

# 2022 Thai Hypertension Society guidelines on home blood pressure monitoring

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## Abstract

In 2021, the Universal Health Coverage Payment Scheme of Thailand approved home blood pressure monitoring (HBPM) devices for reimbursement. National utilization of HBPM devices will begin in 2022. This article provides the recommendations for HBPM from the Thai Hypertension Society. In this report, the authors review the benefits of HBPM and recommend confirming the diagnosis of hypertension by HBPM. Devices for HBPM should be the automated and validated upper arm cuff devices. HBPM should be ideally done for seven consecutive days before each clinic visit and take at least two readings (1 min apart) in the morning and before going to bed. The average blood pressure (BP) of 125–134/75–84 mmHg is classified as high normal BP and hypertension is BP of 135/85 mmHg or more. Target BP levels depend on the age of the patients; that is, < 125/75 mmHg for patients aged 18–65 years old, and < 135/85 mmHg for patients over 65 years of age.

## KEYWORDS

clinical practice, guidelines, home blood pressure monitoring, Thailand

## 1 | INTRODUCTION

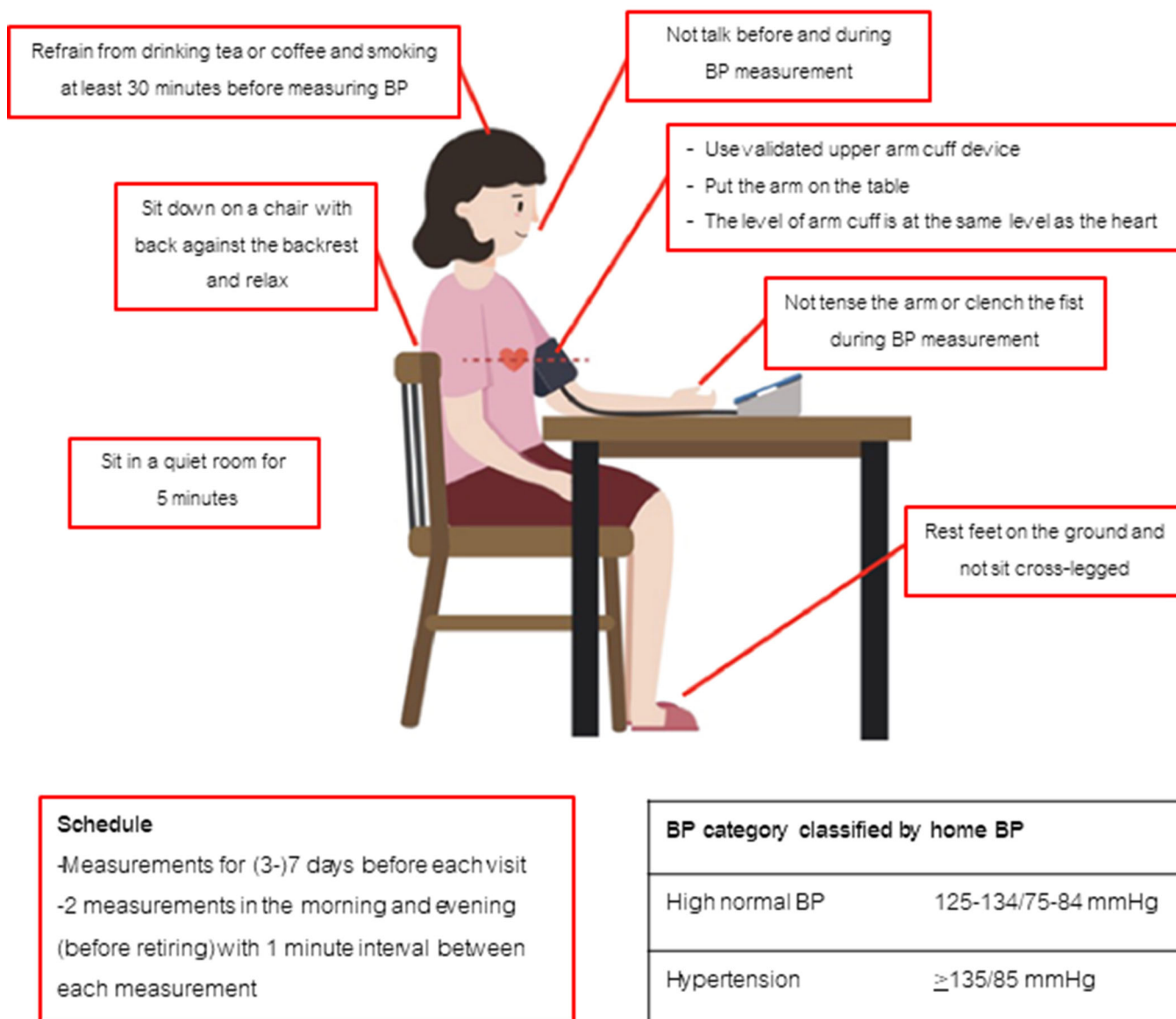
Automated blood pressure (BP) devices have been available for home use in Thailand for several years. In 2021, the Universal Health Coverage Payment Scheme of Thailand approved home blood pressure monitoring (HBPM) devices for reimbursement. National utilization of HBPM devices will begin in 2022. Therefore, there is an urgent need to establish country recommendations for HBPM.

In this guideline, an expert committee appointed by the Thai Hypertension Society makes recommendations on the selection and calibration of HBPM devices, the methodology of BP measurement,

and the diagnostic threshold of home BP. The expert committee also recommends targets for home BP control, and suggests actions for the management of individuals with uncontrolled home BP. The main recommendations were summarized in Figure 1. The strength of the recommendation and the quality of the evidence are described in Tables 1 and 2.

The screening and control of hypertension in Thailand in the past 16 years has not significantly improved. The sixth National Health Examination Survey (NHES) in 2020<sup>1</sup> reported that 25.4% of Thai adults were hypertensive (26.7% in men and 24.2% in women) which was higher than the previous surveys.<sup>2–4</sup> Furthermore, in the sixth NHES,<sup>1</sup> the percentage of awareness, treatment, and control of BP

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**FIGURE 1** 2022 Thai Hypertension Society Guidelines on home blood pressure monitoring

**TABLE 1** Strength of recommendation

Level I	"Should be practiced"	The recommendation is highly reliable, beneficial to patients and worthwhile
Level IIa	"Could be practiced"	The recommendation is moderately reliable, likely beneficial to patients and probably worthwhile
Level IIb	"May be practiced"	The recommendation is not reliable enough, without adequate proof that it is beneficial to patients and probably not worthwhile, but will not cause any harm to them
Level III	"Should not be practiced" or "Must not be practiced"	The recommendation is not beneficial and will probably cause harm to patients

**TABLE 2** Quality of evidence

A	The evidence from various high-quality, randomized controlled trials, or the evidence from meta-analysis
B	The evidence from at least one high-quality, randomized controlled trial or from a large-scale, non-randomized study with definitive outcome on advantages or disadvantages
C	The evidence from other types of high-quality studies; a retrospective descriptive study, a registry study, or agreement from a group of medical specialists being based on clinical experience

in Thai adults with hypertension were 51.2%, 47.6%, and 22.6%, respectively, which were lower than the previous reports.

The Thai NHES defines hypertension awareness as an adult with previous knowledge of high BP that had been diagnosed with hypertension before the survey. According to data gathered from the May Measurement Month 2021 Project that the Thai Hypertension Society and the International Society of Hypertension collected, low levels of awareness could be explained by a lack of confidence in hypertension diagnosis and misconceptions, more so than the inadequacy of BP measurements.

In Thailand, we must focus on better hypertension screening methods and improved treatment protocols. HBPM can contribute importantly, especially to increase screening and help to build confidence in the diagnosis of hypertension for patients and physicians. There is a need, then, to standardize, popularize, and expand the use of HBPM in Thailand to advance the prevention and control of hypertension.

The Thai Guidelines on the Treatment of Hypertension 2019 recommended that HBPM should play a role in the diagnosis and monitoring of hypertension treatment (Strength of Recommendation I, Quality of Evidence A), but did not provide much detail about HBPM.<sup>5</sup> According to one survey, most Thai physicians recommend the use of HBPM to their patients, but their recommendations on measurement schedule and diagnostic threshold vary.<sup>6</sup> So, this guideline focuses on the most essential parts of HBPM and is intended to support the proper application and understanding of this technology in Thailand.

## 2 | THE BENEFITS OF HOME BLOOD PRESSURE MONITORING

Several studies have shown that HBPM is more reliable and more reproducible than office BP monitoring.<sup>7-9</sup> A persistently high home BP will help to increase awareness and encourage people to seek early advice and proper treatment (Figure 2).

HBPM enables a greater number of measurements in the daily-life environment, which is much different from the hospital environment. HBPM helps to verify the high BP status first detected by office BP measurements or health screenings. It also helps to detect “white-coat hypertension” (high office BP, normal home BP), “masked hypertension” (normal office BP, high home BP) in untreated populations, or “white-coat effect” and “masked uncontrolled hypertension” (con-

1. To improve awareness of hypertension
2. To improve diagnostic accuracy
3. To better determine cardiovascular risk in hypertensive patients
4. To improve individualized treatment in hypertensive patients
5. To improve blood pressure medication compliance, adherence and to achieve better control of blood pressure in hypertensive patients
6. To provide the foundation for future telemedicine

**FIGURE 2** The benefits of home blood pressure monitoring

trolled office BP, high home BP) in treated populations. Thai studies have reported significant numbers of white-coat hypertension, masked hypertension and masked uncontrolled hypertension occur in the Thai population.<sup>10,11</sup> Thus, HBPM helps to improve the diagnostic accuracy beyond the clinic or office BP measurement.

The cardiovascular prognostic significance of HBPM has been reported to be comparable to that of ambulatory BP monitoring (ABPM).<sup>12,13</sup> One real-world observational study showed that the risk of a major cardiovascular event was significantly increased when morning, evening, or averaged morning and evening home BP was high.<sup>14</sup> In addition, patients with masked hypertension and high morning systolic BP (SBP) were at increased risk of cardiovascular events, even when their office SBP were normal.<sup>14</sup> The controlling morning BP is particular importance in cardiovascular disease prevention especially stroke prevention which had high incidence in Asian population.<sup>15</sup> The day-to-day variability of BP measured by HBPM has also been reported to predict the risk of cerebrovascular and cardiovascular diseases.<sup>16</sup>

HBPM provides diagnostic value with high reproducibility and is very effective for the evaluation of antihypertensive-drug effects and their duration. Better control of home BP throughout the day and avoiding the morning rise of BP, together with the possibility of controlling BP at nighttime, should reduce the risk of cardiovascular events. This target can be achieved by modifying the type, dosage, and timing of antihypertensive medications, according to the HBPM results.

The introduction of HBPM in the diagnosis and treatment of hypertension facilitates the attainment of target BP, compared with hypertension management based on office BP alone.<sup>17-23</sup> Implemen-

**TABLE 3** Recommendation for home blood pressure monitoring (HBPM)

Recommendations	Strength of recommendations	Quality of evidence
HBPM is recommended to confirm the diagnosis of hypertension	I	A
HBPM should be considered in adults with high normal BP (office BP 130–139/85–89 mmHg) to detect masked hypertension	Ila	B
Antihypertensive treatment based on HBPM should be considered	Ila	B
HBPM may be considered in treated hypertensive patients to increase adherence to medications	Ilb	B

tation of antihypertensive therapy guided by HBPM can help patients to achieve their target BP sooner.<sup>24,25</sup> Awareness of home BP, together with the active commitment by patients and their families, can help to improve adherence to antihypertensive medication and lead to better BP control.

During the COVID-19 pandemic, “lock-down” and other social-distancing policies were applied that caused a significant burden for many hypertensive patients. Most antihypertensive medications were sent to patients without any knowledge of their BP status. With the advance of devices for HBPM, BP values can be stored as electronic data that can be transmitted via the internet to healthcare providers to inform treatment decisions.

Most hypertension guidelines do not contain specific recommendations on the use of telemedicine/telehealth for hypertension management. The 2017 American College of Cardiology/American Heart Association hypertension guidelines recommend the use of telemedicine to confirm the diagnosis of hypertension, and as an adjunct to standard management to improve BP control and adherence.<sup>26</sup> However, this recommendation was published before the COVID-19 pandemic. Evidence about the usefulness of telemedicine for the management of hypertensive patients during a pandemic is limited. The current evidence supports its use in hypertensive patients including those with difficult-to-treat hypertension, or in patients that adhere poorly to medication regimens.<sup>27–29</sup> The expert committee recognizes that all information about telemedicine is derived from studies that use it to supplement traditional, in-person medical care. The committee is confident that the benefit of telemedicine for hypertension management will become evident and that the COVID-19 pandemic will accelerate this process.

We encourage the use of HBPM not just in hypertensive patients. Persons with normal BP and, more importantly, adults with high normal BP (office BP 130–139/85–89 mmHg) should measure their BP at home to detect masked hypertension (Strength of Recommendation Ila, Quality of Evidence B) (Table 3).

### 3 | PROCEDURES REQUIRED FOR HOME BLOOD PRESSURE MONITORING

HBPM can play an important role in the diagnosis and monitoring of hypertension. The procedures required for HBPM must include

careful patient training, selection of proper measuring devices, and instructions on measurement procedures (Table 4).

## 4 | DIAGNOSTIC CRITERIA

If the mean home BP is between 125–135/75–84 mmHg, the patient should be categorized as having high-normal BP. If the mean home BP is  $\geq 135/85$  mmHg, the patient is considered to be hypertensive (Strength of Recommendation I, Quality of Evidence A) The home BP classification in adults is provided in Table 6.

If the mean home BP of the morning and evening is  $\geq 135/85$  mmHg, a home BP-based diagnosis of hypertension should be made (Strength of Recommendation I, Quality of Evidence A). If the mean home BP in the morning OR in the evening is  $\geq 135/85$  mmHg, a home BP-based diagnosis of hypertension should be made (Strength of Recommendation Ila, Quality of Evidence B) (Table 7).

## 5 | TARGETS OF ANTIHYPERTENSIVE TREATMENT

The target home BP for antihypertensive treatment is different from the target office BP. There have been few studies that focused on antihypertensive treatment guided by home BP monitoring. Our proposed target home BP for antihypertensive treatment is derived from the relationship between home and office BP, and on risk categories based on home BP (Table 8).

In clinical trials and practice guidelines on hypertension, office BP remains the standard for diagnosis and treatment targets. However, there are new clinical data about ambulatory and home monitoring. With recent improvements in technology and increased utilization of such devices, HBPM represents a paradigm shift in the diagnosis and management of hypertension. The normotensive value of home BP and also the treatment target for home BP levels are mostly approximated from office BP measurement because there is a lack of large-scale, prospective interventional studies focusing only on home BP. Large-scale clinical studies in hypertensive patients provided information for clinicians to aim for lower BP targets.<sup>33,34</sup> A recent meta-analysis also supported lower BP targets without significant concern about the J shape relationship from BP treatment that results in hypotension.

**TABLE 4** Procedures required for home blood pressure monitoring (HBPM)

Patient training under supervision

Information about hypertension

Device selection

Acknowledgment that individual blood pressure (BP) readings can vary substantially

Measurement procedure training

Home BP diagnostic threshold of hypertension and treatment target

Recording and interpretation

#### Device selection<sup>30,31</sup>

Devices for HBPM should be automated and validated upper arm cuff devices and verified according to international standard such as: the 2018 Universal Standard AAMI/ESH/ISO, British Hypertension Society (BHS), the Association for the Advancement of Medical Instrumentation (AAMI), or European Society of Hypertension (ESH)

Information on validated devices were available at [www.stridebp.org](http://www.stridebp.org), [www.bihsoc.org/bp-monitors](http://www.bihsoc.org/bp-monitors), [www.validatebp.org](http://www.validatebp.org)

Avoid using auscultatory devices because patients and relatives can rarely master the technique required for measurements of BP with such devices

Devices with storage of readings/connectivity facilities are preferred

For validation of the device, simultaneous measurements using bilateral arms or sequential measurements using one arm are applicable. A device that differs from the auscultatory method by <5 mmHg is considered to be accurate

The appropriate size of arm-cuff should be selected as described in Table 5. However, many manufacturers have developed autofit arm-cuff which is suitable for patients with wide range of upper arm circumference. Therefore, updated information from the manufacturers of BP monitors should be followed.

Wrist cuff devices are not recommended, except in selected cases such as obese subjects or measurement of nighttime BP

Finger cuff devices or cuffless devices are not recommended

Device maintenance should be done every 6–12 months, i.e., checking the device accuracy, tubing, connections and cuffs

#### Environment for measurement<sup>30,31</sup>

Quiet room with appropriate temperature

Avoid smoking, caffeinated beverages, alcohol, or exercise within 30 min before measurements

Urinate if feel the need to do so

Ensure at least 5 min of quiet rest in sitting position before measurement

Sitting on a chair with a straight support for the back without legs cross

No conversation before and during measurement

Keep arm supported on a flat surface, with the upper arm at heart level

Bottom of the cuff should be place directly above the antecubital fossa (bend the elbow)

Cuff may be applied over the thin cloth from shirt or dress

Remain still before and during measurement

Verify that left/right inter-arm difference is not significant (<10 mmHg). If difference is significant, measurement should be taken on the arm with the higher reading

#### Measurement conditions

Morning: within 1 h after waking up, after urination, before antihypertensive drugs dosing in the morning, and before breakfast

Evening: before retiring to sleep

For evening measurement, certain lifestyle habits may affect BP levels and should be considered when interpreting the HBPM values. It has been revealed that bathing and alcohol consumption have a significant depressor effect.<sup>32</sup>

Other conditions according to physician's advice

Take at least two readings per occasion, each reading is 1 min apart, record all of the readings and the mean of two measurements should be adopted as the BP level for a given occasion

#### Measurement period

For diagnostic purposes, HBPM should be ideally done for seven consecutive days. If not possible or in urgent conditions, HBPM should be done at least 3 days.

In a stable period

Measure once or twice per week OR

Measure 7 days before each clinic visit, and at least over 1 week within 3 months

Obtain 7 days BP reading beginning 2 weeks after initiation or a change in the treatment regimen, during the week before a clinic visit, and measure at least 3 days

#### Documentation and evaluation

All BP readings should be documented without selection, together with the pulse rate, and the date and time of measurements. Use of devices with a printer or an integrated circuit memory is useful to avoid selection bias.

Home BP is evaluated using the mean values of all measurements in the morning and evening, averaged for a certain period

**TABLE 5** Upper arm circumference and appropriate size of arm-cuff

Upper arm circumference	Appropriate size of arm-cuff	Bladder size
22–26 cm	Small adult	12 × 22 cm
27–34 cm	Adult	16 × 30 cm
35–44 cm	Large adult	16 × 36 cm
45–52 cm	Extra-large adult	16 × 42 cm

**TABLE 6** Classification of home blood pressure (BP) in adults

Category	Average home BP (mmHg)	
	Systolic	Diastolic
Normal	<125	And <75
High normal	125–134	And/or 75–84
Hypertension	≥135	And/or ≥85

**TABLE 7** Recommendation for hypertension diagnosis based on home blood pressure monitoring (HBPM)

Recommendations	Strength of recommendations	Quality of evidence
The average of whole-day HBPM from all measured occasions of ≥135/85 mmHg is diagnostic for hypertension	I	A
The average of both morning and evening HBPM of ≥135/85 mmHg is diagnostic for hypertension	I	A
The average of HBPM measured in the morning or in the evening of ≥135/85 mmHg is diagnostic for hypertension	Ila	B

**TABLE 8** Risk categories based on home BP

Home BP	High normal BP 125–134/75–84 mmHg	Hypertension ≥135/85 mmHg
ASCVD risks	High normal BP 125–134/75–84 mmHg	Hypertension ≥135/85 mmHg
DM, CKD stage 3, HMOD	Medium	Medium to high
ASCVD, CKD stage ≥4, DM with organ damage	High	High to very high

HMOD is hypertension-mediated organ damage which are arterial stiffening, left ventricular hypertrophy, microalbuminuria, moderate or severe chronic kidney disease, asymptomatic peripheral arterial disease, and advanced hypertensive retinopathy such as hemorrhages, or exudates, papilledema. ASCVD is cerebrovascular disease (ischemic stroke, cerebral hemorrhage, transient ischemic attack), coronary artery disease (myocardial infarction, angina, myocardial revascularization), heart failure, symptomatic peripheral arterial disease, presence of atheromatous plaque on imaging, and atrial fibrillation. Low risk: 10-year CVD mortality risk <1%, medium risk: 10-year CVD mortality risk 1%–5%, high risk: 10-year CVD mortality risk 5%–10%, and very high risk: 10-year CVD mortality risk >10%. ASCVD, atherosclerotic cardiovascular disease; BP, blood pressure; CKD, chronic kidney disease; DM, diabetes mellitus; HMOD, hypertension mediated organ damage.

**TABLE 9** Home blood pressure (BP) targets

Age	Target home BP (mmHg)
18–65 years	<125/75
>65 years	<135/85

**TABLE 10** Recommendations for achievement of home blood pressure control

Recommendations	Strength of recommendations	Quality of evidence
The average value of whole-day BP should satisfy the goals of treatment in Table 9	I	A
It is reasonable that both the average home BP values in the morning and evening satisfy the goals of treatment in Table 9	IIa	B
In patients with uncontrolled home BP, medication adherence should be ensured and encouraged	I	A
In patients with uncontrolled home BP, life style modification should be encouraged	I	A
In patients with uncontrolled home BP, confirmation of diagnosis by ABPM is reasonable before modification of antihypertensive drug therapy	IIb	C
In patients with uncontrolled home BP, adjustment of dosing, time and/or shift to longer-acting antihypertensive drug may be indicated	IIb	C

ABPM, ambulatory BP monitoring; BP, blood pressure.

These data encouraged the expert committee to set lower home BP targets (Table 9). The recommendations for achievement of home BP control were described in Table 10.

## 6 | CONCLUSIONS

HBPM is useful in improving the awareness, diagnosis, and management of hypertension. However, in the absence of established international consensus on HBPM standards, these guidelines are intended to provide simplified instruction for physicians and other health care personnel in Thailand. Home BP management under these guidelines is expected to improve the diagnosis and management of hypertension in the Thai population.

## ACKNOWLEDGMENT

This work was supported by Thai Hypertension Society. We would like to thank Ms. Ayako Okura for her support.

## CONFLICT OF INTEREST

There was no conflict of interest to disclose.

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**How to cite this article:** Kunanon S, Roubanthisuk W, Chattranukulchai P, et al. 2022 Thai Hypertension Society guidelines on home blood pressure monitoring. *J Clin Hypertens*. 2022;24:1139-1146.  
<https://doi.org/10.1111/jch.14569>