

Effects of health literacy improvement program on self-care behaviors and health outcomes in older adults with type 2 diabetes and hypertension comorbidities

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ABSTRACT

Health literacy is a necessary factor affecting self-care behaviors. This randomized control trial research aimed to study the effects of a health literacy improvement program on self-care behaviors and health outcomes in older adult patients with diabetes and hypertension comorbidities. Older adults at a private primary care unit, Bangkok, Thailand; aged 60-69 years, who had been diagnosed with diabetes and hypertension, were selected by simple random sampling into experimental and control groups, of 30 people each. The experimental group received eight weeks of a health literacy improvement program. Group activities were held in three sessions at 4-week intervals. The control group received standard care only. Data were collected by using interview questionnaires at baseline, post-intervention, and follow-up. Research instrumentation included collected data on general characteristics and illness history. Health literacy, self-care behavior, healthy eating, physical activity, stress management, and medication adherence scales were also included. In addition, blood pressure and HbA1C were examined at baseline and follow-up. Descriptive statistics, independent t-test, chi-square, Repeated Measures ANOVA, and Bonferroni post hoc test were used for data analysis. After the intervention and follow-up, the experimental group had the following mean scores: health literacy ($M_E 118.33 \pm 7.79$, 123 ± 4.90 ; $M_C 94.53 \pm 7.51$; 94.17 ± 5.86 , $p < .001$), self-care behaviors in healthy eating ($M_E 49.10 \pm 3.14$, 52.13 ± 3.19 ; $M_C 43.70 \pm 2.83$, 43.66 ± 3.25 , $p < .001$), physical activities ($M_E 36.90 \pm 2.26$, 38.53 ± 2.56 ; $M_C 26.90 \pm 2.67$, 26.83 ± 2.67 , $p < .001$), stress management ($M_E 26.83 \pm 1.89$, 28.30 ± 1.89 ; $M_C 21.33 \pm 2.00$, 21.60 ± 2.09 , $p < .001$), and medication adherence ($M_E 34.60 \pm 2.47$, 36.07 ± 1.87 ; $M_C 27.40 \pm 2.64$, 28.30 ± 3.18 , $p < .001$), all of which were significantly higher than the control group. Furthermore, HbA1C ($\text{Diff}_E -0.46 \pm 0.50$; $\text{Diff}_C 0.06 \pm 0.45$, $p < .05$) and systolic blood pressure ($\text{Diff}_E -9.70 \pm 9.29$; $\text{Diff}_C -1.26 \pm 12.89$, $p < .05$) were significantly lower than the control group.

Key words:

health literacy improvement program; older adults with type II DM & hypertension; health literacy; self-care behavior; HbA1C; hypertension

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INTRODUCTION

Diabetes is a chronic disease that is most common in the elderly. According to a report on the health status of the elderly in Thailand in 2020, the Thai population aged 60 years and over has the highest number of diabetes cases.¹ Diabetes is a metabolic disorder that causes the body to have high blood sugar levels over a long period, which causes a condition called atherogenesis, and is often accompanied by high blood pressure.^{2,3,4} It has been found that diabetic patients are more likely to have high blood pressure than those without diabetes; vice versa, patients with high blood pressure are more likely to have diabetes than people with normal blood pressure.^{1,5} This condition might affect the incidence of cardiovascular disease.^{3,4}

Health literacy (HL) skills are essential to enable self-management and shared decision-making in patients with type 2 diabetes mellitus (T2DM). A patient with limited HL (health literacy) is associated with poorer health outcomes.⁶ The type 2 DM patients with limited HL often cannot read medication labels accurately, may take medication incorrectly, may not understand consent forms, and generally have difficulty understanding printed instructions for follow-up care and reading health advisories or warnings.⁷ Evidence shows that patients with low literacy are generally 1.5 to 3 times more likely to experience a poor health outcome.⁸ Similarly, there is likely sufficient evidence to support a positive relationship between health literacy and self-care activities or healthy behaviors.⁹ ¹² Some studies have found that self-efficacy is a predictor of improved self-care ability among diabetic patients with limited HL.¹³

Personal health literacy is the degree to which individuals can find, understand, and use information and services to inform health-related decisions and actions for themselves and others.^{14,15} It has been found that people with low health literacy have a relationship with poor knowledge about diabetes, poor self-care behaviors, and poor blood sugar control.¹⁶ Elderly patients with low functional health literacy are more likely to experience poor blood sugar and blood pressure control.¹⁷ According to findings, the elderly have degeneration of cognitive function with a deterioration of various sensory perceptions affecting older people who tend to have low health literacy.¹⁸ HL could be a benefit to personalize patients' follow-up and should be routinely assessed in its three dimensions (functional, interactive, and critical) to enhance patients' ability to cope with clinical recommendations.¹⁹

Unfortunately, little research has been conducted with experimental designs to assess the effectiveness of interventions.¹⁸ This study aimed to examine the effects of a health literacy improvement program on self-care behaviors and health outcomes in older adults with type 2 DM and hypertension comorbidities. The concept of health literacy was applied to design a health literacy improvement program. The results will be beneficial to health care providers at DM clinics caring for elderly patients with chronic diseases.

RESEARCH OBJECTIVES

To determine the effects of a health literacy improvement program on health literacy, self-care behaviors, and health outcomes (HbA1c and blood pressure) of elderly with diabetes and co-hypertension.

METHOD

Research Design

This study was a two-armed randomized control trial with measures repeated three times.

Participants

The inclusion criteria of participants included both male and female older adults aged 60 - 69 years who had been diagnosed with type II DM and hypertension comorbidities, HbA1C not less than seven mg% , systolic blood pressure ranging between 140-160 mm.Hg. or diastolic blood pressure between 90-100 mm.Hg, using oral drug treatment only and having the ability to communicate well. The patients who developed advanced complications of the diseases during the study and required a revision of treatment were excluded from further participation in the study.

The sample size was calculated by using Program G*Power, which allowed for an error of 0.05, power ($1-\beta$) of 0.8, and a large effect size of 0.8²⁰ for investigation among older adults with type II DM and hypertension comorbidities. Thus, 26 participants were assigned to each group. A 20% attrition rate was allowed, resulting in a sample size of 30 participants in each group.

Sixty participants were recruited between June and October 2020 from the primary care clinic of a private hospital in Bangkok, Thailand. Patients were randomized by the researcher to the experimental or control group, with the allocation sequence generated by a random number table. Before signing consent forms, the patients were informed about the purpose of the study as well as their vital roles in participating in this study.

Intervention

After receiving standard clinical care, the experimental group received an intervention consisting of a set of activities to promote health literacy in older adults with type II DM and hypertension comorbidities. Three sessions were delivered over eight weeks, with small-group face-to-face interventions provided. The health literacy promoting program in this study focused on the strengthening of functional HL, interactive HL, and critical HL in controlling Type II DM and hypertension in patients.

At Week 1, the patients received education activities focused on accessing health information and health services skills, as well as health media literacy. This session provided one-and-a-half hours of group work education in practicing reading medical terms on type II DM and high blood pressure. The researchers taught the patients how to search for a piece of reliable health information and how to select reliable health information sources, essential skills and discussions were carried out, including making sure patients understood the health information and medications received. Patients also received a manual of self-care guidelines for type II DM and hypertension in older adults for reviewing at home. All documents were developed by the researchers.

At Week 4, the patients received teaching and demonstration activities in addition to practicing focused interactive HL promotion. 90 minutes of small-group education and skill practice in selecting healthy foods for controlling type II DM and hypertension, reading nutrition labels, watching food intake, sugar, and salt daily intake calculation, physical activities, and exercise for older adults, stress management, and medication intake (type of drug, dosage, medicinal properties, and common side effects) were all addressed. Video media and teaching materials

including pictures, and flip sheets with easy language were provided to patients with teaching techniques such as “Ask Me 3” and “Teach-back method”. At the end of the sessions, the patients were asked to review a manual on self-care guidelines and instructed to self-observe for upcoming activities ahead of the next session.

At Week 8, the patients received education activities focused on critical HL promotion. 90 minutes of small-group practice in communication and decision-making skills concerning the patients' health condition were provided by teaching strategy including “Ask Me 3”. The patients practiced questioning skills such as: What is my health problem today? What do I need to do about it? What do I need to do? And how important is it? The participants also played quiz games. Moreover, patients were allowed to analyze and discuss health problems and healthy behavior for blood sugar and blood pressure control. At the end of the discussions, patients were asked for a follow-up the next week for outcome assessment.

The participants in the control group received the standard care protocol for type II DM patients, including brief health education focused on dietary intake, exercise, stress management, smoking, and alcohol, assessment for vital signs and blood pressure, and management based on health condition with the inclusion of an information leaflet. They were asked to follow up on medication every month. In addition, they were asked to monitor blood glucose every three months.

Outcome Assessment

Data were collected via interview questionnaires for the experimental and control groups at Weeks 1, 9, and the follow-up at Week 12. HbA1C and blood pressure were monitored during Week 1

and Week 12. Data for socio-demographics and clinical characteristics included gender, age, occupation, education level, income level, medical history, and time of diagnosis with type II DM with hypertension comorbidities. Data on medication were then collected.

The health literacy scale measured cognitive and social skills in accessing, understanding, assessing, applying knowledge, and communicating information on type II DM and hypertension. The research used the Thai version of the health literacy scale by Chiangkhong, & et al.²¹ This interview questionnaire contained 30 items related to functional, interactional, and critical health literacy, ranging in level of literacy from 1 (lowest) to 5 (highest). Scores can range from 30 to 150, with Content Validity Index (CVI) being 0.90 and Cronbach's alpha coefficient at 0.83.

The self-care behavior scale measured four dimensions of self-care practices consisting of healthy eating, physical activities, and exercise, stress management, and medication adherence behaviors. These interview questionnaires were developed by researchers and contained 15 items for healthy eating, 10 items for physical activities and exercise, 10 items for stress management, and 10 items for medication, ranging in the frequency of practice from 1 (never or rarely) to 4 (always). The Content Validity Index (CVI) ranged from 0.83 to 0.96 and the Cronbach's alpha coefficient ranged from 0.70 to 0.79.

Health outcomes refer to HbA1C as monitored by the pre-and post-test reports from the clinic's laboratory tests. Blood pressure was evaluated before the intervention and every time data were collected.

Statistical Analysis

Data were analyzed by SPSS (Version 18). Descriptive statistics were used to analyze participants' characteristics. Frequency, percentage, mean, and standard deviation, when applicable, were calculated by chi-square and independent t-test. The normality test of the data was conducted by Kolmogorov-Smirnov test and resulted in normal distribution; therefore, the repeated measures ANOVA test, post hoc multiple comparisons with Bonferroni test, paired t-test, and independent t-test were used to compare mean values within and between groups, respectively, and the results were presented in mean and standard deviation (SD). All differences were considered significant at a p-value less than 0.05.

Ethical Approval

This study was approved by the Human Ethical Committee (MUPH2020-059) following the 1964 Declaration of Helsinki.

RESULTS

Sixty out of 156 eligible participants were recruited, and 30 participants (each) were allocated to the experimental and control groups. Finally, 60 participants completed the study until follow-up (Figure 1).

Baseline socio-demographic and clinical characteristics are reported in Table 1. No differences were found between groups in gender, age, marital status, education level, occupation, monthly income, duration of diagnosis with type II DM and hypertension ($p > 0.05$).

HL and self-care behavior, including healthy eating, physical activities and exercise, stress management, and medication adherence behaviors in the experimental group, improved significantly

during the post-intervention and follow-up period compared to the control group. The mean HL score of the experimental group was higher than that of the control group at the post-intervention and follow-up with statistical significance ($p < 0.001$ and < 0.001 , respectively), as demonstrated in Table 2.

Self-care behavior, including healthy eating, physical activities and exercise, stress management, and medication adherence behaviors in the experimental group improved significantly at the post-intervention and follow-up compared to the control group. The mean healthy eating score, mean physical activity and exercise score; and the mean stress management score in the experimental group was higher than that of the control group at post-intervention and follow-up with statistical significance ($p < 0.001$ and < 0.001 , respectively). In addition, after intervention and follow-up, the mean score of medication adherence behaviors was also higher in the experimental group than that of the control group with statistical significance ($p < .001$ and < 0.001 , respectively), as demonstrated in Table 2.

Health outcomes composed of HbA1C and blood pressure at the follow-up in the experimental group improved significantly compared to the control group. The mean difference from baseline HbA1C in the experimental group decreased more than that of the control group with statistical significance ($p = 0.002$). Similarly, the mean difference from baseline systolic blood pressure in the experimental group decreased more than that of the control group with statistical significance ($p = 0.005$). Nevertheless, the mean difference from baseline diastolic blood pressure in the experimental group showed no statistically significant difference compared to the control group ($p = 0.17$) as shown in Table 3.

DISCUSSION

A health literacy improvement program intervention demonstrated significant improvement in health literacy and self-care behaviors composed of healthy eating; physical activity and exercise; stress management; and medication adherence in older adult patients with type II DM and hypertension comorbidities. In addition, health outcomes consisting of HbA1C and blood pressure were also improved in the experimental group. These findings follow the previous studies⁸, in which patients with low HL had poorer health outcomes, including knowledge, intermediate status markers, measures of morbidity, general health status, and use of health resources. Interactions with healthcare providers and educational attainment will improve limited HL in patients with Type II DM and hypertension comorbidities to make daily decisions on healthcare and perform complex self-management activities to achieve disease control.⁶

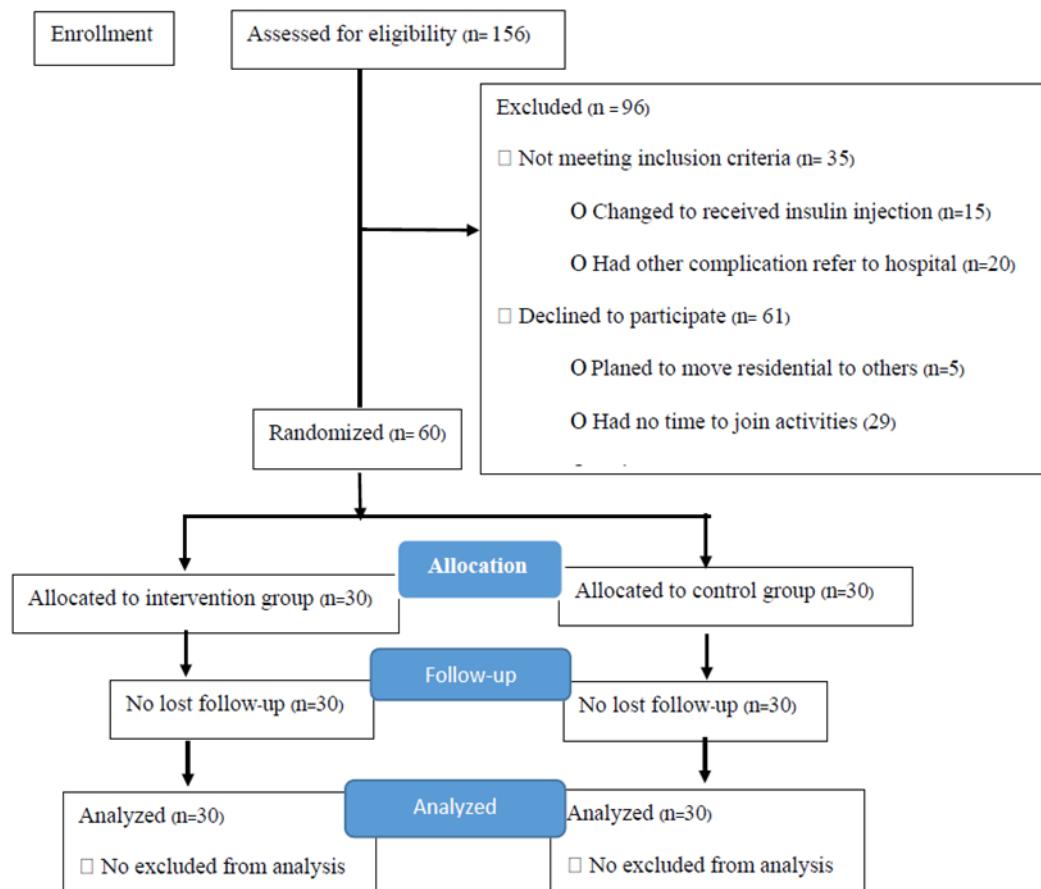
Noticeably, the patients who received the intervention showed significantly improved self-care behaviors that affected their glycemic and blood pressure control. These findings are in line with previous studies,²¹⁻²⁶ while low HL patients received the health education with simplified medication terms and were allowed to actively participate in health teaching strategies such as the “Ask Me 3” and “Teach Back” methods as well as group discussions and skill practice, all of which encouraged the patients to improve their cognitive and social skills^{11, 27}

The strength of the present study lies in the study design, which focused on

patients with complex health problems and followed up more than one time to ensure that patients had improved HL, which would enhance patient engagement in proper self-care, eventually enabling them to control their health outcomes. When compared with previous studies, the intervention was easily implemented with patients who had only a single disease and no follow-up period. In addition, there was no loss of follow-up cases in this study. It can be concluded, therefore, that the patients enjoyed all program activities and that participation made them happy in skill practices as they shared their opinions and joined with others. Despite the encouraging findings, some limitations should be addressed for generalization. First, this present study involved observed outcomes by researchers, so there might be some observer bias. Self-care behaviors were measured by self-report, so there might also be some response bias due to the desire for social acceptance. Lastly, the sample size was quite small and implemented in only one clinic, which might limit the generalization of the findings.

CONCLUSION

This health literacy program was able to improve HL, self-care behaviors, and health outcomes in older people with diabetes and hypertension co-morbidities. Health care providers at chronic care clinics in both private and public primary care units can apply this program for implementation. Further study should be considered in the form of a large-scale randomized controlled trial to validate the sample size and other settings for the validation of the efficacy of the findings.

**Figures 1****Table 1** Socio-demographics and clinical characteristics (n=60).

Variables: majority	Experimental Group (n=30;n(%))	Control Group (n=30;n(%))	p-value*
Gender: male	16 (53.3)	15 (50.0)	0.79 ^a
Age (unit: years)			0.56 ^b
Mean ±SD	65.13±2.81	64.90 ±2.97	
Min. to Max.	60 to 69	60 to 69	
Marital Status: married	17 (56.7)	15 (50.0)	0.62 ^a
Education: Primary School	26 (86.7)	28 (93.3)	0.39 ^a
Occupation: Work as Employee	14(46.7)	16(53.3)	0.87 ^a
Monthly Income (unit: baht)			0.66 ^b
Mean ±SD	3783.33 ±3522.55	3633.30±3798.67	
Min. to Max.	500 to 15,000	500 to 20,000	
Duration of Diagnosis with Type II DM (unit: years)			0.59 ^b
Mean ±SD	12.56 ± 5.67	13.63 ±5.34	
Min. to Max.	3 to 23	3 to 25	

Variables: majority	Experimental Group (n=30);n(%)	Control Group (n=30);n(%)	p-value*
Duration of diagnosis with hypertension(years)			0.63 ^b
Mean ±SD	12.10 ±5.37	13.23 ± 5.05	
Min. to Max.	3 to 23	3 to 22	

SD= standard deviation

*p-value <0.05; a chi-square; b Independent t-test

Table 2 Comparison of mean scores for health literacy, self-care behaviors between groups, and between times measured.

Variables	Experimental Group (n=30)		Control Group (n=30)		<i>t</i>	<i>p</i> -value*	ANOVA ^{tests}		
	Mean	S.D.	Mean	S.D.			Variable & Effect	F	p-value*
Health Literacy									
Baseline	96.3	9.6	96	8.3	.115	.354 ^a	group	393.2	<.001
Post	118.3	7.8	94.5	7.5	12.039	<.001 ^b	time	113	<.001
Intervention									
Follow-up	123.7	4.9	94.2	5.9	21.174	<.0001 ^b	Group*time	300.4	<.001
Healthy Eating Self-care Behavior									
Baseline	37.3	5.9	35.8	4.9	1.021	.287 ^a	group	127	<.001
Post-	49.1	3.1	43.7	2.8	7.005	<.001 ^{b*}	time	125.7	<.001
intervention									
Follow up	52.1	3.2	43.7	3.3	10.17	<.001 ^{b*}	Group*time	42.7	<.001
Physical Activity and Exercise Behavior									
Baseline	26.8	2.9	26.7	2.9	.044	.953	group	114.3	<.001
Post	36.9	2.3	26.9	2.7	15.646	<.001 ^{b*}	time	229.7	<.001
Intervention									
Follow-up	38.	2.6	26.8	2.7	17.263	<.001 ^{b*}	Group*time	148.1	<.001
Stress Management Behavior									
Baseline	28.6	2.6	28.2	2.8	.534	.661 ^a	group	126.5	.001
Post-	34.6	2.5	27.4	2.6	10.889	<.001 ^b	time	59.2	.001
intervention									
Follow-up	36.1	1.9	28.3	3.2	11.5	<.001 ^b	Group*time	143.1	.001
Medication Adherence Behavior									
Baseline	22.1	2.4	21.7	1.9	.837	.080 ^a	group	119.9	.001
Post	26.8	1.9	21.3	2.0	10.992	<.001 ^b	time	63.3	.001
Intervention									
Follow-up	28.3	1.5	21.6	2.1	14.356	<.001 ^b	Group*time	79.5	.001

^a two-tailed test; ^b one-tailed test, ^c two-way repeated ANOVA

Variables	Experimental Group (n=30)		Control Group (n=30)		<i>t</i>	<i>p</i> -value*	ANOVA tests	
	Mean	S.D.	Mean	S.D.			Variable & Effect	F p-value*

p*-value<0.05Table 3** - HbA1C, Blood pressure between groups and between times.

Variable	Experimental Group (n=30)		Control Group (n=30)		<i>t</i> -test	<i>p</i> -value*
	Baseline	Follow up	Baseline	Follow up		
HbA1C (mg%)	7.9 (0.79)	7.4 (0.71)	7.7(0.93)	7.7 (0.93)		
Mean diff (SD diff)	-0.46 (0.50)		0.06 (0.45)		-3.22	.002 ^a
Systolic Blood Pressure (mmHg)	150(8.39)	140 (10.23)	155(8.82)	153(10.01)		
Mean diff (SD diff)	-9.70 (9.29)		-1.26 (12.95)		-2.89	.005 ^a
Diastolic Blood Pressure (mmHg)	84 (9.13)	83(8.74)	79 (8.66)	81 (11.05)		
Mean diff (SD diff)	-5.30 (9.63)		-1.40 (11.98)		-1.39	.170 ^a

Mean diff = mean difference between baseline to follow-up; a=two tailed test

**p*-value<0.05

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