Effectiveness of the Protection Motivation Theory–based Education Program among People at Risk of Stroke: A Randomized Controlled Trial

Patcharin Khomkham, Linchong Pothiban, Tipaporn Wonghongkul, Waraporn Boonchieng, Weeraporn Suthakorn*

Abstract: Stroke is a serious health issue that causes mortality and disability in the world's population. People at risk of stroke need to manage the risk factors of stroke and adherence to stroke prevention, which are the key to success in improving clinical outcomes, particularly blood sugar and blood pressure levels. This randomized controlled trial, with a two-arm pre- and post-test, aimed to investigate the effectiveness of the Protection Motivation Theory-based Education Program on adherence to prevention and clinical outcomes among people at risk of stroke. The sample consisted of 58 adults visiting diabetes and hypertension clinics at a health-promoting hospital in a province in southern Thailand. They were recruited using multi-stage random sampling and randomly assigned into two arms. The experimental arm received the four-week Protection Motivation Theory-based Education Program (n = 29), and the control arm received only usual care (n = 29). Data were collected using a Demographic Data Form, the Morisky Medication Adherence Scale, the Adherence to Preventive Behavior Scale for Thai persons with prehypertension, a mercury sphygmomanometer, and a laboratory test recording form. Data were analyzed using descriptive statistics, Mixed Model ANOVA, and independent t-test.

The results showed that after receiving the program, the experimental arm had higher adherence to stroke prevention, lower blood pressure, and lower HbA1C levels than before receiving the program and the control arm after the program completion. The findings indicate the program's effectiveness in improving adherence to stroke prevention among people at risk of stroke, which results in better clinical outcomes. Thus, nurses can use this program in clinical practice with further testing in other settings with larger groups before it can be widely used.

Keywords: Adherence, Clinical outcomes, Nursing, Protection Motivation Theory, Risk of stroke, Stroke prevention

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Introduction

Stroke is a serious health issue affecting 101.5 million individuals worldwide[1] with a 70.0% rise in incidence from 1990 to 2019.[2] The majority of the global stroke burden, including mortality and disability,

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is concentrated in lower- and lower-middle-income nations.[2] In Thailand, the stroke incidence has risen from 90.37 per 100,000 people in 2009 to 203.66 in 2021.[3] It ranks second in terms of disability and is the third most common cause of death.[4]

Primary stroke prevention aims to reduce stroke risk factors through medical treatment, or lifestyle modification is necessary.[5] Up to 80% of strokes can be prevented if people recognize and eliminate or control the conditions in which their risk factors exist.[6] According to the American Heart Association (AHA), risk factors of stroke can be categorized into non-modifiable, modifiable, and potentially modifiable.[7] Among those risk factors, hypertension and diabetes are well-accepted as the main modifiable risk factors of stroke.[8] Thus, adherence to stroke prevention by lowering blood pressure and blood glucose is the target to prevent stroke. In Thailand, stroke prevention has been adopted as an important policy,[9] and there are many campaigns to raise knowledge and awareness of stroke,[9] but the achievement of the goal is still far. Evidence shows that the numbers of cases of uncontrolled hypertension[10] and diabetes[11] are rising.

Adherence is the degree to which an individual follows the agreed-upon suggestions from the healthcare professional regarding behaviors, such as taking medication, adhering to a diet, and/or making changes to their lifestyle.[12] Medication adherence leads to better glycemic[13] and blood pressure control,[14] thus reducing stroke risk. Additionally, adherence to recommended lifestyle modification for stroke preventive behaviors is vital to lessening stroke risks.[15] However, a large number of people at risk of stroke were not adherent to treatment regimen[16] and lifestyle modification recommendations.[17]

Various studies revealed that adherence in the stroke risk group was influenced by many factors, including disease knowledge,[18] self-efficacy,[19] health beliefs and perceptions,[20] social support,[18,] and intention to adhere to recommended regimens.[21] However, people at risk of stroke still lack the intention to perform healthy behaviors.[22] Also, the knowledge of an intervention positively affecting health behaviors is limited. Studies in Thailand of people with a risk of stroke showed high knowledge but inadequate preventive behavior in non-adherence to medication[18] and lifestyle modification.[23] Thus, there is a need to incorporate the motivation factors that help people with a risk of stroke to adhere to treatment regimens and modification behaviors recommendations by health care professionals. Therefore, this study intended to develop and test the education program based on the Protection Motivation Theory among people at risk of stroke.

Conceptual Framework and Review of Literature

This study was guided by the Protection Motivation Theory (PMT).[24] The PMT posits that knowledge and prior experience activate threat appraisals and coping appraisals. The threat appraisals include perceived severity, which reflects how severe people think the threat to their own lives is, and perceived vulnerability, which involves how vulnerable people are to the conveyed threat. The coping appraisals consist of response efficacy, which describes how successful people think their coping strategy is in stopping the threat, and self-efficacy, which represents how confidently people feel they can use the coping mechanism.[24] These appraisals subsequently influence people's goal intentions (protection motivation), triggering the behaviors.[24] Therefore, providing knowledge and experiences related to stroke can motivate people at risk of stroke to make lifestyle modifications to avoid stroke when they are confident that lifestyle modification is effective in reducing stroke risk and that they can carry out the recommended behaviors.[25] As a result, they will develop an intention to perform stroke prevention and adhere to the recommended behaviors. A high level of adherence improves the effectiveness of lifestyle modification and pharmacological interventions, which then leads to better clinical outcomes.[13,14]

The PMT has been adopted in many prevention programs, including stroke risk groups. Various strategies have been used, including education and group discussion,[26,27] skill training,[26] verbal persuasion,[26] social support from family,[28] and telephone follow-up.[28] These programs demonstrated effectiveness in improving physical activity in adults with diabetes,[26] and stroke preventive behaviors among Thai adults with a high risk of stroke.[27] However, activities in the previous programs did not focus on the prior knowledge and beliefs about stroke, or personal experiences related to stroke by drawing upon the experience of stroke occurring to family members, friends, or others. Since individuals' experiences influence how they perceive and appraise threats, these strategies can stimulate fears[24] and motivate individuals to make lifestyle changes to improve their health.

Study Aim and Hypotheses

This study aimed to examine the effectiveness of the Protection Motivation Theory-based Education Program (PMT-BEP) on adherence to stroke prevention and clinical outcomes among people at risk of stroke. It was hypothesized that participants receiving the PMT-BEP would have better adherence to stroke prevention at 4, 12, and 20 weeks after the program and lower blood pressure and HbA1C at 12 weeks after the program than those receiving only usual care. After receiving the PMT-BEP, adherence to stroke prevention and clinical outcomes would be better than before receiving the PMT-BEP.

Methods

Design: This study was a randomized controlled trial (RCT) with two-arm pre-post-test parallel trial. The Consolidated Standards of Reporting Trials (CONSORT) was used to guide the report of this study.

Sampling and Settings: We calculated the sample size according to the power table for ANOVA for more than three groups mean test,[29] setting a .05 significance level and a 0.80 power. Due to the lack of similar studies in Thailand, we employed an effect size of 0.5.[29] The calculation formula was: "eta square equals the sum of squares between (SSb) divided by the total sum of squares (SSt), yielded 22 participants per group."[29,p.405] After adding 10% of the sample size for attrition,[29] our sample consisted of 29 participants per group, totaling 58 participants.

Multi-stage random sampling was employed for sample selection. First, using simple random sampling without replacement, we selected one district from the eight districts of a province in southern Thailand and then selected one sub-district from that district. Participants were purposively selected from a sub-district health-promoting hospital of the selected sub-district based on the inclusion criteria: 1) aged 35-59 years; 2) identified as having a moderate risk of stroke without history of stroke diagnosis as indicated in the Stroke Risk Scorecard; 3) cognitively intact with score of more than 23 points on the Thai Mental State Examination (TMSE);[30] 4) uncontrolled hypertension (blood pressure>140/90 mmHg measured twice weekly for three consecutive months, and uncontrolled diabetes mellitus (HbA1C 6.5% or higher); and 5) able to read and write Thai language. Exclusion criteria included mental illness and complications (i.e. diabetic foot ulcers and diabetic retinopathy). At first, we approached 100 people at risk of stroke, but 42 failed to meet the criteria. All participants remained until the end of the study. The final number used for data analysis was 29 participants per arm (**Figure 1**).

We used permuted block randomization to assign participants to the experimental arm and the control arm. We used 15 blocks of four participants and assigned two participants to the experimental arm and the control arm through random selection of one of six possible permutations, EECC, CCEE, ECEC, CECE, ECCE, and CEEC, until the number of four persons per arm was reached. The eligible participants were allocated into each arm using sequential numbers placed in sealed opaque envelopes.

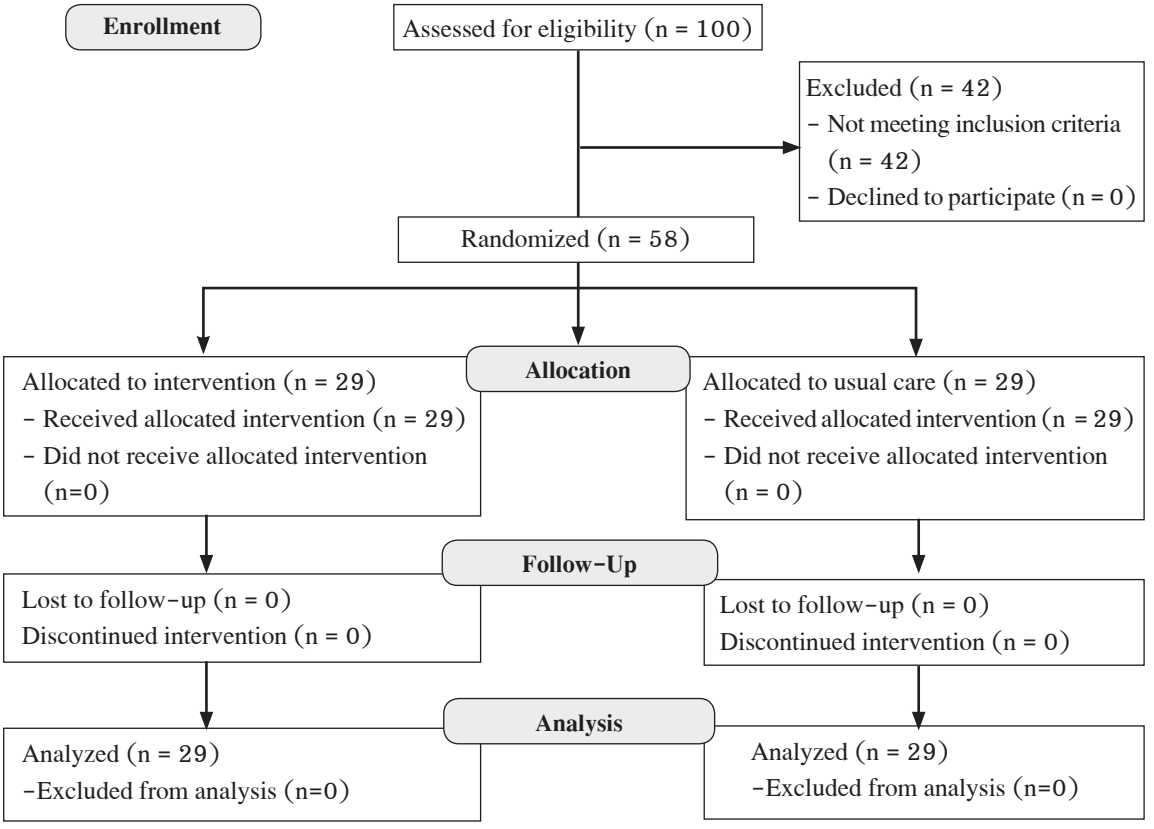


Figure 1. Flowchart of randomization

Ethical Considerations: Approval was obtained from the Faculty of Nursing Ethics Committee, Chiang Mai University (No. 018/2021) and Yala Provincial Public Health Office. All participants were provided with a detailed explanation of the study, the protection of their rights, and potential risks and benefits. Their participation was voluntary. Consent forms were signed by participants who agreed to participate.

Research Instruments: Data were collected using four instruments.

A Demographic Data Form was developed by the primary investigator (PI) to gather information about gender, age, body mass index (BMI), education level, marital status, religion, occupation, income, and duration since diagnosis of chronic diseases.

The Morisky Medication Adherence Scale (MMAS), developed by Morisky et al.,[31] was used with permission from Morisky Medication Adherence Research, LLC., who provided the Thai version of the scale. The MMAS contains eight items to evaluate medication-taking practices, such as forgetting to take a prescription or quitting because of adverse consequences. Items 1 through 7 have yes (0) or no (1) as response options. For item 8, a response is 0 (always) and 1 (never). An example item is: "When you travel or leave home, do you sometimes forget to bring along your medications?" The values from each item are added to obtain a sum score. The total possible score is between 0 and 8, with a higher score indicating higher adherence, with the cut-off points interpreted into optimal/high adherence (score of 8), medium adherence (score of 6 to < 8), and low adherence (score of < 6).[31] The Kuder-Richardson 20 was 0.70 in a pilot test with 15 people at risk of stroke and 0.72 in the actual sample.

The Adherence to Preventive Behavior Scale for Thai Persons with Prehypertension developed by Chukumnird[32] was modified by the PI with permission to assess lifestyle modification adherence. There are 65 items with three dimensions: 1) intentions and engagement in practicing preventive behaviors (26 items); 2) perseverance in performing preventive behavior (19 items); and 3) maintaining preventive behavior (20 items). The ratings for each item range from 0 (not at all true) to 4 (very true). Example item is: "I exercise for at least 30 minutes at a time." The total possible score ranges from 0 to 260, with a higher score indicating better adherence to stroke prevention.[32] The Scale Content Validity Index (S-CVI) was 0.98. The Cronbach's alpha was 0.92 in a pilot test with 15 people at risk of stroke and 0.96 in the sample.

An ALPK2-300VSN mercurial sphygmomanometer with a stethoscope was used to measure blood pressure. Blood pressure was measured on the non-dominant arm, with the arm placed on the same level as the heart. Blood pressure was measured twice, with a 1-minute interval. The values from both measurements were calculated to obtain a mean. A sub-district health-promoting hospital calibrated this tool to ensure its quality.

The Laboratory Test Recording Form was used to indicate HbA1C, tested by the laboratory of Yala Hospital. The results were read by a medical technologist responsible for examining and interpreting laboratory results. The results were reported at the physician's request and sent to the sub-district health-promoting hospital. HbA1C of 6.5 or higher indicates poor control of blood glucose level, while HbA1C of 6.4 or lower indicates good control of blood glucose level.[33]

Protection Motivation Theory-based Education Program (PMT-BEP)

The PMT-BEP was developed by the PI based on the PMT to enhance adherence to stroke preventive behavior and improve clinical outcomes (blood pressure and HbA1C) of people at risk of stroke, including knowledge provision and enhancing threat appraisals (perceived vulnerability and perceived severity), coping appraisals (response efficacy and self-efficacy), and goal intention. The program consisted of four weekly sessions for four consecutive weeks; each session took two hours (**Table 1**).

Usual care included the care activities provided at the sub-district health-promoting hospital for the group with stroke risk and an HbA1C test every three months to monitor uncontrolled diabetes.

Data Collection: Data were collected during March 2021. The PI screened the potential participants from the medical registry provided by a medical registrar. Participants were then approached face-to-face and selected purposively based on the inclusion criteria. After recruitment and random allocation into arms, an appointment was made for the experimental arm to attend the program on different days from the control arm. A pretest of stroke prevention adherence (medication adherence and lifestyle modification adherence) and clinical outcomes (blood pressure and HbA1C) was conducted in a meeting room of the selected sub-district health-promoting hospitals. Then, the experimental arm engaged in the PMT-BEP in addition to usual care. The control arm was given only usual care. The participants completed the questionnaires to measure prevention adherence at 4, 12, and 20 weeks after the program ended and were tested for clinical outcomes at 12 weeks after the program ended. To collect data, the PI recruited two research assistants (RAs) who were nurses working in the hospital and trained them on how to administer the questionnaires and check for completeness of data. The double-blind method was used to prevent participants from knowing the allocation results by carrying out activities for each arm on separate days and to prevent the RAs from knowing in which arm the participants were.

Data Analysis: Demographics were analyzed with descriptive statistics (percentage, mean, and standard deviation) and compared with an independent t-test, Chi-square test, and Fisher's exact test. Using mixed model ANOVA, we compared stroke prevention adherence and clinical outcomes between arms. Before analysis, all statistical assumptions were tested using the Kolmogorov-Smirnov and Levene's tests, and the results revealed normal distribution and homogeneity of variance, respectively. Mauchly's Test of Sphericity yielded a p-value of < .001 for stroke prevention adherence, which was lower than the acceptable value of 0.05,[34] indicating a violation of sphericity. Therefore, we adjusted the degrees of freedom with Greenhouse-Geisser Epsilon.[34]

Results

Most participants in the experimental and control arms were female, with similar mean age and BMI. Most participants in both arms had elementary education and were married and Muslim. About one-third of the experimental arm were unemployed, with a mean monthly income of 4,948.28 baht (143.85 USD), while about a quarter of the control arm were general laborers and merchants, with a mean monthly income of 6,895.86 baht (200.46 USD). The time since diagnosis with hypertension and diabetes was 1-10 years. The mean HbA1C of the experimental arm and control arm were 9.32% and 9.31%, respectively. We observed no significant differences between arms in demographic and clinical characteristics (**Table 1**).

Table 1. Demographic characteristics of participants (n = 58)

Demographic	Experimental arm (n = 29)		Control arm (n = 29)		p-value
	n	%	n	%	
Gender					.202[b]
Male	6	20.7	11	37.9	
Female	23	79.3	18	62.1	
Age (years)	Mean = 51.90, SD = 5.49		Mean = 51.69, SD = 4.49		.881[t]
Min-Max	39-59		37-59		
35-40	3	10.3	1	3.4	
41-45	1	3.4	1	3.4	
46-50	6	20.8	7	24.8	
51-55	10	34.5	16	54.6	
56-60	9	31.0	4	13.8	
BMI (kg/m^2)	Mean = 26.42, SD = 5.34		Mean = 26.21, SD = 4.20		.878[t]
Min-Max	19.46-35.42		20.78-34.45		
18-22.9	7	24.8	7	24.8	
23-24.9	4	13.6	5	17.2	
25-29.9	12	41.2	9	30.7	
> 30	6	20.4	8	27.3	
Education level					.745[a]
Elementary school	21	72.4	22	75.9	
Secondary school	8	27.6	7	24.1	
Marital status					.694[a]
Single	1	3.4	-	-	
Widowed	4	13.8	5	17.2	
Divorced	1	3.4	-	-	
Separated	2	6.9	1	3.4	
Married	21	72.5	23	79.4	
Religion					.537[b]
Buddhism	1	3.4	9	31.0	
Islam	28	96.6	20	69.0	
Occupation					.753[a]
Agriculturist	2	6.9	1	3.4	
General laborer	8	27.7	9	31.1	
Merchant	7	24.1	9	31.1	
Business owner	1	3.4	3	10.3	
Unemployed	11	37.9	7	24.1	

Table 1. Demographic characteristics of participants (n = 58) (Cont.)

Demographic	Experimental arm (n = 29)		Control arm (n = 29)		p-value
	n	%	n	%	
Monthly income in baht (USD)	Mean = 4,948.28 (143.85) SD = 3,378.88		Mean = 6,895.86 (200.46) SD = 893.96		.184[t]
< 5,000 (145.35)	21	72.4	20	69.0	
5,001-10,000 (145.35-290.70)	6	20.7	6	20.7	
10,000-15,000 (290.70-436.05)	2	6.9	3	10.3	
Duration since diagnosis chronic diseases					
Hypertension (years)					.550[t]
Min-Max	1-37		2-25		
1-10	24	82.8	25	86.2	
> 10	5	17.2	4	13.8	
Diabetes (years)					.267[t]
Min-Max	1-23		1-25		
1-10	18	62.1	25	86.2	
> 10	11	37.9	4	13.8	
Dyslipidemia (years)					.317[t]
Min-Max	1-20		3-18		
1-10	7	24.2	17	58.7	
> 10	1	3.4	2	6.8	
No	21	72.4	10	34.5	
HbA1C (%)	Mean = 9.32, SD = 1.51		Mean = 9.31, SD = 2.00		509[t]
Range	6.9-14.2		7.2-16		
6.5-7.9	10	34.6	11	37.9	
8.0-9.9	11	37.9	12	41.4	
10.0-11.9	5	17.2	4	13.8	
> 12.0	3	10.3	2	6.9	

Note. [a] =Chi-square test; [b] = Fisher's Exact test; [t] = Independent sample t-test

Adherence to stroke prevention was assessed in terms of lifestyle modification adherence and medication adherence. No significant differences between the experimental and control arms were found in lifestyle modification and medication adherence at baseline. However, lifestyle modification and medication adherence scores were significantly different between arms at 4, 12, and 20 weeks after the program ended (**Table 2**). The between-group effect size was 1.02 for medication adherence and 1.30 for lifestyle modification adherence, with the actual effect size of 0.80. No significant differences were observed in the mean scores of lifestyle modification adherence and medication adherence between arms and between each point of measurement in each arm. Moreover, the time-group interaction was also significant (**Table 3**); therefore, an independent t-test was used to demonstrate the interactions over time (**Figures 1 and 2**). In the experimental arm, significant differences in lifestyle modification adherence and medication adherence scores were found between each measurement point (**Table 4**).

Clinical outcomes included blood pressure level (systolic and diastolic blood pressure) and blood glucose level (HbA1C). There were no significant differences in the systolic and diastolic blood pressure and HbA1C between the experimental and control arms at baseline (**Table 2**). Twelve weeks after the program ended, significant differences

were found in the systolic and diastolic blood pressure and HbA1C between arms (**Table 2**). Within groups, the experimental arm's systolic and diastolic blood pressure levels at 12 weeks after the program ended were significantly lower than baseline. HbA1C of the experimental arm 12 weeks after the program ended was significantly lower than baseline. In contrast, no significant difference was found in the control arm's blood pressure level and HbA1C between baseline and 12 weeks after the program ended (**Table 5**).

Table 2. Comparisons of lifestyle modification adherence, medication adherence, systolic and diastolic blood pressure, and HbA1C between the control and experimental arms at each point of measurement

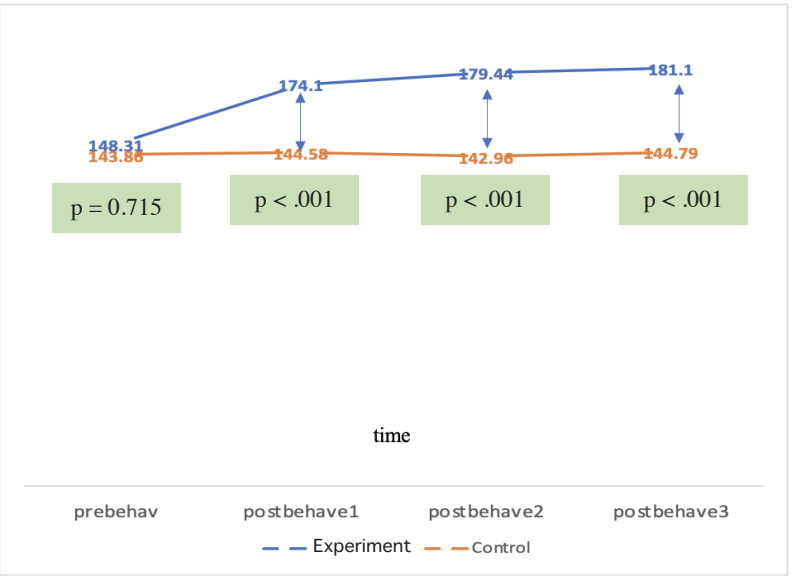
Variable	Time	Group	Mean difference	Std. error	p-value	95% Confidence Interval for difference	
						Lower bound	Upper bound
Lifestyle modification adherence	Baseline	Experimental - Control	4.448	12.128	0.715	-19.847	28.744
	4 weeks after program	Experimental - Control	29.517	5.351	< .001	18.797	40.237
	12 weeks after program	Experimental - Control	36.483	3.867	< .001	28.736	44.229
	20 weeks after program	Experimental - Control	36.310	7.015	< .001	22.257	50.363
Medication adherence	Baseline	Experimental - Control	0.724	0.461	0.122	-0.199	1.647
	4 weeks after program	Experimental - Control	2.448	0.287	< .001	1.874	3.022
	12 weeks after program	Experimental - Control	3.414	0.297	< .001	2.818	4.009
	20 weeks after program	Experimental - Control	3.084	0.172	< .001	2.741	3.428
Systolic blood pressure	Baseline	Experimental - Control	-1.660	5.550	0.766	-12.770	9.460
	12 weeks after program	Experimental - Control	-26.000	4.250	< .001	-34.520	-17.480
Diastolic blood pressure	Baseline	Experimental - Control	-0.100	1.720	0.952	-3.550	3.340
	12 weeks after program	Experimental - Control	-6.140	2.260	0.009	-10.660	-1.610
HbA1C	Baseline	Experimental - Control	0.310	0.470	0.509	-0.620	1.250
	12 weeks after program	Experimental - Control	-2.640	0.430	< .001	-3.520	-1.780

Note. Lifestyle modification adherence and medication adherence using Bonferroni Test;
Systolic blood pressure, diastolic blood pressure, and HbA1C using independent t-test

Table 3. The difference in lifestyle modification adherence and medication adherence between the control and the experimental arms at each point of measurement

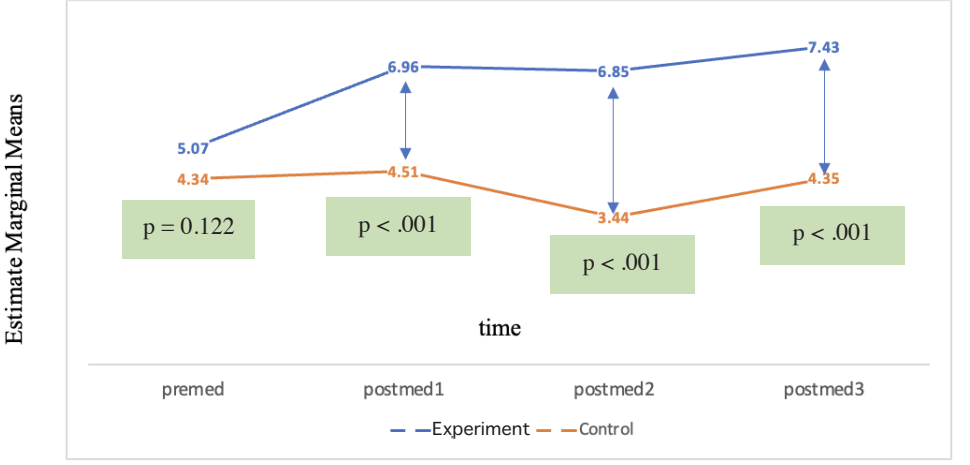
Variables	SS	df	MS	F^r	p-value	η^2
Lifestyle Modification Adherence						
Between subject						
Group	10,328.897	1	10,328.897	54.892	< .001	0.993
Error	10,537.358	56	188.167			
Within-subject						
Time	10,269.483	1.960	5,240.582	3.768	0.027	0.063
Time x Group	10,021.483	1.960	5,114.026	3.677	0.029	
Error	152,641.534	109.738	1,390.963			
Medication Adherence						
Between subject						
Group	84.755	1	84.755	242.489	< .001	0.812
Error	19.573	56	0.350			
Within-subject						
Time	20.161	2.274	22.875	11.355	< .001	0.169
Time x Group	61.936	2.274	27.461	13.632	< .001	
Error	256.420	127.321	2.014			

Note. ^{r} = Mixed Model ANOVA using the p-value from the Greenhouse-Geisser correction



Note. Independent t–test

Figure 1. Comparison of mean differences in lifestyle modification adherence between the experimental and control arms at each point of measurement



Note. Independent t–test

Figure 2. Comparison of mean differences in medication adherence between the experimental and control arms at each point of measurement

Table 4. Multiple pairwise comparisons of lifestyle modification adherence and medication adherence scores of the experimental arm at each point of measurement

Variables	Time	Mean	Mean difference	p-value
Lifestyle modification adherence	1-2	148.31 – 174.10	-25.793	.003
	1-3	148.31 – 179.44	-31.138	.002
	1-4	148.31 – 181.10	-32.793	.001
	2-3	174.10 – 179.44	-5.345	1.000
	2-4	174.10 – 181.10	-7.000	1.000
	3-4	179.44 – 181.10	-1.655	1.000
Medication adherence	1-2	5.06 – 6.96	-1.897	< .001
	1-3	5.06 – 6.85	-1.784	< .001
	1-4	5.06 – 7.43	-2.362	< .001
	2-3	6.96 – 6.85	0.112	1.000
	2-4	6.96 – 7.43	-0.466	< .001
	3-4	6.85 – 7.43	-0.578	< .001
Lifestyle modification adherence	1-2	148.31 – 174.10	-25.793	.003
	1-3	148.31 – 179.44	-31.138	.002
	1-4	148.31 – 181.10	-32.793	.001
	2-3	174.10 – 179.44	-5.345	1.000
	2-4	174.10 – 181.10	-7.000	1.000
	3-4	179.44 – 181.10	-1.655	1.000
Medication adherence	1-2	5.06 – 6.96	-1.897	< .001
	1-3	5.06 – 6.85	-1.784	< .001
	1-4	5.06 – 7.43	-2.362	< .001
	2-3	6.96 – 6.85	0.112	1.000
	2-4	6.96 – 7.43	-0.466	< .001
	3-4	6.85 – 7.43	-0.578	< .001

Note. The significance level of the post hoc test using the Bonferroni correction is p < .008.

Table 5. Within-group comparison of clinical outcomes (blood pressure and HbA1C levels) of the experimental and the control arms between baseline and post-test (n = 58)

Variable	Experimental arm (n = 29)		t	p-value	Control arm (n = 29)		t	p-value
	Baseline	12 weeks			Baseline	12 weeks		
	Mean (SD)	Mean (SD)			Mean (SD)	Mean (SD)		
Systolic	156.79 (23.80)	130.17 (18.08)	6.113	< .001	154.80 (20.08)	158.44 (18.04)	.298	.766
Diastolic	90.06 (6.68)	74.48 (10.55)	2.717	.009	90.17 (6.42)	80.62 (6.05)	.606	.952
HbA1C	9.32 (1.51)	6.46 (1.14)	.082	< .001	9.01 (2.00)	9.11 (2.03)	.327	.509

Discussion

Our findings showed that PMT-BEP improved stroke prevention and medication adherence, lowering blood pressure and HbA1C. The findings supported the research hypotheses and were consistent with the study framework.[24]

In our study, the educational activities were designed to increase the participants' threat appraisal (perceived severity and perceived vulnerability) and coping appraisal (response efficacy and self-efficacy), which led to the goal intention to adhere to stroke prevention. Knowledge and experience related to stroke were enhanced using discussions on stroke occurrence among family members, friends, or persons in the same community. People's previous experiences with threatening situations or the utilization of protective approaches influence their knowledge of prospective risks, perceptions of dangers, and possible defensive responses.[24] Participants assessed this information to decide to perform a protective behavior in response to stroke risk. We also fostered the perceived severity of stroke by having an adult stroke patient share prior experiences with stroke regarding negative impacts on his life, asking the stroke risk group to discuss the possible impacts of stroke on themselves, and giving verbal persuasion to increase the perceived severity of stroke. Similarly, the perceived severity of stroke was associated with more engagement in preventive behaviors.[35] Then, perceived vulnerability to stroke was enhanced by having the participants reflect on their results on the Stroke Risk Scorecard to increase their awareness, which helped arouse fear about stroke. Our participants were classified as having a moderate risk of stroke, making them afraid of the consequences of stroke that could occur to them and aware that they needed to change their behaviors. If those at risk believe they have a higher chance of getting sick or that the illness will have catastrophic consequences, they are more inclined to change their behavior.[24]

Moreover, response efficacy was promoted through education about effective stroke prevention (medication taking, proper diet, exercise, stress management, and alcohol and smoking cessation) with the demonstration of a food model and exercise coaching, which helped the participants perceive the effectiveness of these behaviors in preventing stroke. Consistently, another program engaged the participants in education and multimedia about approaches to recurrent stroke prevention and their benefits, increasing confidence in the effectiveness of such approaches.[36] For self-efficacy, a role model shared their experience of successful stroke prevention, which helped to trigger self-efficacy and a sense of responsibility to modify health behavior to prevent stroke[37] and increase adherence to preventive behaviors of recurrent stroke.[36] Moreover, participants engaged in shared experiences about their efforts in stroke prevention and planned to change behaviors, which helped them put positive intentions into action.[38] They also received verbal persuasion throughout the program. Verbal persuasion increases persons' belief about their capability to perform health behaviors and strengthens their sense of empowerment to perform health behaviors to control the disease.[26] These strategies contributed to the intention to perform stroke prevention, as observed by their commitment to maintaining proper behaviors and adhering to stroke prevention.

Better adherence to stroke prevention directly contributed to better clinical outcomes (lower blood pressure and HbA1C levels). The experimental arm obtained education about effective stroke prevention through medication taking, proper diet, exercise, stress management, and alcohol and smoking cessation, which might lead them to understand what they needed to do to improve their health behaviors to control their conditions. Therefore, they could better perform recommended behaviors to control blood pressure and HbA1C. Managing diabetes and hypertension involves changes in lifestyle, including diet, physical activity, and pharmacotherapy to achieve blood pressure and

blood sugar control. Adherence to prescribed medications and lifestyle modifications, such as healthy eating, quitting smoking, exercising, and reducing alcohol consumption, efficiently lowers blood pressure[39] and HbA1C.[40] However, it should be noted that we did not collect data on the participants' current medication regimens, which might have contributed to the changes in their blood pressure and HbA1C. Thus, the results need to be interpreted with caution.

Consistent with our findings, previous studies showed that education programs based on the PMT could improve stroke prevention adherence and reduce blood pressure and HbA1C levels among people at risk of stroke in Thailand[28] and Iran.[26]

Limitations

This study had limitations in that it was conducted in one community setting, which might limit the generalizability of findings to the target population. Further study should test the effectiveness of the program in other settings to broaden the findings.

Conclusions and Implications for Nursing Practice

Our findings demonstrate the effectiveness of the PMT-BEP in enhancing adherence to stroke prevention and improving clinical outcomes. Nurses can integrate PMT-BEP into the outpatient nursing practice for people at risk of stroke, especially those with hypertension and diabetes who have not been identified as people at risk of stroke, to provide specific primary prevention of stroke. Nurses can adopt the PMT-BEP to assess and promote stroke risk group's intention for stroke prevention to increase their motivation for adherence to stroke prevention, which can also improve clinical outcomes.

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Appendix

Table 1. The PMT-BEP

Week	Objectives	Strategies	Activities
1	To enhance knowledge and experience related to stroke of stroke risk group	Group education Feedback Group discussion	Group session components: Show PowerPoint presentation and multimedia of stroke Conduct a group discussion for participants to share their prior experience about stroke (e.g., experience of stroke in family members, friends, or persons in the same community) Ask participants to share their prior knowledge and beliefs about stroke Give feedback on the correct and incorrect knowledge and beliefs Provide a manual of adherence to stroke prevention and education about stroke (causes, symptoms, treatments, and prevention)
2	To increase perceived severity of stroke in the stroke risk group	Group education Group discussion Verbal persuasion Situation learning	Group session components: Provide education using PowerPoint presentation and multimedia to raise awareness of the impact of stroke Ask participants to discuss and share their opinion about what they have learned Invite an adult stroke patient to share prior experience about stroke regarding negative impacts on his/her life Ask participants to discuss possible impacts of stroke on themselves Give verbal persuasion to increase perceived severity of stroke
	To increase perceived vulnerability of stroke in the stroke risk group (Week 2)	Group education Group discussion Situation learning	Group session components: Ask participants to complete the Stroke Risk Scorecard Form Provide education using PowerPoint presentation and multimedia about risk factors of stroke Ask participants to discuss about their current stroke risk factors by referring to the results of the Stroke Risk Scorecard to stimulate awareness of their stroke risk Give verbal persuasion to increase perceived vulnerability
3	To enhance response efficacy of stroke risk group	Group education Coaching Demonstration Role model Group discussion Recommendation Verbal persuasion Emotional arousal	Group session components: Provide education about effective stroke prevention (medication taking, proper diet, exercise, stress management, and alcohol and smoking cessation) using PowerPoint presentation and multimedia Demonstrate food model as a part of nutrition education Give exercise coaching Ask participants to evaluate the benefits and effectiveness of medication taking, proper diet, exercise, stress management, and alcohol and smoking cessation in group discussion Give verbal persuasion

Table 1. The PMT-BEP (Cont.)

Week	Objectives	Strategies	Activities
	To enhance self-efficacy of stroke risk group	Role model Verbal persuasion Emotional arousal	Group session components: Ask participants to exercise and review the prevention as instructed in the previous session Invite a role model who was an adult stroke patient to share experiences about successful stroke prevention and favorable outcomes Conduct a group discussion for participants to share their experiences about their effort to adopt stroke prevention and talk about their plan to change behaviors Recommend solutions to potential barriers to adherence to stroke prevention Give verbal persuasion to increase self-confidence in adopting and adhering to stroke prevention Ask participants to perform stroke prevention at home and record in the behavior record form at the end of the manual
4	To enhance stroke goal intention	Group discussion Verbal persuasion	Conduct a group discussion to review lessons learned from previous sessions Provide group counselling about problems and barriers to stroke prevention Give verbal persuasion to perform stroke prevention and have participants commit to performing stroke prevention

ผลของโปรแกรมการให้ความรู้ตามทฤษฎีแรงจูงใจในการป้องกันโรคในผู้ที่เสี่ยงต่อโรคหลอดเลือดสมอง : การทดลองแบบสุ่มและมีกลุ่มควบคุม

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บทคัดย่อ: โรคหลอดเลือดสมองเป็นปัญหาสุขภาพที่สำคัญที่ทำให้เกิดการตายและความพิการของประชากรโลก ผู้ที่เสี่ยงต่อโรคหลอดเลือดสมองจำเป็นต้องจัดการปัจจัยเสี่ยงของโรคหลอดเลือดสมอง และการปฏิบัติตามแนวทางป้องกันโรคหลอดเลือดสมองเป็นกุญแจสู่ความสำเร็จเพื่อผลลัพธ์ทางคลินิกที่ดีขึ้น โดยเฉพาะระดับน้ำตาลในเลือดและความดันโลหิต การวิจัยเชิงทดลองแบบสุ่มและมีกลุ่มควบคุมนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมการให้ความรู้ตามทฤษฎีแรงจูงใจในการป้องกันโรคต่อความร่วมมือในการป้องกันโรคหลอดเลือดสมองและผลลัพธ์ทางคลินิกในผู้ที่เสี่ยงต่อโรคหลอดเลือดสมอง กลุ่มตัวอย่างเป็นผู้ใหญ่ที่รับบริการที่คลินิกเบาหวานและความดันโลหิตสูงที่โรงพยาบาลส่งเสริมสุขภาพตำบลของจังหวัดในภาคใต้ของประเทศไทยจำนวน 58 คน คัดเลือกโดยใช้การสุ่มตัวอย่างแบบหลายขั้นตอนและสุ่มเข้ากลุ่มสองกลุ่ม กลุ่มทดลองได้รับโปรแกรมการให้ความรู้ตามทฤษฎีแรงจูงใจในการป้องกันโรค 4 สัปดาห์ (n = 29) และกลุ่มควบคุมได้รับการดูแลตามปกติอย่างเดียว (n = 29) เก็บข้อมูลโดยใช้แบบบันทึกข้อมูลประชากร แบบวัดความร่วมมือในการรับประทานยาของโมริสกี้ แบบวัดความร่วมมือในพฤติกรรมการป้องกันสำหรับคนไทยที่มีความเสี่ยงเป็นโรคความดันโลหิตสูง เครื่องวัดความดันชนิดปรอท และแบบบันทึกผลการตรวจน้ำตาลในเลือดทางห้องปฏิบัติการ วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา การทดสอบความแปรปรวนแบบผสม และสถิติทีอิสระ

ผลการวิจัยพบว่ากลุ่มทดลองมีความร่วมมือในการป้องกันโรคหลอดเลือดสมองสูงกว่ากลุ่มควบคุม และมีความดันโลหิตและระดับน้ำตาลในเลือดต่ำกว่ากลุ่มควบคุม หลังจากได้รับโปรแกรมการให้ความรู้ตามทฤษฎีแรงจูงใจในการป้องกันโรค กลุ่มทดลองมีความร่วมมือในการป้องกันโรคหลอดเลือดสมองสูงขึ้น มีระดับความดันโลหิตลดลงและระดับน้ำตาลในเลือด (ระดับ HbA1C) ลดลงกว่าก่อนได้รับโปรแกรม ข้อค้นพบเป็นหลักฐานเชิงประจักษ์ที่พยาบาลสามารถใช้เพื่อช่วยเหลือผู้ที่เสี่ยงต่อโรคหลอดเลือดสมองให้ควบคุมความเสี่ยงของโรคหลอดเลือดสมองได้

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