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Original Article

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Effect of community-based intervention on self-management of blood pressure among hypertensive adults: findings from the Communities for Healthy Hearts Quasi-experimental Study in Vietnam

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ABSTRACT

Background: Hypertension is one of the leading causes of cardiovascular diseases and deaths globally. Controlling blood pressure is the key factor to reduce clinical events. The current study aims to evaluate the effects of Communities for Healthy Hearts intervention in improving the self-management of blood pressure among hypertensive patients.
Methods: From October 2017 to September 2019 a quasi-experimental study was implemented in the intervention and control districts of Ho Chi Minh City, Vietnam. 2,701 hypertensive adults (1,315 in the intervention group and 1386 in the control group) were interviewed at the onset and for four rounds of follow-up after the intervention. Self-management of blood pressure was assessed via the utilization of self-management tools, including blood pressure monitors, diaries and practical guidelines. Random slope mixed-effects models with propensity matching method were employed to evaluate the effectiveness of the project and identified factors related to self-management.
Results: The percentage of hypertensive adults who self-managed blood pressure increased in both intervention and control groups, although the increase in the intervention group was 8.5% higher. Compared to the difference in self-management of blood pressure between the intervention and control group at baseline, significant increase in intervention effects was observed at round three and four of follow-up, with odds ratio (OR), 1.77 (95% confidence interval [CI], 1.24–2.52) and 1.48 (95% CI, 1.00–2.18), respectively. As compared to housewives and non-smokers, freelance workers and current smokers had a lower likelihood of self-management of blood pressure whereas, higher age, higher education, and being obese were protective factors.
Conclusion: The Communities for Healthy Hearts intervention improved the self-management of blood pressure among hypertensive adults via the utilization of blood

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Conflict of Interest

The authors declare that they have no competing interests. This paper is one of the 4 study series under the evaluation of Communities for Healthy Hearts program in Ho Chi Minh City, Viet Nam.

Author Contributions

Conceptualization: Khuong QL, Adler AJ, McGuire H, Hoang VM; Data curation: Bui PL, Tran TA, Le MD, Nguyen TD, Hoang HH, Tran TN, Nguyen BN, Tran TP, Nguyen TNP, Nguyen TV, Do VV; Formal analysis: Khuong QL; Funding acquisition: Shellaby JT, Hoang VM; Methodology: Khuong QL, Bui PL, Adler AJ, McGuire H, Tran TN, Hoang VM; Project administration: Bui PL, Adler AJ, Shellaby JT, McGuire H, Bui VT, Tran TN, Nguyen BN, Hoang VM; Resources: Bui PL, McGuire H, Bui VT, Tran TN; Supervision: Adler AJ, Tran TN, Hoang VM; Visualization: Khuong QL; Writing - original draft: Khuong QL; Writing - review & editing: Bui PL, Adler AJ, Shellaby JT, Aerts A, McGuire H, Bui VT, Tran TA, Le MD, Nguyen TD, Hoang HH, Tran TN, Nguyen BN, Tran TP, Nguyen TNP, Nguyen TV, Do VV, Hoang VM.

pressure self-management tools. More attention is needed for hypertensive adults who are 40–49 years old, participants with only primary education or below, and current smokers.

Keywords: Hypertension; Self-management; Communities for healthy hearts; Quasi-experimental; Vietnam

INTRODUCTION

Hypertension is one of the leading causes of cardiovascular diseases (CVD) and CVD-related deaths globally. In 2019, the global burden of hypertension was approximately 1.13 billion people worldwide who had raised blood pressure (BP).[1,2] In 2016, non-communicable diseases (NCDs) accounted for 40.5 million; 17.9 million or 44% of NCDs-related deaths were due to CVD with hypertension as the leading risk factor.[3,4] Prevention of hypertension is critically important, and effective management is vitally important for the large and rapidly growing number of individuals impacted worldwide.

Controlling blood pressure by medication, adherence to treatment regimens including follow up appointment, and lifestyle changes is a key factor for reducing clinical events. A blood pressure reduction is one the most effective interventions to prevent both primary and secondary strokes.[5,6] However, since hypertension treatment is a long-term treatment and needs strict adherence, patients often fail to achieve the targeted BP (i.e. blood pressure < 140/90 mmHg).[7,8] Self-management tools, which include BP monitors, BP diaries, and practical guidelines, are developed to support patients on their treatment and lifestyle changes based on personal provision of hypertension information. Some studies have shown that self-management of BP plays an important role in achieving the targeted BP,[9,12] through BP recognition, which may lead to improved adherence to treatment and control. A meta-analysis of 37 randomized control trials found that compared with clinic-based measurements, home-based BP monitoring improves the systolic blood pressure (SBP) with −2.63 mm Hg and diastolic blood pressure (DBP) with −1.68 mm Hg. Moreover, self-BP monitoring was associated with less therapeutic inertia defined as unchanged medication despite elevated BP (relative risk for unchanged medication, 0.82).[9] Another meta-analysis indicated that mean BP was 4.4 mmHg lower among patients who did self BP monitoring compared to those who had standard blood pressure monitoring in the healthcare system.[13]

To respond to the rising tide of NCDs, and hypertension as a key risk factor for cardiovascular disease, the Novartis Foundation, PATH, and the Ho Chi Minh City (HCMC) Provincial Health Department partnered to implement the Communities for Healthy Hearts program in HCMC, Vietnam, an innovative health service delivery model to address hypertension in underserved communities. The goal of Communities for Healthy Hearts was to improve BP control and management among adults in Vietnam by increasing accessibility of community-based hypertension services that are sustainable and scalable. The objective of this paper is to evaluate the effects of the Communities for Healthy Hearts intervention in improving the self-management of BP among hypertensive patients enrolled in the Communities for Healthy Hearts project.

METHODS

Study setting and participants

Study design

The study was a quasi-experimental study, with 5 repeated measurements.

Setting

The study was conducted in HCMC, Vietnam from November 2017 to September 2019. HCMC is the largest city in the south of Vietnam with a population of about 8.6 million in 2018.[14] In the Communities for Healthy Hearts program, Thu Duc and Go Vap districts were selected to implement the intervention. Therefore, we recruited participants from these two districts as the intervention group in this study. Binh Tan district, where Communities for Healthy Hearts was not implemented, was selected as a control site in this quasi-experimental study. Both Thu Duc and Go Vap districts were selected because they were classified as semi-urban districts. This was the same for Binh Tan district, which had similar socio-economic and health system characteristics and was relatively far away distance-wise from the intervention districts.

Participants

Eligibility criteria for inclusion were 1) residents of one of the research districts, 2) aged between 40 and 69 years, 3) previous diagnosis of hypertension by a health professional or have SBP ≥ 140 mmHg or DBP ≥ 90 mmHg. Exclusion criteria were 1) a history of stroke, 2) diagnosed with diabetes mellitus, 3) a secondary cause of hypertension, 4) a medical condition likely to limit survival to less than 3 years, and 5) pregnancy, trying to become pregnant, or of child-bearing potential and not using birth control.

Description of the Communities for Healthy Hearts intervention

The Communities for Healthy Hearts program introduced an innovative health care delivery model that was designed to improve hypertension self-management and control. **Fig. 1** shows the full model that engages the community, public health services from primary health care to district levels, health authorities at the provincial level, and the private sector. Self-management of BP was implemented by introducing, encouraging and monitoring the utilization of BP self-management tools, which included a BP monitor, BP diary, mobile applications, and software.

Its first aim was to increase knowledge of hypertension of people over 40. The program utilized a range of communications outlets and developed an online social and behavior change communication (SBCC) campaign. In 2016, Communities for Healthy Hearts' behavior change communication contents was developed based on the national and international best practices regarding communication strategies on NCD/hypertension control; results from the audience assessment, and feedback by stakeholders and local partners, including district PMC staff, and community health stations (CHSs) workers in HCMC. Over a three-year period, with the main messages of 'Act Early for a Healthy Heart' and the 'Follow Treatment Plans for a Healthy Heart', the function of SBCC campaign was to augment utilization of hypertension screening services, adherence to treatment, and adoption of healthy lifestyle behaviors. In addition, the program included training and offering equipment of health workers, collaborators and BP-checkpoint volunteers to conduct face-to-face communication, and small health talks, and community events in districts and a large-scale event on World Hypertension Day at the city level.

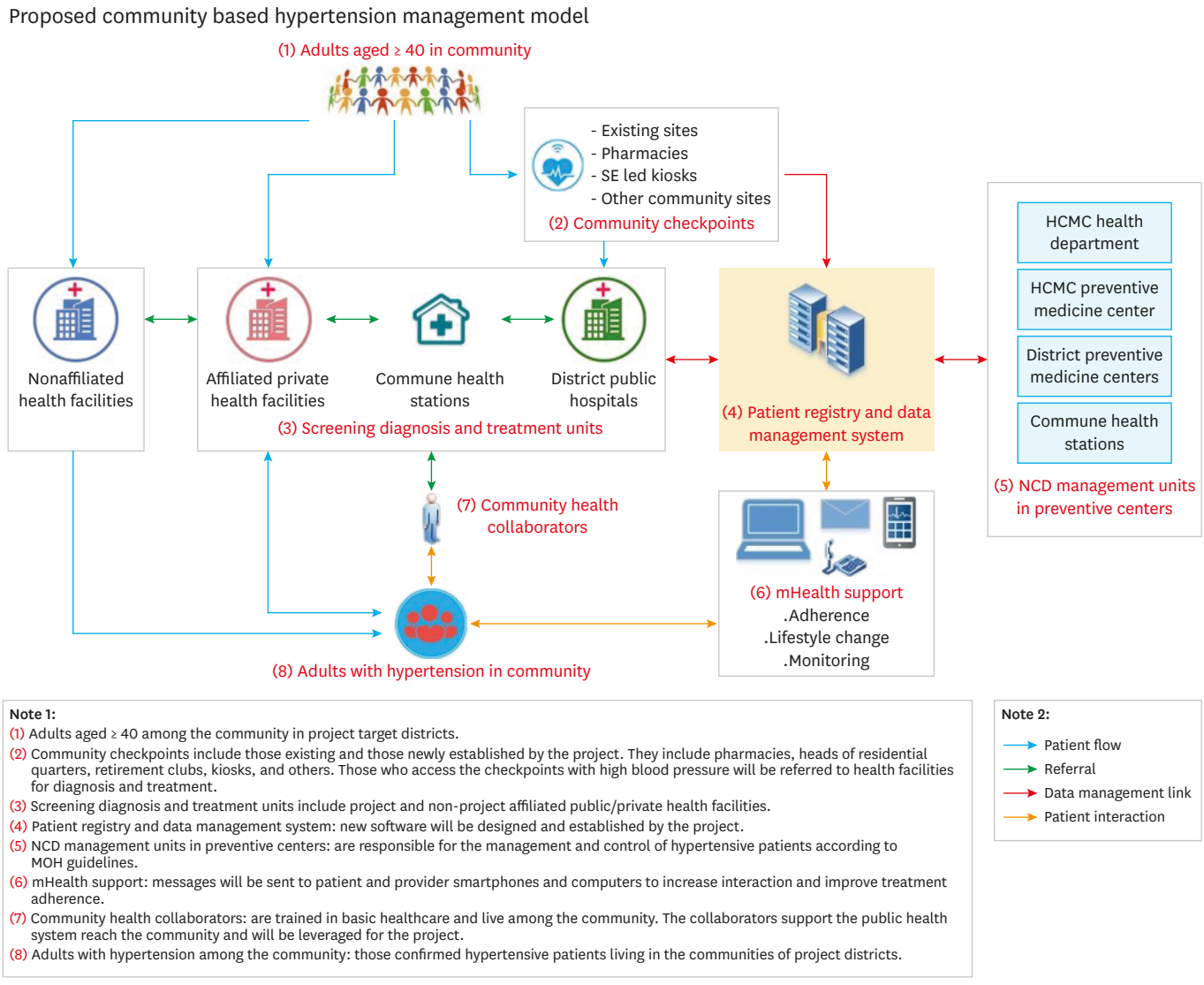

Fig. 1. Description of the Communities for Healthy Hearts health care delivery model.

Second, to optimize opportunities for BP measurement, refer high BP people to healthcare facilities for diagnosis and treatment as well as provision of continuous cares and supports of hypertension people in targeted intervention districts, the Communities for Healthy Hearts program established a network of collaborators (called case managers), volunteers, and nontraditional outlets (called as checkpoints) to offer free BP measurement, counseling, and referrals through "*checkpoints*", continuum of care through "*case managers*". Case managers were from existing health collaborators, members of official community organizations, or leader of the residential group while checkpoints included pharmacies, local authority offices, local people's houses, and temples that were voluntary to participate the Communities for Healthy Hearts program. Each sub-ward had one collaborator and three checkpoints. Collaborators had functioned as checkpoints first, then follows up with patients and assisted checkpoints. They were supervised by a staff member of CHSs that coordinate all project activities at the ward of about 10–15 sub-wards. Community checkpoints and collaborators provided hypertension counseling and BP checks at local meeting and events,

screening sites were established in pharmacy chains, and their houses and also home visits. These nontraditional outlets included pharmacies, community centers, and high traffic places such as residential group leader's homes, or manicure saloons, and other places.

Third, the program strengthened the capacity of CHSs, public and private hospitals (providers), and community networks to offer high-quality diagnosis, treatment, and management of hypertension cases based on the Ministry of Health and World Health Organization guidelines through training courses, learning forums and supportive supervision systems.

Fourth, the program focused on empowering patients and their families to take more responsibility in managing their own health (self-care), to increase medication adherence, and adopt healthy behavioral changes via increased physical activity and improved nutrition. This included: 1) free BP checks, one-on-one patient counseling and support by community collaborators; communication tools, such as BP diary (BP self-management tools), leaflets 2) supportive tools such as SMS reminders for those on treatment and care plans. PATH and clinical experts developed the contents for SMS (mHealth), included importance of BP control, positive behaviors that reduce the risk of hypertension and dealing with hypertensive emergency. SMS reminders were automatically delivered to registered patients at 7 am every Wednesday; and 3) system tools (digital registry 'eHTN Tracker') to enable Preventive Medical Centers and Communities for Healthy Hearts program managers to track the coverage and retention of hypertensive patients, while also allowing health workers in CHSs, the private sector, and hospitals to enter their medical administrative records, and lists of patients.

Finally, the Communities for Healthy Hearts' program overarching goal was to pioneer and validate new ways to improve awareness, early detection, treatment, and management of hypertension in Vietnam for the eventual adoption by the Vietnamese health authorities. As such, a key component of the program was to collect outcomes data and generate evidence of the model to advocate for the replication and scale-up of successful approaches, and to inform policies that would lead to improved and comprehensive hypertension management in Vietnam.

Variables

Outcome

The main outcome of interest in this paper was the proportion of hypertensive adults who self-managed BP. This outcome was evaluated by the utilization of BP self-management tools (yes or no). The same multiple-choice questions were used for five rounds of the survey to ask about whether participants used any of BP monitoring tools, which included: BP monitors, BP diaries, and practical guidelines to support hypertensive BP treatment.

This was the outcome for BP management of the Communities for Healthy Hearts intervention. The outcome on BP measurement (i.e., SBP, DBP, controlled BP) will be described in another paper.

Independent variables

Independent variables included demographic factors including age, gender (male, female), marital status (currently married, others), ethnicity (Kinh, others), education (primary, secondary, high school), and occupation (business, retired, housewife, industrial laborer, freelancer, others), medical history (including comorbidities diagnosed by health professionals), and risk factors, such as smoking, alcohol consumption, and body mass index (BMI).

Sample size and sampling procedure

Sample size

The sample size was originally calculated to detect the difference in proportions of patients with controlled BP between the two groups before and after the intervention. The expected change in % of participants who have their BP controlled were 13% and 20% in control and intervention groups respectively, types I and II error rates were 5% and 20%, and a design effect of 1.5 and a lost to follow up rate of 20%. There were 1,400 patients in each group and in each period who were invited to the study.

The final sample size of 1,315 individuals in the intervention group and 1,386 in the control group, was sufficient to provide a power of greater than 90% to detect a difference of 8.5% in the change in the utilization of BP self-management tools between groups, over the five repeated measurements.

Sampling method

The multistage random sampling was performed with five measurements, at baseline, 3, 6, 9, 15, and 21 months of follow-up.

Sampling procedure

The initial calculated sample size of 2,800, 1,400 new participants involved in the Communities for Healthy Hearts program and residing in the two intervention districts (Thu Duc and Go Vap) were selected into the study (700 participants for each district), and 1,400 participants for the comparison group were chosen from Binh Tan District.

In the first stage, we randomly selected 4 wards in both intervention districts (8 wards in total) and 8 wards for the control district. In the second stage, we obtained the list of hypertensive patients who met inclusion and exclusion criteria from the district preventive medicine centers and Communities for Healthy Hearts team. Based on the demographic characteristics of each ward provided by the district preventive center, we identified gender ratios and age groups, and then randomly selected 130 newly diagnosed hypertensive patients in each ward.

Data analysis

Descriptive statistics were used to summarize the data, with frequencies and percentages for categorical variables. To detect differences in participants' characteristics between intervention and control groups at baseline, we used Fisher's exact tests and χ^2 test when appropriate for categorical variables.

Logistic mixed-effects models were used, with the assumption that patients had different values for each indicator at baseline and across rounds, and we fitted the mixed-effects models with the random slope in rounds. To identify the intervention effect, we included the interaction term between treatment (control [coded = 0] vs. intervention [coded = 1]) and rounds in the model, the interaction term reflected changes in effect of the intervention group across rounds, as compared to the control group (i.e., "*intervention effect*").

Due to the quasi-experimental design, the participants were not randomly allocated to the control or intervention group. To mitigate this, we used the propensity score matching method with a matched ratio of 1:1 using nearest neighbor algorithms. Propensity score matching is a statistical technique in which an individual in the treatment group is matched

with one or more individuals in the control group based on their propensity score. This technique can help to increase the balance in participants' characteristics between groups and reduce selection bias.[15] The propensity scores were calculated on the basis of the subjects' socio-demographic characteristics, as well as their habits with regards to smoking and alcohol consumption. A significance level of 0.05 was used for all statistical tests. All analyses were carried out using Stata v16 SE (StataCorp, College Station, TX, USA).

Ethical statement

All procedures performed in this study were in accordance with the ethical approval of the Institutional Review Board of Hanoi University of Public Health (IRB No. 017-375/DD-YTCC, date 12/11/2017). All participants provided signed informed consent.

RESULTS

Participants' characteristics

In total, 2,701 patients were included into this study, 1,315 in the intervention group (Thu Duc and Go Vap districts) and 1386 in the control group (Binh Tan district). A total of 1962 patients completed the survey at endline; 739 patients (27.4%) were lost-to-follow-up at endline.

Gender distribution was similar across groups, approximately 50%. The majority of participants were of Kinh ethnicity and currently married. In the intervention group, 42.8% of the patients had high school education or higher, as compared to 30.5% in the control group. About half of the participants were housewives/househusbands or freelancers (51.9% for intervention site vs 54.1% for control site) (**Table 1**).

Table 1. Participants' socio-demographic characteristics

Characteristics	Original data				Matching data		
	Total	Intervention	Control	*P*	Intervention	Control	*P*
No. of participants	2,701	1,315	1,386		1,010	1,010	
Gender				0.51			0.062
Men	1,342 (49.7)	662 (50.3)	680 (49.1)		479 (47.4)	521 (51.6)	
Women	1,359 (50.3)	653 (49.7)	706 (50.9)		531 (52.6)	489 (48.4)	
Age group				< 0.001			0.73
40–49 years	762 (28.2)	310 (23.6)	452 (32.6)		292 (28.9)	276 (27.3)	
50–59 years	966 (35.8)	501 (38.1)	465 (33.5)		372 (36.8)	380 (37.6)	
60–69 years	973 (36.0)	504 (38.3)	469 (33.8)		346 (34.3)	354 (35.0)	
Ethnicity				< 0.001			0.86
Kinh	2,590 (95.9)	1,299 (98.8)	1,291 (93.1)		994 (98.4)	993 (98.3)	
Other	111 (4.1)	16 (1.2)	95 (6.9)		16 (1.6)	17 (1.7)	
Marital status				0.30			1.00
Currently married	2,272 (84.1)	1,116 (84.9)	1,156 (83.4)		855 (84.7)	855 (84.7)	
Other	429 (15.9)	199 (15.1)	230 (16.6)		155 (15.3)	155 (15.3)	
Education				< 0.001			0.89
≤ Primary school	796 (29.6)	300 (23.0)	496 (35.8)		297 (29.4)	291 (28.8)	
Secondary school	912 (33.9)	445 (34.2)	467 (33.7)		375 (37.1)	385 (38.2)	
≥ High school	979 (36.4)	557 (42.8)	422 (30.5)		338 (33.5)	333 (33.0)	
Occupation				< 0.001			0.078
Business owner	155 (5.7)	91 (6.9)	64 (4.6)		45 (4.5)	54 (5.3)	
Retired	351 (13.0)	217 (16.5)	134 (9.7)		96 (9.5)	125 (12.4)	
Housewife/househusband	742 (27.5)	338 (25.7)	404 (29.1)		324 (32.1)	272 (26.9)	
Industrial labourer	210 (7.8)	120 (9.1)	90 (6.5)		75 (7.4)	77 (7.6)	
Freelancer	659 (24.4)	313 (23.8)	346 (25.0)		249 (24.7)	267 (26.4)	
Other	584 (21.6)	236 (17.9)	348 (25.1)		221 (21.9)	215 (21.3)	

Values are presented as number of participants (%).

Statistically significant differences between the intervention and control group were found in age, ethnicity, education, and occupation ($P < 0.001$). However, after applying the propensity score matching method, there were no more statistically significant differences in participants' socio-demographic characteristics between groups (**Table 1**).

Medical history, and rates of smoking, and alcohol consumption are described in **Table 2**. Osteoarthritis was the most frequent co-morbidity, with 14.4% and 23.4% of people suffering from this condition in the intervention and control groups respectively. Also, digestive disease and hyperlipidemia were frequent co-morbid conditions in about 7.7% and 13.1% of the participants. People smoking and those who ever consumed alcohol were 21.8% and 61.3% in the intervention group, as compared to 24.3% and 56.2% in the control group. More than half of the participants were overweight or obese in both groups.

Change in the utilization of BP self-management tools

Fig. 2 shows the changes in the proportion of hypertensive adults using BP self-management tools. The percentage of hypertensive adults who used self-management tools increased in both intervention and control groups, from 33.6% to 53.8% in the intervention area and from 25.4% to 37.1% in the control area, despite a slight decrease at follow-up 1 and 2. The increase in the intervention group was 8.5% higher compared to the control group.

Intervention effect of Communities for Healthy Hearts intervention

The effect of the intervention on self-managed BP is shown in **Table 3**. Compared to the control group, the intervention increased the odds of self-management of BP at round three and four compared to baseline (interaction terms, PSM model) with odds ratio (OR), 1.77 (95% confidence interval [CI], 1.24–2.52) and 1.48 (95% CI, 1.00–2.18) respectively, the

Table 2. Medical history, smoking and alcohol consumption of participants

Characteristics	Total	Intervention	Control	P^a
No. of participants	2,701	1,315	1,386	
Coronary artery disease	18 (0.7)	5 (0.4)	13 (1.0)	0.070
Myocardial infarction	7 (0.3)	1 (0.1)	6 (0.4)	0.125[b]
Heart failure	13 (0.5)	7 (0.5)	6 (0.4)	0.725
Angina	40 (1.5)	12 (0.9)	28 (2.1)	0.017
Hyperlipidemia	221 (8.3)	100 (7.7)	121 (8.9)	0.263
Liver diseases	43 (1.6)	18 (1.4)	25 (1.8)	0.359
Anemia	21 (0.8)	9 (0.7)	12 (0.9)	0.586
Neuropathy	15 (0.6)	8 (0.6)	7 (0.5)	0.728
Respiratory diseases	32 (1.2)	13 (1.0)	19 (1.4)	0.348
Digestive disease	259 (9.7)	80 (6.2)	179 (13.1)	< 0.001
Osteoarthritis disease	507 (19.0)	188 (14.4)	319 (23.4)	< 0.001
Smoking status				0.002
Non-smoker	1,875 (69.4)	907 (69.0)	968 (69.8)	
Formal smoker	202 (7.5)	121 (9.2)	81 (5.8)	
Current smoker	624 (23.1)	287 (21.8)	337 (24.3)	
Ever consume alcohol				0.007
No	1,116 (41.3)	509 (38.7)	607 (43.8)	
Yes	1,585 (58.7)	806 (61.3)	779 (56.2)	
BMI categories				0.020
Underweight	78 (2.9)	43 (3.3)	35 (2.5)	
Normal	1,031 (38.2)	532 (40.5)	499 (36.1)	
Overweight	1,308 (48.5)	619 (47.1)	689 (49.8)	
Obese	281 (10.4)	120 (9.1)	161 (11.6)	

Values are presented as number of participants (%).
BMI = body mass index.
[a]All p values were calculated using χ^2 tests unless otherwise indicated; [b]Fisher's exact tests.

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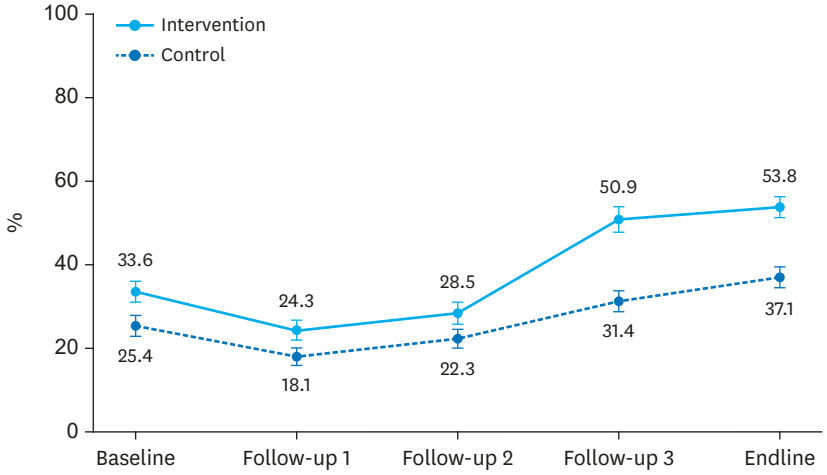

Fig. 2. Changes in proportion hypertensive adults using self-management tools to support hypertensive blood pressure treatment. The error bars show the 95% confidence interval.

Table 3. Effect of intervention on the utilization of blood pressure self-management tools among hypertensive adults

Variables	Multivariable model[a]		PSM model[b]	
	OR	95% CI	OR	95%CI
Group effect				
Control	Ref.	-	Ref.	-
Intervention	1.55[e]	1.23–1.95	1.68[e]	1.29–2.18
Round				
Baseline	Ref.	-	Ref.	-
Follow-up 1	0.57[e]	0.46–0.71	0.62[e]	0.48–0.80
Follow-up 2	0.77[c]	0.62–0.95	0.84	0.65–1.09
Follow-up 3	1.40[d]	1.12–1.74	1.35[c]	1.04–1.76
Follow-up 4	1.87[e]	1.47–2.39	1.94[e]	1.45–2.58
Intervention*Round (intervention effect)				
Intervention*Baseline	Ref.	-	Ref.	-
Intervention*Follow-up 1	0.93	0.69–1.25	0.87	0.62–1.23
Intervention*Follow-up 2	0.87	0.64–1.17	0.73	0.51–1.03
Intervention*Follow-up 3	1.89[e]	1.39–2.56	1.77[d]	1.24–2.52
Intervention*Follow-up 4	1.75[d]	1.25–2.46	1.48[c]	1.00–2.18

PSM = propensity score matching; OR = odds ratio; CI = confidence interval.
[a]Multivariable model: multivariable logistic mixed-effects model adjusted by gender, age, ethnicity, marital status, education, occupation, smoking and alcohol consumption; [b]PSM model: mixed-effects logistic model using propensity score matching method; [c]$P < 0.05$, [d]$P < 0.01$, [e]$P < 0.001$.

differences were statistically significant ($P < 0.05$). However, the intervention effect was not seen in follow-up round one and follow-up round two.

Other factors related to the utilization of BP self-management tools

Fig. 3 shows other factors related to the self-management of BP among hypertensive adults. After adjusting for the group, time and intervention effects of the Communities for Healthy Hearts intervention, participants who worked freelance or were a current smoker had a lower likelihood of using BP self-management tools (OR, 0.71; 95% CI, 0.56–0.91 and OR, 0.76; 95% CI, 0.60–0.96, respectively). In contrast, participants were more likely to use BP self-management tools if they were older (50–59 vs. 40–49 years: OR, 1.86, 95% CI, 1.52–2.28 and 60–69 vs. 40–49 years: OR, 2.23, 95% CI, 1.79–2.77, respectively), had higher education (secondary school: OR, 1.48; 95% CI, 1.22–2.80 and high school: OR, 2.15; 95% CI, 1.75–2.63), or were obese (OR, 1.49; 95% CI, 1.16–1.93).

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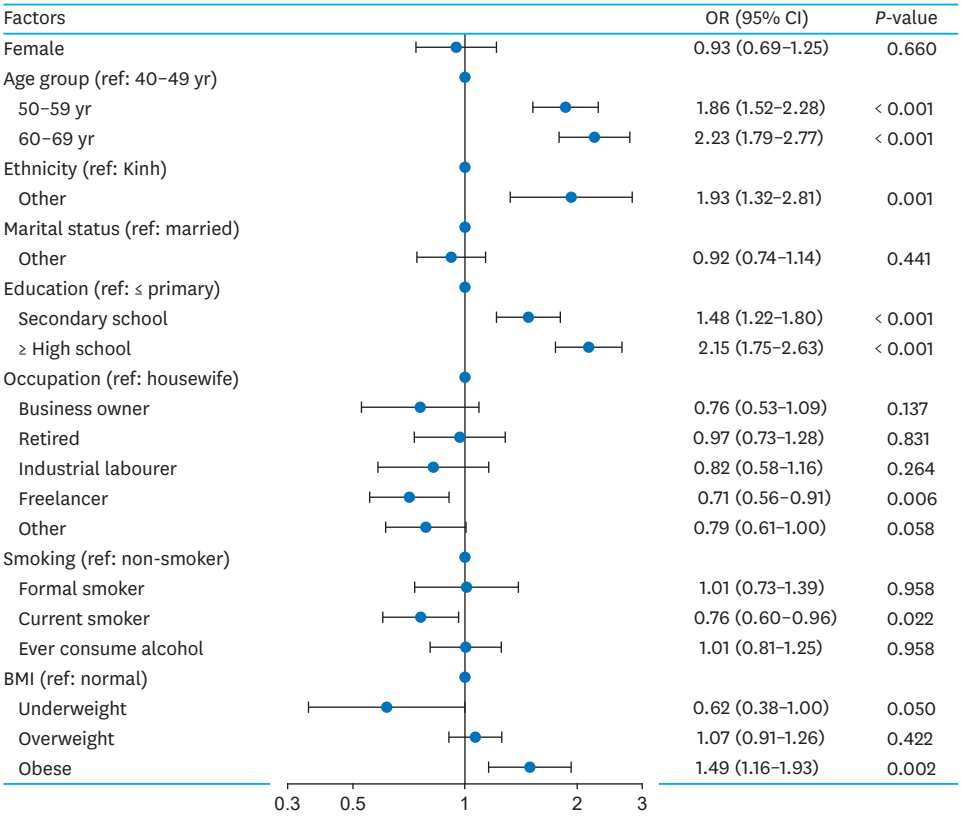

Fig. 3. Other factors related to the utilization of blood pressure self-management tools among hypertensive adults. The coefficients were obtained from the mixed-effect logistic model adjusted for the group effect, time effect and intervention effect of Communities for Healthy Hearts program.
BMI = body mass index.

DISCUSSION

In the original data, significant differences between the intervention and control groups were found in participants' characteristics including age, ethnicity, education, and occupation. The propensity score matching method resolved this issue and no further difference was noted in the matched data, and this allowed to generate more precise estimates for the Communities for Healthy Hearts intervention effects on the improvement of self BP management. In literature, the propensity score matching method has been widely used to strengthen causal arguments in quasi-experimental and observational studies by reducing selection bias.[15,16] The self-management tools such as those used in Communities for Healthy Hearts program helped remind patients about their BP status, and develop their self-efficacy as well as their confidence to carry out major lifestyle changes.[17,18] This is important as previous studies have indicated that self-management BP is efficient to support treatment adherence and can help improve treatment outcomes.[17,18]

Our study found that the percentage of patients using tools for the self-management of BP increased from baseline to endline. However, compared to the difference between the intervention and the control group at baseline, statistically significant increase in intervention effect was observed only in 3rd and 4th follow-up, but no in the 1st and 2nd follow-up. This may be because hypertension is a chronic condition that requires longer-term

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interventions. Our findings were consistent with that of the Stanford Five-City Project,[19] a nine-year field trial of the community control of CVD. The project investigated cardiovascular disease epidemiology, communication, health education, behavior change, community organization, and potentially cost-effective programs to prevent cardiovascular disease at the community level. Also, the innovative part of the Communities for Healthy Hearts model, i.e. the establishment of BP check points in high traffic points within the communities, to increase early detection of hypertension, training and equipping of non-traditional health players to measure BP and deliver health information or referral to the health system, may have been confronted with some challenges to gain credibility from the community members at the onset of the program.

At follow-up three and endline, the interaction terms (odds ratio) between rounds and intervention (i.e., intervention effect) was greater than 1 indicating a positive effect of the Communities for Healthy Hearts' intervention in terms of increasing the use of BP self-management tools. Within the three years of the program, it can be inferred that the positive outcomes were largely due to several components of the interventions, namely the various training courses of healthcare providers and collaborators, as well as the health education in the communities to increase population awareness and literacy on the risks of high BP.

This intervention and approach helped hypertensive individuals become more aware of their BP status, improve their knowledge about the importance of BP management and increase the use of self-management tools, and achieved a notably high retention rate over a two-year period. The Communities for Healthy Hearts program focused on establishing a community-based network of non-physicians to accelerate the early detection of hypertension and engage with the health system via various levels, which also helped strengthen the role of primary care. Similar to the Communities for Healthy Hearts project, many studies have indicated the positive effects of community-based interventions among hypertensive patients, such as the Cardiovascular Health Awareness Program (CHAP).[20] CHAP is a large-scale Canadian initiative with 2-arm 39-community cluster randomized controlled trial that targeted older adults over 65-year-old and was conducted in 2006. The CHAP program was comprised of 3-hour BP and cardiovascular risk-factor assessment and educational sessions held in community pharmacies, delivered free of charge over a 10-week period. CHAP was implemented successfully in the communities to reach newly hypertensive patients, and reduction in adjusted annual rates of hospital admission.[20] Findings from the Community-based Hypertension Improvement Project (ComHIP) cohort study in Ghana also showed the positive effect of the community-based model of hypertension care in terms of controlling BP among hypertensive patients.[21]

In this study, Community for Healthy Hearts achieved a retention rate of 72.6% over two years, notably higher than found across other programs. ComHIP achieved a 25% retention rate after one year,[21] study in Kenya where 64% of patients were in the program after 2 years.[21] Study in Malawi where 47% of hypertensive patients were still in contact after 24 months,[22] or in Cameroon where only 18.1% of patients remained in the program after 1 year.[21]

Our study has several limitations. Firstly, the intervention was conducted in HCMC, the largest city in Vietnam, and as a result our findings may not be generalizable to all other areas in the country. Secondly, the Communities for Healthy Hearts intervention was implemented in the same location one year before this assessment was officially initiated, which may have caused a higher proportion of using self-management of BP tools at baseline in the

intervention group. Consequently, the intervention effect on the use of self-management may have been even larger than as found by this study. Finally, we did not have information on the wealth level, which might potentially affect the analyses.

After adjusting for the Communities for Healthy Hearts intervention effect, we found several factors related to the self-management of BP among hypertensive adults. Older patients had higher odds of using BP self-management tools. The link between age and self-care behavior might have been a result of more learning opportunities for those of higher age. Peters and Templin (2008) also found that patients with a longer history of hypertension had higher hypertension knowledge and self-care scores.[23] In this study, we also found that subjects who attended secondary or high school did more BP self-management, as compared to those with only a primary level education or less. This corresponds to what other studies have found previously, such as that by Kolbe,[24] demonstrating that education is regarded as an essential prerequisite for the self-management of chronic disease, or by Weijman et al.[25] It also has been described that poor BP self-management practice may contribute to a higher risk of target organ damage in hypertensive patients and cardiovascular or renal complications.[26] We also discovered a negative association between smoking status and using BP self-management, which can synergistically elevate the risk of CVD in patients with established hypertension. Furthermore, adherence to treatment plays an important role in chronic disease management. In this study, the retention rate was high, which may contribute to the improvement in the utilization of BP self-management tools.

In conclusion, the utilization of BP self-management tools in the Communities for Healthy Hearts program improved BP self-management in hypertensive adults in HCMC. Given the importance of self-management as a means to improve patient outcomes, the intervention was successful in changing behaviors and enabling hypertensive patients to manage their blood pressure including notably high retention rates over two years in the program. More attention is needed to increase BP self-management for hypertensive adults who are 40–49 years old, only attended primary education or below, and who are current smokers. These findings can help inform policy discussions around how community-based approaches and efforts to strengthen primary care can be scaled up in Vietnam (and beyond) for improved outcomes in hypertension management.

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