Noninferiority of Telemedicine Delivered **Compared With In-person Diabetes Self-Management Education and Support** (DSMES) During Covid-19 Pandemic in Thailand

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## Abstract

This study aimed to compare the clinical outcomes and program satisfaction of diabetes self-management education and support (DSMES) for type 2 diabetes patients delivered by telehealth during COVID-19 pandemic to in-person delivery during pre-COVID-19. A retrospective case-controlled study was conducted (95 telehealth and 95 on-site). Differences in hemoglobin AIc (HbAIc) reductions between groups were analyzed by linear mixed-effects models, and satisfaction was collected. Compared with baseline, at the three-month follow-up, the HbAIc reductions of the telehealth and on-site DSMES were 1.20  $\pm$  0.15% and 1.21  $\pm$  0.15%, respectively (P < .001), whereas these were 1.28  $\pm$  0.16% and 1.18  $\pm$  0.15% at six-month follow-up, respectively (P < .001). There were no significant differences in HbA1c reduction between the two groups (P = .967 and .674 at three- and six-month follow-up). Majority of participants in both groups had high program satisfaction (telehealth 98.7% vs on-site 95.1%, P = .269). In conclusion, DSMES delivered via telehealth is as effective in lowering HbAIc as that delivered in-person, with a high satisfaction rate.

#### **Keywords**

diabetes self-management education and support, telehealth, covid-19, multidisciplinary team, patient-generated health data

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## What We Already Know

 Diabetes self-management education and support (DSMES) delivered via telehealth is effective during pre-COVID era.

## What This Article Adds

 Diabetes self-management education and support (DSMES) delivered via telehealth during COVID-19 pandemic is as effective as that delivered in-person during pre-pandemic in lowering hemoglobin A1c, with similar high satisfaction.

## Introduction

Diabetes self-management education and support (DSMES) is effective in improving metabolic outcomes, quality of life in person with diabetes (PWD) and reduces cost.<sup>1</sup> Emerging evidence suggests that DSMES delivered by telehealth is acceptable, effective in improving glycemic control and can be especially useful in PWD who otherwise might have limited access to care.<sup>2</sup> However, the uptake of telehealth varied in different countries.

In Thailand, telehealth was sparsely used before COVID-19 era,<sup>3</sup> especially for PWD. One study of 35 PWD showed improved glycemic control using automated interactive voice response calls to patients and email notifications to their nurses.<sup>4</sup> Telehealth use in Thailand increased during COVID-19, both for monitoring of COVID-19 and other conditions.<sup>3,5</sup> Only one retrospective study explored the effectiveness of diabetes care via telehealth in 111 PWD in Thailand which revealed no changes in hemoglobin A1c (HbA1c) levels, but benefits were seen in those with baseline HbA1c > 7%.<sup>6</sup> However, the efficacy of telehealth DSMES, particularly in comparison with that of the in-person DSMES, has not been well studied. This study aimed to compare the outcome of glycemic control between DSMES delivered via telehealth (COVID-19 era) and in-person (pre-COVID-19 era), along with patient satisfaction, using a case-controlled study in patients with type 2 diabetes in a tertiary care center in Thailand.

## **Methods**

A retrospective case-controlled study included PWD (type 2 diabetes) who participated in DSMES program delivered by telehealth during the COVID-19 pandemic (cases, March-September 2020) and in-person (controls, year 2019) at Ramathibodi Hospital, Bangkok. The cases and controls were randomly matched 1:1 by age, diabetes duration, and education levels. The study protocol was approved by Human Research Ethics Committee, Faculty of Medicine Ramathibodi Hospital, Mahidol University (Ethical approval COA. MURA2020/949).

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## Telehealth and In-person DSMES

Telehealth DSMES was performed through telephone by one of the multidisciplinary team members (advanced practice nurses, nurses, pharmacists, and dieticians). At the first visit (30-45 minutes), individuals received the assessment and education according to the framework of ADCES 7 Self-Care Behaviors.<sup>1</sup> If additional needs arose, a referral was made to another team member to contact the patients. Video conferences by smart phone application were provided as needed. Blood glucose monitoring devices were provided (through delivery services).

An in-person DSMES program was conducted by the same multidisciplinary team with a similar content to telehealth DSMES. The setting was a group delivery. The first visit (about four hours) included general diabetes knowledge, exercise, foot care, followed by individual assessments of glucose monitoring, medication taking, and diet.

After the first visit, in both formats of DSMES, a behavioral goal setting was made, and a follow-up appointment was arranged in three months.

## Outcomes

HbA1c levels at the program start, three and six months after the first visit, were the primary outcome of interest and collected from medical records. Program satisfaction (rating 1-5 with 5 being the highest) was collected at a follow-up visit from PWD.

## Statistical Analysis

Data are expressed as mean (standard deviation [SD] or standard error of the mean [SEM]) or frequency (percentage). Comparison between groups were analyzed by independent *t* test or  $\chi^2$  test as appropriate. Linear mixed-effects models Stata 16.1 was used to analyze differences in HbA1c reductions at three and six months of follow-up between groups.

## Results

Table 1 shows characteristics of PWD in both groups. Person with diabetes in the telehealth group had more prevalent hypertension than the in-person group, while other characteristics were similar.

## HbAIc Levels and Program Satisfaction

Compared with their own baseline, at the three-month follow-up, the reductions of HbA1c (mean  $\pm$  SEM) of the inperson and telehealth DSMES groups were  $1.21 \pm 0.15\%$ and  $1.20 \pm 0.15\%$ , respectively (P < .001), whereas at the six-month follow-up, the reductions were  $1.18 \pm 0.15\%$  and  $1.28 \pm 0.16\%$ , respectively (P < .001) (Figure 1). These reductions were similar between the two groups (P = .967

<b>Table I.</b> Baseline Characteristics of Participants ( $n = 1$	90).
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Category	In-person	Telehealth	P value
N	95	95	
Demographic			
Age (years)	59.89 $\pm$ 11.95	59.91 $\pm$ 11.84	.995
Sex (M/F)	34/61	41/54	.373
Educational level			
High school or less N (%)	41 (43.2)	41 (43.2)	1.000
More than high school N (%)	54 (56.9)	54 (56.9)	
BMI (kg/m <sup>2</sup> )	27.75 ± 8.70	28.25 ± 5.76	.637
Married n (%)	55 (57.9)	63 (73.3)	.30
History of hypertension		· · · · ·	
Yes n (%)	64 (67.4)	80 (84.2)	.011
Diabetes characteristics			
Diabetic duration (years)	8.9 ± 8.16	9.6 ± 8.20	.586
Diabetes medication use (%)			
No diabetes medication	6 (6.3)	9 (9.5)	
Oral medications only	54 (56.8)	55 (57.9)	0.050
Insulin, GLP-I RA, and oral medications	28 (29.5)	31 (32.6)	
Insulin only	7 (7.4)	0 (0.0)	
HbA1c at baseline (%), mean $\pm$ SEM	8.75 ± 0.16	8.62 ± 0.16	0.654

Note. SEM = standard error of the mean.



**Figure 1.** HbA1c levels at baseline, three, and six months in telehealth and in-person DSMES groups. *Note.* DSMES = diabetes self-management education and support.

and .674 at three and six months) (Figure 2). Program satisfaction was high (scores 4-5) in both groups (telehealth 98.7% vs on-site 95.1%, P = .269).

# Discussion

The study demonstrated that DSMES delivered by telehealth in Thailand during COVID-19 pandemic is effective in improving glycemic control and non-inferior to that of an in-person delivery, with high patient satisfaction. The program could serve a model for telehealth DSMES, both during COVID-19 era and beyond.

The magnitude of HbA1c reduction in our study (~1.2%) is comparable to those performed pre-COVID-19 era (~1.5% at 12 months).<sup>7</sup> A few studies in other countries demonstrated that DSMES delivered via telehealth during COVID-19 pandemic was effective. For example, a virtual training on a hybrid closed-loop pump in patients with type 1 diabetes



**Figure 2.** Comparisons of HbA1c reduction at three and six months between telehealth and in-person DSMES groups. *Note.* DSMES = diabetes self-management education and support.

resulted in similar glycemic matrixes and satisfaction compared with in-person training prior to COVID-19 pandemic.<sup>8</sup> In India, diabetes education and insulin injection techniques given via telephone and/or video to patients hospitalized with COVID-19 resulted in improved self-care and high satisfaction.<sup>9</sup> In Singapore, telephone consultations and remote patient monitoring delivered to 298 PWD were found to be safe and efficient in replacing in-person visits.<sup>10</sup> The use of two-way communications between patients and providers, along with individualized feedback and education, and the use of patient-generated health data were suggested as key components of telehealth and likely influenced the success in our study. These results, along with ours, support the clinical efficacy of DSMES delivered via telehealth.<sup>5</sup>

Our study has strength in being one of a very few studies that compares the effectiveness of DSMES before and after COVID-19 pandemic, with a follow-up of six months. Limitations include being a nonrandomized study and that the effects of diabetes medication use on HbA1c could not be completely accounted for. However, both groups had similar medication use. Future framework of telehealth in Thailand has recently been laid out and included monitoring/reporting, stakeholder engagement, facilitators, and risk management.<sup>3</sup>

# Conclusion

Diabetes self-management education and support delivered via telehealth is as effective in lowering HbA1c as that delivered in-person, with a high satisfaction rate, and should be incorporated for care of PWD.

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#### **Declaration of Conflicting Interests**

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