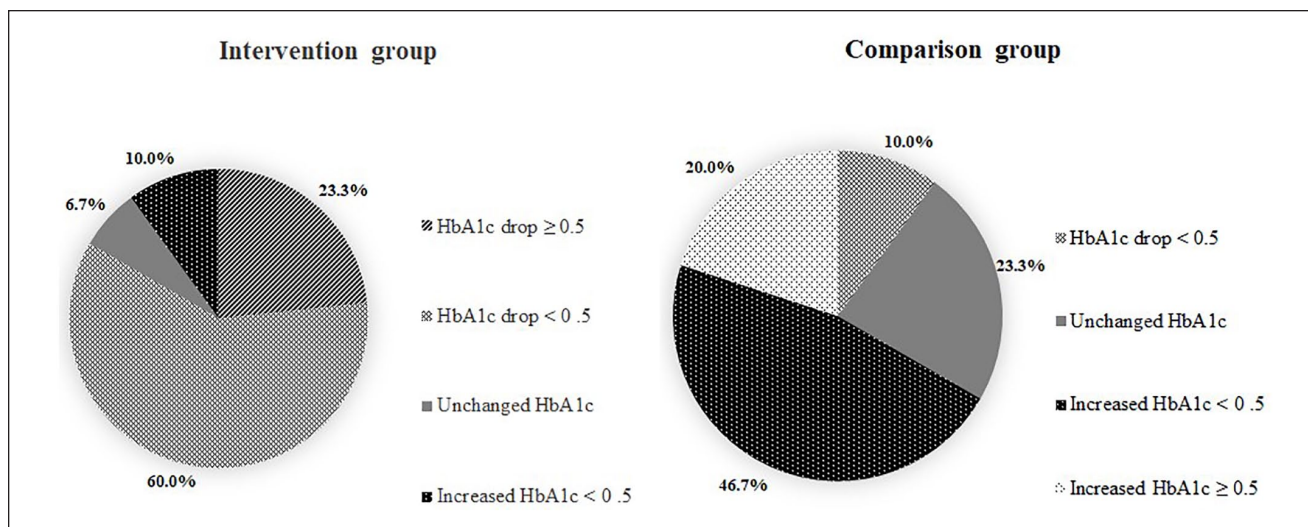
Figure 1. Changes in HbA1c level of intervention and comparison groups.

Conclusion

The CHV involvement program developed based on King's General Systems Framework could effectively reduce glycated hemoglobin levels. Supportive environments for patients created by CHVs could be considered as significant reinforcement for behavior changes. The program could be replicated in other communities seeking community involvement in glycemic control.

Author Contribution

PS, PP, SL, RC conceptualized, designed, and management of the study. PS, PP were responsible for delivering the intervention, collecting, and analyzing the data. PP, PS, SL contributed to the interpretation and report on the study. All authors approved the final version for submission.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical Consideration

Ethics approval was obtained from the Human Research Ethics Committee, Faculty of Public Health, Mahidol University (MUPH 2018-123) and the Bangkok Metropolitan, Administration Human Research Ethics Committee (U033h/61). The study procedures were conducted following the Declaration of Helsinki.

ORCID iD

Panan Pichayapinyo ![iD] https://orcid.org/0000-0002-5320-5291

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