

Effectiveness of Self-Monitoring Blood Pressure in Primary Care: A Randomized Controlled Trial

Journal of Primary Care & Community Health
2016, Vol. 7(2) 58–64
© The Author(s) 2015
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/2150131915614069
jpc.sagepub.com


Wichai Aekplakorn¹, Paibul Suriyawongpaisal¹,
Rassamee Tansirisithikul¹, Thida Sakulpipat²,
and Phikul Charoensuk²

Abstract

Objective: To examine the effectiveness of self-monitoring blood pressure (SMBP) in a randomized controlled trial with 12 months of follow-up in a community hospital. **Methods:** A total of 224 eligible patients with hypertension were randomly allocated to the SMBP ($n = 111$) and usual care groups ($n = 113$). Each patient in the SMBP group was provided with a blood pressure (BP) monitor for home BP measurement. Mixed model regression was used to compare changes in BP at months 6 and 12 and compare between groups. **Results:** At month 12, compared with usual care, the SMBP group had average systolic BP decreased by 2.5 mm Hg. The benefit of the SMBP was found in those aged ≥ 60 years, which significantly decreased by -8.9 mm Hg (95%CI = -15.1 to -2.7) compared with those in the usual care. For individuals aged 60 years and older in the SMBP group, the proportion of those with uncontrolled BP decreased from 90.9% at baseline to 38.2% at month 12 ($P < .05$). However, among those aged < 60 years, SMBP did not perform better than the usual care group. **Conclusion:** For primary care setting in urban area, the SMBP resulted in lower BP in the older persons with hypertension at 12 months. Further study on effectiveness of SMBP in other settings may be warranted.

Keywords

community health, disease management, patient-centeredness, primary care, managerial epidemiology

Introduction

One-fourth of the world's population aged 20 years and older are affected by high blood pressure (BP) or hypertension. Hypertension is one of the most common risk factors for cardiovascular disease and it contributed to 40% of the mortality from cardiovascular disease, diabetes, and chronic kidney diseases.¹ The poor control of high BP results in complications of hypertension, which range from microvascular to macrovascular. The burden of morbidity, disability, and mortality related to hypertension contribute to the economic loss for the society. Hypertension management including medication and lifestyle modification can effectively reduce the morbidity and mortality.² However, the proportion of controlled BP among patients with hypertension remains low in many countries.^{3–6} The proportion of uncontrolled hypertension are also higher in low- and middle-income countries compared with high-income countries due to the weaker health service system.⁷ In Thailand, the prevalence of hypertension is high at 22%, and the recent national health examination survey showed that one-third of the patients with hypertension could not adequately control

of their BP.⁷ The prevalence of hypertension in the United States is 30.8% and the treated controlled were 51.2% in 2012; whereas the corresponding percentages for the Chinese population were 29.6% and 27.4%, respectively.^{4,5}

A strategy to better control of BP such as self-monitoring blood pressure (SMBP) or home BP monitoring has been advocated in the past decade as an adjunct method in the management of hypertension.^{8,9} The SMBP provides immediate feedback to patients and may improve adherence to medication and advice to control for poor BP control.¹⁰

Studies have reported the effectiveness of SMBP in controlling BP mostly in high-income countries.¹⁰ However, in some populations, short- and long-term effects of SMBP are still inconclusive.¹¹ In addition, there is very limited evidence for the role of the effectiveness of SMBP in the

¹Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

²Bangphli Hospital, Samutprakarn, Thailand

Corresponding Author:

Rassamee Tansirisithikul, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Rama 6 Road, Ratchathewi, Bangkok 10400, Thailand.
Email: artrassamee@gmail.com

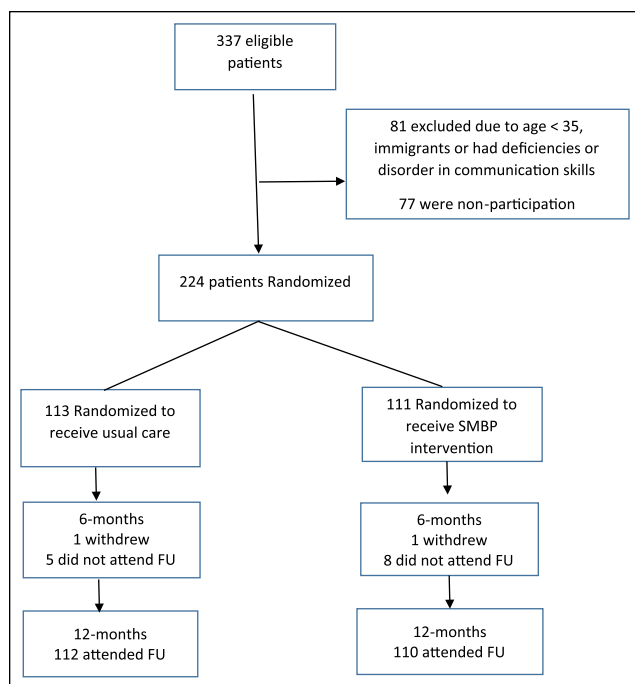


Figure 1. Flow of study recruitment for self-monitoring blood pressure and usual care arm. FU, follow-up; SMBP, self-monitoring blood pressure.

improvement of BP in low- and middle-income countries. It is not clear whether the findings from the studies can be applied to the other populations with different cultures and characteristics. The present randomized clinical trial aimed to assess the effectiveness of SMBP in controlling for BP among patients in a catchment area of a community hospital in Thailand.

Method

Study Design and Study Population

The inclusion criteria were patients with systolic BP (SBP) ≥ 140 mm Hg or diastolic BP (DBP) ≥ 90 mm Hg based on average of the prior 12 months from community hospital registry and living in Bang phli district, Samutprakarn province. A total of 337 patients who met the criteria were enrolled. Eighty-one patients were excluded due to age < 35 years old, immigrants, or were having deficiencies or disorder in communication skills. The eligible patients were invited to join the study and provided written informed consent. A total of 77 patients refused because of their inability to make visits to see the physicians in the community hospital every 2 months for at least 12 months. A total of 224 patients participated in this study (Figure 1). We randomly allocated each subject to either an intervention or usual care group based on concealed block randomization. A random sequence of 3 interventions and 3 controls assignments

were contained in each block, placed in a concealed envelope. Each eligible patient was allocated to a study group according to the number assignment in each envelope.

Home Blood Pressure Measurement

Those randomized to the intervention group received a BP monitor. Each participant was instructed individually about how to use the monitor, record, and interpret the BP data whether they were in optimal level. The present study was conducted from May 2013 to June 2015.

Participants in the SMBP were trained to measure their BP at home every day for 6 months using the provided oscillometric BP monitor (Omron model HEM-7117, Kyoto, Japan). Blood pressures were measured 2 times a day (3 readings for each time), once in the morning within 1 hour after waking up, after urination, before breakfast and medication, and after 5 minutes of resting and another in the evening before going to bed according to the Japanese Society of Hypertension guideline 2003.⁸ The patients were asked to bring their BP records when they came to follow-up for physician review at the hypertension clinic. Any of 3 physicians in the community hospital assessed the recorded BP and communicated with the patients on their BP status and provided advice on medication and healthy lifestyle.

Usual Care

Patients with hypertension in the usual care arm were treated at the discretion of the physician. The patients did not receive the home BP monitor. They were informed about their BP status at time of visit and advised about medication usage and healthy lifestyle practice, including healthy diet and exercise as usual.

Outcome

The differences in SBP were measured between the SMBP and usual care at 6 and 12 months taking into account baseline SBP and repeated measurement. Uncontrolled BP was defined as SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg in the last visit. Body mass index (BMI) was calculated from weight in kilograms (kg) divided by square of the height in meters (m^2). Weight were measured using digital weighing scale (Tanita model BC-587, Tokyo, Japan) and height were measured using stadiometer while standing without shoes at start and at 12 months.

Statistical Analysis

Sample size determination was based on the comparison of usual and intervention group with an estimated difference of mean SBP over 12 months of 5 mm Hg, at .05 of

alpha error and 80% of power, which required a sample size of 110 patients per group (allowance for 10% loss to follow up).

The statistical analysis included participants who attended the 12-month follow-up with complete BP data. Mean and standard deviation of SBP for both groups at baseline, 6 months, and 12 months were calculated. The difference in SBP in 12 months between the SMBP group and the usual care group was examined by a linear mixed model controlling for baseline BP and repeated measurement at 6 months, sex, and age. Differences in percentage of uncontrolled BP from baseline to month 6 and month 12 between the SMBP and usual care were performed by using mixed effects logistic regression. Subgroup analysis was carried out by age group (<60 and ≥ 60 years), sex (male and female), BMI status (<25 and ≥ 25 kg/m²) and high SBP at baseline (≤ 145 and >145 mm Hg). Stata software version 13 (Stata Corp, College Station, TX, USA) was used for all the statistical analyses.

Results

Of the 224 patients who participated the study, 34% were male, which was similar in both groups. The mean age was 59 years (SD = 9.2) with slightly older in the usual care group (60.8 vs 58.0 years, $P = .02$). Overall, 85% of the subjects had primary school educational level or less with no significant difference between groups. Overall, systolic and diastolic BP, BMI, duration of hypertension, underlying diseases, for example, diabetes, coronary heart disease, stroke, and dyslipidemia were not different between groups at baseline. The most common antihypertensive medication used were angiotensin-converting enzyme inhibitor, followed by beta-blocker and diuretic. Nearly half of the subjects received 2 classes of antihypertensive medications. There were no differences in antihypertensive medication between groups (Table 1).

Table 2 shows mean BP at baseline, 6 months, and 12 months for the usual care and the SMBP groups. The SBP in both groups decreased at 6 months and slightly further decreased at month 12. At month 12, the SMBP group had SBP and DBP less than the usual care group by 2.5 mm Hg and 1.2 mm Hg, respectively, with no significant difference.

Table 3 gives the differences in SBP between groups according to sex, age group, BMI status, and high baseline SBP (>145 mm Hg). There were no statistically significant differences among subgroups in term of SBP reduction except for the older age group, where the benefit of SMBP was found in those aged ≥ 60 years, which was statistically significant and decreased by 8.9 mm Hg (95% CI = -15.1 to -2.7) compared with those in the usual care group.

Table 4 shows the percentages of patients with uncontrolled BP at baseline, month 6, and month 12 in both

groups. The proportions of uncontrolled BP were substantially decreased at month 6, but slightly increased at month 12. Overall, at the end of the study 46% of the patients in both groups had their BP at control target. For individuals aged 60 year and older in the SMBP group, the proportion of those with uncontrolled BP decreased from 90.0% at baseline to 38.2% at month 12 ($P = .02$). However, among those aged <60 years, SMBP did not perform better than the usual care group.

Adherence to Self-Monitoring Blood Pressure

Adherence to the self-monitored practice was not complete. In the SMBP group, 84.1% of the subjects record their BP measurement with an average of 123.94 recorded days, and 54.7% of the subjects recorded their daily BP measurement more than 135 days. The proportion of regular recorders of their BP was slightly higher, but not significant among those aged ≥ 60 years compared with those aged <60 years (61% vs 47%, $P = .24$). Prescription of antihypertensive medications increased in both groups, but there were no significant differences in numbers of drug items and classes between groups.

Discussion

The present study evaluated the effect of SMBP in primary care of a community hospital. The results indicated that at month 12 in both the usual care and the SMBP groups, there were reductions in the SBP and increase in the proportion of controlled BP. Both groups had the BP reduced by 10 mm Hg in the first 6 months and the BP remained stable thereafter. The magnitude of BP reduction were not significantly different between the SMBP and usual care groups according to sex, SBP level (≤ 145 vs >145 mm Hg) or BMI level (<25 vs ≥ 25 kg/m²); however, there were difference by age group. The older persons (≥ 60 years) obtained most benefit from SMBP. The explanation for the similar effects in both groups might be that they might receive more aggressive medication at the follow-up period in both intervention and control groups, therefore the reduction effect was seen in both groups. The greater benefit of SMBP found in the older persons might be because of the fact that they usually spent more time at home, so they were more likely to measure, whereas, those in the younger age group spent less time at home, so were less likely to measure the BP themselves, as shown by the higher percentage of daily BP record among older persons compared with those who were younger, although it was not significant. In other words, those SMBP patients aged older than 60 years were more likely to gain feedback leading to better compliance to medication and lifestyle modifications than those SMBP patients who were younger than 60 years. The greater reduction in SBP among the older patients in the SMBP group was also observed in

Table 1. Baseline Characteristics.

	Usual Care (n = 113)	SMBP (n = 111)	P Value
Age, years, mean (SD), yr	60.83 (9.0)	58 (9.4)	.02
Age group, n (%)			
<60 years	47 (41.6)	56 (50.5)	.18
≥60 years	66 (58.4)	55 (49.6)	
Men, n (%)	39 (34.5)	39 (35.1)	.92
Blood pressure, mm Hg, mean (SD)			
Systolic	147.2 (14.9)	149.4 (11.4)	.22
Diastolic	82.2 (11.7)	83.4 (9.9)	.40
Body mass index, kg/m ² , mean (SD)	26.4 (4.5)	27.3 (5.2)	.19
Duration of hypertension, years, mean (SD)	5.5 (5.1)	6.9 (7.8)	.11
Occupation			
No job	65 (57.5)	53 (47.7)	.007
Workers	21 (18.6)	41 (36.9)	
Self-employed	27 (23.9)	17 (15.3)	
Smoking	14 (12.4)	6 (5.4)	.07
Underlying diseases			
Diabetes	5 (4.4)	5 (4.5)	.98
CVD	5 (4.4)	8 (7.2)	.37
Stroke	7 (6.2)	7 (6.3)	.97
Dyslipidemia	63 (55.7)	64 (57.7)	.77
Antihypertensive medication			
Calcium channel blocker	65 (57.5)	62 (55.9)	.80
ACEI	64 (56.6)	72 (64.9)	.21
ARB	9 (8.0)	11 (9.9)	.61
Diuretic	28 (24.8)	25 (22.5)	.69
Beta-blocker	45 (39.8)	42 (37.8)	.76
Alpha-blocker	2 (1.8)	1 (0.9)	.57
Vasodilator	6 (5.3)	6 (5.4)	.97
No. of antihypertensive drugs			
1	39 (34.5)	32 (28.8)	.50
2	52 (46.0)	51 (45.9)	
≥3	22 (19.5)	28 (25.2)	

Abbreviations: SMBP, self-monitoring blood pressure; SD, standard deviation; CVD, cardiovascular disease; ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blocker.

a study by McManus et al,¹² where the difference in SBP at 12 months was 10.5 mm Hg in those aged >65 years and was 6.5 mm Hg in those aged ≤65 years; however, the authors did not provide explanation for those findings. The similar effects in men and women in the present study were consistent with other studies.^{12,13} We did not observe a different effect by baseline SBP level, whereas the study by Margolius et al¹³ in a minority population in the United States found a greater reduction among those with SBP ≥160 mm Hg compared with those with SBP <160 mm Hg. The explanation for the different findings might be due to the greater intensity of home coaching and titration of medication in that study, whereas we did not invest such resource in the present study and could results in a smaller effects.

The advantage of SMBP includes the practicality, high reproducibility and rules out “white coat” hypertension.^{8,10,14}

However, use of SMBP needs cooperation of the patients and their ability to judge whether the BP was too high.¹⁵ SMBP measurement might be appealing to patients and increase their awareness of high BP and possibly lead them to better control their BP.

Previous studies of the benefit of SMBP were inconclusive. A Cochrane review on intervention used to improve BP control reported a moderate net reduction in systolic BP associated with self-monitoring.¹⁶ Piette et al¹⁷ reported results of using automated telephone care management plus home BP measurement had a better outcome for patients with hypertension; however, a systematic review and meta-analysis of SMBP with or without additional support could lower BP in short-term but the long-term benefit beyond 12 months was not confirmed.¹¹ The systematic review reported a summary reduction of 3.9 mm Hg for SBP at 6

Table 2. Mean Systolic and Mean Diastolic Blood Pressures at Baseline, 6 Months, and 12 Months and the Adjusted Difference Between Usual Care and SMBP Groups.

Outcomes	Blood Pressure, mm Hg						Adjusted Difference Between Intervention and Control Groups ^a	
	Baseline		6 Months		12 Months		6 Months	12 Months
	No. of Patients	Mean (95% CI)	No. of Patients	Mean (95% CI)	No. of Patients	Mean (95% CI)	Mean difference (95% CI)	Mean difference (95% CI)
Systolic BP								
Usual care	113	147.2 (144.5, 150.0)	107	137.9 (135.3, 140.5)	112	136.8 (133.6, 140.0)	-2.9 (-7.8, 1.8)	-2.5 (-7.3, 2.2)
SMBP	111	149.4 (147.3, 151.5)	102	137.4 (135.0, 139.7)	110	136.4 (133.6, 139.0)		
Diastolic BP								
Usual care	113	82.2 (80.0, 84.4)	107	76.0 (74.0, 78.0)	112	78.1 (75.6, 80.5)	-0.6 (-3.9, 2.7)	-1.2 (-4.5, 2.0)
SMBP	111	83.4 (81.6, 85.3)	102	76.4 (74.6, 78.2)	110	78.1 (76.0, 80.1)		

Abbreviations: SMBP, self-monitoring blood pressure; CI, confidence interval.

^a Adjusted difference: adjusted for baseline and repeated measurement using usual care as reference.**Table 3.** Adjusted Difference in Systolic Blood Pressure Between SMBP and Usual Care Group at Months 6 and 12 by Subgroups.^a

	No. of Patients	Differences in Mean SBP (95% CI) at Month 6	Differences in Mean SBP (95% CI) at Month 12
Sex			
Men	78	-2.8 (-10.6, 4.9)	-2.9 (-10.5, 4.7)
Women	146	-3.0 (-9.1, 3.0)	-2.3 (-8.3, 3.6)
Age (years)			
<60	103	-0.6 (-7.9, 6.6)	5.3 (-1.8, 12.3)
≥60	121	-4.7 (-11.0, 1.5)	-8.9 (-15.1, -2.7)
BMI (kg/m ²)			
<25	87	-1.9 (-9.7, 5.7)	0.7 (-6.8, 6.3)
≥25	127	-4.2 (-10.5, 2.1)	-4.4 (-10.7, 1.8)
SBP (mm Hg)			
≤145	91	-4.8 (-11.3, 1.6)	-3.6 (-9.9, 2.7)
>145	133	0.79 (-5.2, 6.8)	1.0 (-4.8, 6.9)

Abbreviations: SMBP, self-monitoring blood pressure; SBP, systolic blood pressure; CI, confidence interval; BMI, body mass index.

^a Used SBP of usual care at baseline as reference.

months, but not at 12 months. Other studies included additional support such as self-titration in addition to self-monitoring, which showed the successfulness in the reduction of SBP ranging from 3.4 to 8.9 mm Hg¹¹ and concluded that additional support other than SMBP enhances the BP reduction effect. A systematic review on potential mediators of SMBP to reduce BP concluded that increases in medication adherence might be the contributor, but the role of SMBP to influence lifestyles change and medication persistence were inconclusive.¹⁸ Other studies, which involved nurses in the intervention process, seemed to improve the BP reduction by greater effects.^{14,19} Further study on feasibility and effectiveness of additional intervention modalities in addition to SMBP in middle-income countries is warranted.

The present study has its strength as the randomization worked relatively well, as the characteristics of both arms were similar with small differences in age in favor of the SMBP group. The present study was designed to measure the effectiveness of SMBP in the real world without telecommunication

technology in the intervention as well as with the constraint of limited human resources. Nurse-led education for the patients was didactic and usually practiced before the patients saw the physician in both groups. In this study, we did not invest more effort in the role of the nurses. The implication of this study is that it covered the patients in a semiurban community who were homogeneous in terms of race as they were generally Thais with low- to low-middle socioeconomic status, so external validity should be applicable to the majority of other populations with similar characteristics.

There are some limitations of the study, for instance, the small sample size contributed to the nonsignificant results. Details of medication at the follow-up period were not available. The low adherence to the practice of regular self-measurement as evidenced by low percentage of complete records of BP might attenuate the effect of SMBP to a certain extent.

In conclusion, for a primary care setting in urban area, the application of SMBP resulted in reducing BP for older

Table 4. Percentages of the Uncontrolled Blood Pressure at Baseline, 6 Months, and 12 Months Between Usual Care and SMBP Groups.

	Uncontrolled BP (>140/90 mm Hg)				
	Baseline, n (%)	6 Months, n (%)	Difference Between Groups in Changes Between Month 6 and Baseline ^a (P Value)	12 Months, n (%)	Difference Between Groups in Changes Between Month 12 and Baseline ^a (P Value)
All					
Usual care	88 (77.9)	43 (40.2)	0.13	52 (46.4)	0.13
SMBP	97 (87.4)	41 (40.2)		51 (46.4)	
Age (years)					
<60					
Usual care	34 (72.3)	15 (34.9)	0.28	18 (41.9)	0.78
SMBP	47 (83.9)	17 (35.4)		30 (54.5)	
≥60					
Usual care	54 (81.8)	28 (43.7)	0.24	36 (54.5)	0.02
SMBP	50 (90.0)	24 (44.4)		21 (38.2)	

Abbreviation: SMBP, self-monitoring blood pressure.

^a Adjusted for baseline and repeated measurement.

persons with hypertension at 12 months. Further study on the effectiveness of SMBP in other populations and settings is warranted.

Declaration of Conflicting Interests

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

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

- Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration. Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: a comparative risk assessment. *Lancet Diabetes Endocrinol.* 2014;2:634-647.
- Law M, Wald N, Morris J. Lowering blood pressure to prevent myocardial infarction and stroke: a new preventive strategy. *Health Technol Assess.* 2003;7(31):1-94.
- Pereira M, Lunet N, Azevedo A, Barros H. Differences in prevalence, awareness, treatment and control of hypertension between developing and developed countries. *J Hypertens.* 2009;27:963-975.
- Wang J, Zhang L, Wang F, Liu L, Wang H, China National Survey of Chronic Kidney Disease Working Group. Prevalence, awareness, treatment, and control of hypertension in China: results from a national survey. *Am J Hypertens.* 2014;27:1355-1361.
- Egan BM, Li J, Hutchison FN, Ferdinand KC. Hypertension in the United States, 1999 to 2012: progress toward Healthy People 2020 goals. *Circulation.* 2014;130:1692-1699.
- McAlister FA, Wilkins K, Joffres M, et al. Changes in the rates of awareness, treatment and control of hypertension in Canada over the past two decades. *CMAJ.* 2011;183:1007-1013.
- Aekplakorn W, Sangthong R, Kessomboon P, et al. Changes in prevalence, awareness, treatment and control of hypertension in Thai population, 2004-2009: Thai National Health Examination Survey III-IV. *J Hypertens.* 2012;30:1734-1742.
- Imai Y, Kario K, Shimada K, et al. The Japanese Society of Hypertension Guidelines for Self-monitoring of Blood Pressure at Home (Second Edition). *Hypertens Res.* 2012;35:777-795.
- Pickering TG, Miller NH, Ogedegbe G, et al. Call to action on use and reimbursement for home blood pressure monitoring: a joint scientific statement from the American Heart Association, American Society of Hypertension, and Preventive Cardiovascular Nurses Association. *Hypertension.* 2008;52:10-29.
- Imai Y, Obara T, Asamaya K, Ohkubo T. The reason why home blood pressure measurements are preferred over clinic or ambulatory blood pressure in Japan. *Hypertens Res.* 2013;36:661-672.
- Uhlig K, Patel K, Ip S, Kitsios GD, Balk EM. Self-measured blood pressure monitoring in the management of hypertension: a systematic review and meta-analysis. *Ann Intern Med.* 2013;159:185-194.
- McManus RJ, Mant J, Haque MS, et al. Effect of self-monitoring and medication self-titration on systolic blood pressure in hypertensive patients at high risk of cardiovascular disease: the TASMIN-SR randomized clinical trial. *JAMA.* 2014;312:799-808.
- Margolius D, Bodenheimer T, Bennett H, et al. Health coaching to improve hypertension treatment in a low-income, minority population. *Ann Fam Med.* 2012;10:199-205.
- Bosworth HB, Powers BJ, Olsen MK, et al. Home blood pressure management and improved blood pressure control:

- results from a randomized controlled trial. *Arch Intern Med*. 2011;171:1173-1180.
15. Imai Y. Clinical significance of home blood pressure and its possible practical application. *Clin Exp Nephrol*. 2014;18:24-40.
 16. Glynn LG, Murphy AW, Smith SM, Schroeder K, Fahey T. Self-monitoring and other non-pharmacological interventions to improve the management of hypertension in primary care: a systematic review. *Br J Gen Pract*. 2010;60:e476-e488.
 17. Piette JD, Datwani H, Gaudioso S, et al. Hypertension management using mobile technology and home blood pressure monitoring: results of a randomized trial in two low/middle-income countries. *Telemed J E Health*. 2012;18:613-620.
 18. Fletcher BR, Hartmann-Boyce J, Hinton L, McManus RJ. The effect of self-monitoring of blood pressure on medication adherence and lifestyle factors: a systematic review and meta-analysis. *Am J Hypertens*. 2015;28:1209-1221.
 19. Clark CE, Smith LF, Taylor RS, Campbell JL. Nurse led interventions to improve control of blood pressure in people with hypertension: systematic review and meta-analysis. *BMJ*. 2010;341:c3995.

Author Biographies

Wichai Aekplakorn is a professor in Department of Community Medicine, Faculty of Medicine-Ramathibodi hospital, Mahidol University. He has been working as a leader of Thai National Health Examination Survey project since 1991.

Paibul Suriyawongpaisal is a professor and lecturer in community medicine. Over the past decade, he has been working in health policy and systems research such as road traffic injury, emergency medicine, and primary health care. He also provide consultation in health system development to Vietnam, Laos and Myanmar.

Rassamee Tansirisithikul is a lecturer in Department of Community Medicine, Faculty of Medicine-Ramathibodi hospital, Mahidol University. Her specialty is in Epidemiology and Primary Health Care.

Thida Sakulpipat works as a family physician at Bangphli community hospital, Samutprakarn. She is currently a leader of the hospital family care teams.

Phikul Charoensuk has been working as a nurse in Bangphli hospital for more than 10 years. She is currently a manager of Non-communicable disease clinic at Bangphli hospital.