

## GUIDELINES

# The HOPE Asia network 2022 up-date consensus statement on morning hypertension management

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#### Abstract

Morning hypertension is an important clinical target in the management of hypertension for perfect 24-h blood pressure (BP) control. Morning hypertension is generally categorized into two types: “morning surge” type and “sustained nocturnal and morning hypertension” type. The “morning surge” type is characterized by an exaggerated morning blood pressure surge (MBPS), and the “sustained nocturnal and morning hypertension” type with continuous hypertension from nighttime to morning (non-dipper/riser type). They can be detected by home and ambulatory blood pressure measurements (HBPM and ABPM). These two forms of morning hypertension both increase the risk of cardiovascular and renal diseases, but may occur via different pathogenic mechanisms and are associated with different conditions. Morning hypertension should be treated to achieve a morning BP level of < 135/85 mmHg, regardless of the office BP. The second target morning BP levels is < 125/75 mmHg for high-risk patients with morning hypertension and concomitant diseases. Morning hypertension is more frequently found in Asians, than in Westerners. Thus, the management of morning hypertension is especially important in Asia. The detection of morning hypertension and the individual home BP-guided treatment approach targeting morning BP in combination with ABPM, and the optimal treatment of morning hypertension would reduce cardiovascular events in Asia.

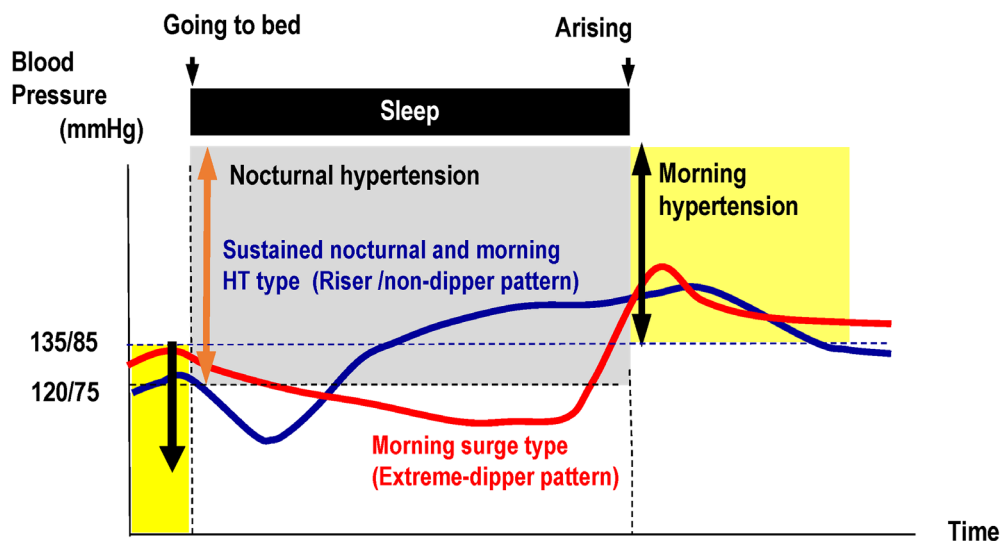
#### KEYWORDS

antihypertensive medication, Asia, bedtime dosing, hypertension, morning, personalized approach

## 1 | BACKGROUND AND RATIONALE OF CONSENSUS

Morning hypertension is an important and effective clinical target in the management of hypertension for perfect 24-h blood pressure (BP) control.<sup>1</sup> There is accumulating evidence that morning hypertension confers high risk for cardiovascular events especially in Asia.<sup>2-6</sup> In particular, for medicated patients with hypertension, once daily dosing of antihypertensive drugs means that the trough BP-lowering effects are often in the morning, immediately prior to the next dose. Thus, morning BP control is the “blind spot” for current hypertensive medication.<sup>1</sup>

Two types of morning hypertension can be detected by home and ambulatory blood pressure measurements (HBPM and ABPM). One is the “morning surge” type, characterized by an exaggerated morning blood pressure surge (MBPS), and the other is the “sustained nocturnal and morning hypertension” type with continuous hypertension from nighttime to morning (non-dipper/riser type) (Figure 1).<sup>1,7</sup> These two forms of morning hypertension both increase the risk of cardiovascular and renal diseases,<sup>8</sup> but may occur via different pathogenic mechanisms and are associated with different conditions.<sup>1</sup> These two types, exaggerated MBPS,<sup>9</sup> and nocturnal hypertension,<sup>10</sup> are more frequently found in Asians, than in Westerners. Thus, the management



**FIGURE 1** Two types of morning hypertension. Reprinted from Kario K. *Am J Hypertens* 2005;18:149-151

of morning hypertension is especially important in Asia and we have focused on its management.<sup>11-13</sup>

Home BP-guided approach is the emerging management of hypertension and recommended for clinical practice<sup>14-19</sup> and it is facilitated for telemedicine in the era of COVID-19.<sup>20,21</sup> Morning BP can easily be self-measured using a HBPM device. In 2022, the HOPE Asia Network has introduced seven action approaches for the management of hypertension in Asia.<sup>22</sup> Among the seven approaches, reducing morning home BP is considered as the first therapeutic target. Here, we release an updated consensus statement on the practical management of morning hypertension in Asia (Tables 1 and 2).

## 2 | DEFINITION OF MORNING HYPERTENSION

Morning hypertension was first broadly defined as the average of the measured morning BPs  $\geq 135/85$  mmHg, regardless of office BP and BP levels measured at the other time periods.<sup>23</sup> This could be evaluated by HBPM, ABPM, or wearable (oscillometric) BP measurements (WBPM).

Masked morning hypertension is defined as morning hypertension with office BPs  $< 140/90$  mmHg but average morning HBPM  $\geq 135/85$  mmHg. Masked uncontrolled morning hypertension is masked morning hypertension on medication. The incidence of masked morning uncontrolled hypertension increases after initiation of antihypertensive treatment. Even with an increase in number of antihypertensive medications of two or more, masked uncontrolled morning hypertension remains at 50% or higher (data not shown) in HI-JAMP study.<sup>24</sup> But the reproducibility of the diagnosis of masked uncontrolled hypertension by HBPM itself is poor because of poor reproducibility of office BP measurement.<sup>25</sup> So HBPM directed treatment may be more consistent in the monitoring of the therapeutic response.

There are two types of morning hypertension. One is the morning surge type, and another is sustained nocturnal and morning

hypertension type with transition from nocturnal hypertension.<sup>1,8</sup> Although morning BP surge has been well recognized as a risk of cardiovascular events,<sup>26,27</sup> a recent ABPM prospective study demonstrated that morning BP surge increased stroke risk in the group with a dipper pattern, but not in the non-dipper group.<sup>28</sup>

## 3 | DEVICE AND ASSESSMENT OF MORNING BP

Validated upper-arm HBPM and ABPM devices are essentially recommended to measure morning BP. Their characteristics are summarized in the Table 3.

### 3.1 | HBPM

Morning home BP is the average of the BPs self-measured after 2-min rest in seated position, twice with 1-min interval after urination, before taking morning pills, and within 1 h after rising in the morning, for  $> 5$  days ( $> 10$  measures).<sup>1</sup>

The maximum morning home systolic BP is the maximum of two measures on one occasion during 1-week of measurements. Lower temperature increases morning BP variability and triggers maximum morning home BP.<sup>29</sup>

### 3.2 | ABPM

Morning ambulatory BP is the average of BPs automatically measured for 2 h (four measures with 30 min-interval each by ABPM) after rising.<sup>1</sup> If the arising time is not available, morning ambulatory BP (fixed-time) is defined as the average of BPs during 7:00-8:59 a.m.<sup>1</sup> Arising time is more accurately determined by Actigraph® in combination with an upright position sensor. Physical activity and upright

**TABLE 1** The HOPE Asia Network 2022 update to the consensus on morning hypertension management**1. Definition**

- Morning hypertension is diagnosed by HBPM, ABPM, or WBPM as the average of the measured morning BPs  $\geq 135/85$  mmHg, regardless of office BP and BP levels measured at the other time periods.
- Masked morning hypertension is defined as morning hypertension with office BP  $< 140/90$  mmHg.
- Masked uncontrolled morning hypertension is masked morning hypertension on medication.
- There are two types of morning hypertension. One is the morning surge type, and the other is sustained nocturnal and morning hypertension type.

**2. Device and assessment**

- Validated upper-arm HBPM and ABPM devices are essentially recommended to measure morning BP.
- Morning home BP is the average of the BPs self-measured after 2 min-rest in seated position, twice with 1 min-interval after urination, before taking morning pills, and within 1 h after arising in the morning, with  $> 5$  days of measurements ( $> 10$  measures).
- Morning ambulatory BP is the average of BPs automatically measured for 2-h (four measures with 30 min-interval by ABPM) after arising. If the arising time is not available, morning ambulatory BP (fixed-time) is defined as the average of BPs during 7:00–8:59 a.m.
- ABPM is recommended to evaluate nocturnal hypertension and simultaneously to differentiate between “morning surge” and “sustained nocturnal and morning hypertension” types. Wrist and upper-arm nighttime HBPM devices (oscillometric) may be available to measure nighttime BP.
- WBPM (oscillometric device) could be used to measure morning BPs, when it is used under similar conditions as HBPM (measured in the sitting condition, within 1-h after arising). Wearable morning home BP, could also be used when it is used under similar conditions as ABPM (measured during 2-h after arising in the ambulatory situation). Upper-arm WBPM is recommended, but wrist WBPM may alternatively be used, when individual wrist-brachial systolic BP difference is confirmed  $< 5$  mmHg.
- Cuff-less device is not recommended to obtain morning BP values for the diagnosis and treatment of hypertension in clinical practice.

**3. Treatment flow**

- 1) Target morning BP is  $< 135/85$  mmHg in general, and  $< 125/75$  mmHg for high-risk group.
- 2) Strict salt reduction  $< 6$  g per day, body weight reduction, and exercise are recommended first, and together with antihypertensives drugs when required.
- 3) Medication
  - a. Long acting CCB or RASi
  - b. If morning BP is not controlled, change timing of morning dosing to twice per day (or bedtime dosing could be considered case-by-case)
  - c. Single pill combination (SPC) is recommended when needed (combine CCB, RASi, Diuretics, or MR antagonist).
  - d. ARNI and SGLT2 inhibitors are also available to reduce morning BP.
  - e. If BP is still not controlled, beta-blocker or alpha-blocker could be added
- 4) Renal denervation is useful for morning BP reduction.

Abbreviations: ABPM, ambulatory BP monitoring; HBPM, home BP monitoring; WBPM, wearable BP monitoring.

positional change affect more morning ambulatory BP than simple eye-opening at supine position.<sup>29</sup> Morning BP, irrespective of the assessment methods and definitions, was generally reproducible and significantly associated with vascular indices.<sup>30</sup> Nevertheless, morning home BP might be preferred than ambulatory measurements because of better reproducibility and stronger correlation with vascular indices.

ABPM is recommended to evaluate nocturnal hypertension and simultaneously to differentiate between “morning surge” and “sustained nocturnal and morning hypertension” types. The simultaneous assessment of nocturnal hypertension would be useful for the high-risk patients with diabetes CKD, sleep apnea, and history of atherosclerotic CVD, heart failure, and/or in drug-resistant hypertension.<sup>32</sup> These high-risk patients are likely to have nocturnal hypertension and nocturnal hypertension per se increases their cardiovascular risk. Wrist and upper-arm nighttime HBPM devices (oscillometric) are available

to measure nighttime BP,<sup>33,34</sup> but currently are mainly for research purposes.

**3.3 | WBPM**

WBPM (oscillometric device) could be used to measure morning BPs, when it is used under similar conditions as HBPM (measured in the sitting position, within 1-h after arising). Wearable morning home BP,<sup>35</sup> could also be used when it is used under similar conditions as ABPM (measured during 2-h after arising in the ambulatory situation). Upper-arm WBPM is recommended, but wrist WBPM may alternatively be used, when individual wrist-brachial systolic BP difference is confirmed as  $< 5$  mmHg.<sup>36</sup> Cuff-less device is not recommended to obtain the morning BP values for the diagnosis and treatment of hypertension in clinical practice.

**TABLE 2** 2022 updated evidence for morning hypertension management**Cardiovascular risk**

Cardiovascular event risk is the lowest under the condition of the average of morning home systolic BP (SBP) < 125 mmHg in the high-risk hypertensive patients.

Maximum home systolic BP > 170 mmHg (one third found in the morning), or morning-evening differences of home systolic BP > 20 mmHg are at risk for cardiovascular events on the top of risk of morning hypertension.

Sustained maximum home systolic BP < 140 mmHg (stable controlled status) is associated with markedly less risk within a few years.

Morning wearable BPs (the peak and average) detected by watch-type wearable BP monitoring are significantly correlated with left ventricular mass index measured by cardiac MRI.

In STEP, a RCT in elderly hypertensive patients, approximate 7.5 mmHg difference in morning home systolic BP between the strict BP control and the standard control groups accounted for 26% difference in cardiovascular events.

**Antihypertensive medication**

SGLT2i significantly decreased morning home BP in diabetic hypertensive patients.

ARNI more effectively reduced morning ambulatory BP in Asia than in Western countries.

A new highly selective MR blocker, esaxerenone, is effective to reduce morning ambulatory BP especially in the elderly hypertensive patients.

**Digital therapeutics and renal denervation**

Hypertension digital therapeutics (therapeutic App) significantly lowers morning home BP.

3-year long-term BP lowering effect of renal denervation was confirmed without adverse effect.

## 4 | RECENT AND NEW EVIDENCE FOR MORNING HYPERTENSION

International guidelines for the management of hypertension recommends home and ambulatory daytime BP levels < 135/85 mmHg. Thus, we set the target morning BP level to < 135/85 mmHg. Recently, several RCTs of antihypertensive treatment evaluated the morning home and/or ambulatory BPs. The STEP study,<sup>37</sup> a RCT of strict versus standard BP control in the elderly, and HERB DH1,<sup>38</sup> a RCT of digital therapeutics, a study that evaluated morning home BP, and SPYRAL HTN-ON-Med feasibility study,<sup>39</sup> a sham-controlled RCT of renal denervation, all evaluated the morning ambulatory BP.

### 4.1 | Cardiovascular disease risk

In the subanalysis of the HONEST study, cardiovascular event risk in the high-risk hypertensive patients with diabetes or history of stroke, was lowest in those whose average morning home systolic BPs was < 125 mmHg.<sup>39</sup> In the recent analysis of JHOP study, maximum home systolic BP (the maximum value of the average of three consecutive measures on one occasion, morning or evening, during the 14 days) of > 170 mmHg (one third found in the morning) was associated with > 10 times increased risk of cardiovascular events, than maximum home systolic BP < 140 mmHg.<sup>40</sup> This sustained maximum home systolic BP < 140 mmHg (always stable, stabilized BP control condition) is markedly at less risk within the next few years. In addition, morning-evening differences (morning minus evening) of home systolic BP > 20 mmHg was at risk for cardiovascular events independent of the home BPs (i.e., the average of morning and evening BPs).<sup>41</sup> Morning wearable BPs (the peak and average) detected by watch-type wearable BP monitoring are significantly correlated with

left ventricular mass index measured by cardiac MRI.<sup>42</sup> The intervention of antihypertensive drug for targeting morning hypertension provided the regression of hypertensive organ damages.<sup>43-45</sup> In the STEP study, approximately 7.5 mmHg difference in morning home systolic BP between the strict BP control versus the standard control groups, resulted in a 26% difference in cardiovascular events.<sup>36</sup>

### 4.2 | Antihypertensive medication

SGLT2i significantly decrease morning home BP in diabetic hypertensive patients.<sup>47,48</sup> The SACRA study, a RCT of diabetic patients with uncontrolled nocturnal hypertension demonstrated that empagliflozin significantly lowered morning home systolic BP by 8.1 mmHg compared with the placebo control group.<sup>47</sup>

In addition, an ARNI is more effective in reducing BPs in salt-sensitive Asians than in the Westerners.<sup>48,49</sup>

ARNI more effectively lowers nighttime BP and NT-proBNP than daytime BP in Asians and older patients, who have salt-sensitive hypertension.<sup>49</sup> Morning ambulatory BP would be more significantly reduced by ARNI. A new highly selective mineralocorticoid-receptor (MR) blocker, esaxerenone, has been shown to be effective in reducing morning and evening ambulatory BP, especially in the elderly hypertensive patients, resulting in reduction of NT-proBNP level.<sup>51</sup>

### 4.3 | Digital therapeutics and renal denervation

Hypertension digital therapeutics (therapeutic App), which facilitate the six non-pharmacological interventions including sodium reduction, lowering body weight, exercise, keeping good sleep, stress management and alcohol restriction, with daily HBPM significantly lowers

**TABLE 3** Role of HBPM and ABPM in the management of morning hypertension

	HBPM	ABPM
Availability	Good	Poor
Repeated measurement	Feasible	Difficult
Evaluation of subtype	Possible	Accurate
Reproducibility	Fair	Poor <sup>a</sup>
Day to day variability	Available	Not available

<sup>a</sup>Hypertension. 2019;74:137–144.

morning home systolic BP by 4.3 mmHg, compared with control group using daily HBPM and standard lifestyle modification by doctors. In this study, the standard lifestyle modification by doctors in combination with daily HBPM significantly lowered morning home systolic BP by 6.2 mmHg at 12 week of intervention, while digital therapeutics (+HBPM) lowered by 10.6 mmHg from baseline.<sup>38</sup> Thus, individual approach of better lifestyle modification, reinforced by the intensity of the App, in combination with daily HBPM would be effective in reducing morning home BP. Another interventional approach is renal denervation. The longer 3-year follow-up results of the sham-controlled RCT, SPYRAL HTN-ON Med feasibility study, demonstrated an 11.0 mmHg-lowering effect of renal denervation compared with sham on ambulatory morning systolic BP, without adverse effects at 36 months after the procedure.<sup>39</sup> However, several clinical trials of renal denervation did not achieve the primary endpoint.<sup>52,53</sup> Whether renal denervation is effective for morning hypertension remains a subject of ongoing debate.

## 5 | CLINICAL MANAGEMENT FLOW OF MORNING HYPERTENSION

HBPM would be the first measurement to be used in the management of hypertension, and home BP-guided approach is recommended for all hypertensive patients.

For the diagnosis of morning hypertension, HBPM should be used first and should be done for all patients while ABPM is recommended in high-risk patients or in which the two types of morning hypertension needs to be defined.

Morning hypertension is the first target to focus on and should be treated to achieve a morning BP level of < 135/85 mmHg, regardless of the office BP. The second target morning BP levels is < 125/75 mmHg for high-risk patients with morning hypertension and concomitant diabetes, coronary artery disease, albuminuria, heart failure, taking antiplatelet or anticoagulant drugs, etc. ABPM is recommended for these high-risk patients to evaluate nighttime BP. Nighttime home BP monitoring may alternatively be used. The final goal is sufficient nighttime BP reduction and stabilized morning BP control without morning BP surge.<sup>1</sup>

Several international guidelines recommend that exercise program included aerobic, resistance and isometric is the foundation of hypertensive treatment.<sup>53–55</sup> Exercise training could be important for the

management of morning hypertension. Regarding antihypertensive treatment of morning hypertension, calcium channel blockers (CCB) are recommended for the elderly hypertensive patients with marked BP variability. RAS inhibitors are recommended for adult hypertensive patients, especially those with albuminuria. If morning BP is not controlled by one drug, ARB/CCB combination, or changing the ARB to sacubitril/valsartan, or adding thiazide-like diuretics or MR antagonist is effective. In addition, previous study reported that the administration of beta blocker reduced morning BP with parallel reduction morning heart rate.<sup>56</sup> If BP is still not controlled, beta-blocker or alpha-blocker could be added.<sup>43</sup>

To achieve fast and strict BP control with improved drug adherence, single pill combinations (SPC) are recommended. A single-pill combination of cilnidipine, an L-/N-type CCB, and ARB effectively reduced morning home BP and morning BP variability.<sup>57</sup>

Practically, when morning hypertension is not controlled by once daily morning dosing, switching to the drug with longer half-life or twice-daily dosing (morning and evening dosing). Bedtime dosing could be considered case-by-case.<sup>45</sup>

Renal denervation may be considered for patients with uncontrolled morning and/or nocturnal hypertension treated with antihypertensive medications.<sup>59</sup>

## 6 | PERSPECTIVES IN ASIA

Morning hypertension is the primary target of hypertension management in Asia. However, morning hypertension is still not sufficiently well controlled. The detection of morning hypertension and the individual home BP-guided treatment approach targeting morning BP in combination with ABPM, and the optimal treatment of morning hypertension would reduce cardiovascular events in Asia.

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












### CONFLICTS OF INTEREST

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#### REFERENCES

- Kario K. *Essential manual of perfect 24-hour blood pressure management from morning to nocturnal hypertension (2nd edition)*. Wiley; 2022: 1-374.
- Ohkubo T, Imai Y, Tsuji I, et al. Home blood pressure measurement has a stronger predictive power for mortality than does screening blood pressure measurement: a population-based observation in Ohasama, Japan. *J Hypertens*. 1998; 16: 971-975.
- Kario K, Ishikawa J, Pickering TG, et al. Morning hypertension: the strongest independent risk factor for stroke in elderly hypertensive patients. *Hypertens Res*. 2006; 29: 581-587.
- Asayama K, Ohkubo T, Metoki H, et al. Cardiovascular outcomes in the first trial of antihypertensive therapy guided by self-measured home blood pressure. *Hypertens Res*. 2012;35:1102-1110.
- Hoshide S, Yano Y, Haimoto H, et al. Morning and evening home blood pressure and risks of incident stroke and coronary artery disease in the Japanese general practice population: the Japan morning surge-home blood pressure study. *Hypertension*. 2016; 68: 54-61.
- Kario K, Saito I, Kushiro T, et al. Morning home blood pressure is a strong predictor of coronary artery disease: the HONEST study. *J Am Coll Cardiol*. 2016; 67: 1519-1527.
- Kario K. Time for focus on morning hypertension: pitfall of current antihypertensive medication. *Am J Hypertens*. 2005;18:149-151
- Wanthong S, Kabutoya T, Hoshide S, Buranakitjaroen P, Kario K. Early morning-best time window of hourly 24-hour ambulatory blood pressure in relation to hypertensive organ damage: the Japan morning surge-home blood pressure study. *J Clin Hypertens*. 2019; 21: 579-586.
- Hoshide S, Kario K, de la Sierra A, et al. Ethnic differences in the degree of morning blood pressure surge and in its determinants between Japanese and European hypertensive subjects: data from the ARTEMIS study. *Hypertension*. 2015;66:750-756.
- Li Y, Staessen JA, Lu L, Li LH, Wang GL, Wang JG. Is isolated nocturnal hypertension a novel clinical entity? Findings from a Chinese population study. *Hypertension*. 2007; 50: 333-339.
- Wang JG, Kario K, Park JB, Chen CH. Morning blood pressure monitoring in the management of hypertension. *J Hypertens*. 2017; 35: 1554-1563.
- Wang JG, Kario K, Chen CH, et al. Management of morning hypertension: a consensus statement of an Asian expert panel. *J Clin Hypertens*. 2018; 20: 39-44.
- Kario K, Shin J, Chen CH, et al. Expert panel consensus recommendations for ambulatory blood pressure monitoring in Asia: the HOPE Asia Network. *J Clin Hypertens*. 2019; 21: 1250-1283.
- Kario K, Shimbo D, Hoshide S, et al. The emergence of home blood pressure-guided management of hypertension based on global evidence. *Hypertension*. 2019; 74: 229-236.
- Park S, Buranakitjaroen P, Chen CH, et al. Expert panel consensus recommendations for home blood pressure monitoring in Asia: the Hope Asia Network. *J Hum Hypertens*. 2018; 32: 249-258.
- Lin HJ, Wang TD, Yu-Chih Chen M, et al. 2020 consensus statement of the Taiwan hypertension society and the Taiwan society of cardiology on home blood pressure monitoring for the management of arterial hypertension. *Acta Cardiol Sin*. 2020;36:537-561.
- Stergiou GS, Palatini P, Parati G, et al. 2021 European society of hypertension practice guidelines for office and out-of-office blood pressure measurement. *J Hypertens*. 2021;39:1293-1302.
- Parati G, Stergiou GS, Bilo G, et al. Home blood pressure monitoring: methodology, clinical relevance and practical application: a 2021 position paper by the Working Group on Blood Pressure Monitoring and Cardiovascular Variability of the European Society of Hypertension. *J Hypertens*. 2021; 39: 1742-1767.
- Miao H, Yang S, Zhang Y. Differences of blood pressure measured at clinic versus at home in the morning and in the evening in Europe and Asia: a systematic review and meta-analysis. *J Clin Hypertens (Greenwich)*. 2022; 24(6): 677-688.

20. Omboni S, McManus RJ, Bosworth HB, et al. Evidence and recommendations on the use of telemedicine for the management of arterial hypertension: an international expert position paper. *Hypertension*. 2020; 76: 1368-1383.
21. Kario K, Harada N, Okura A. State-of-the-art rapid review of the current landscape of digital hypertension. *Connect Health*. 2022. online.
22. Kario K, Chia YC, Siddique S, et al. Seven-action approaches for the management of hypertension in Asia—the HOPE Asia network. *J Clin Hypertens*. 2022; 24: 213-223.
23. Kario K. *Clinician's manual on early morning risk management in hypertension*. Science Press; 2004: 1-68.
24. Kario K, Hoshide S, Tomitani N, et al. HI-JAMP Study Group. Inconsistent control status of office, home, and ambulatory blood pressure all taken using the same device: The HI-JAMP study baseline data. *Am J Hypertens*. 2022 Sep 2: hpac103. <https://doi.org/10.1093/ajh/hpac103>. Epub ahead of print.
25. Barochiner J, Posadas Martínez ML, Martínez R, Giunta D. Reproducibility of masked uncontrolled hypertension detected through home blood pressure monitoring. *J Clin Hypertens (Greenwich)*. 2019; 21: 877-883.
26. Kario K, Pickering TG, Umeda Y, et al. Morning surge in blood pressure as a predictor of silent and clinical cerebrovascular disease in elderly hypertensives: a prospective study. *Circulation*. 2003; 107: 1401-1406.
27. Li Y, Thijs L, Hansen TW, et al. Prognostic value of the morning blood pressure surge in 5645 subjects from 8 populations. *Hypertension*. 2010; 55: 1040-1048.
28. Hoshide S, Kario K. Morning surge in blood pressure and stroke events in a large modern ambulatory blood pressure monitoring cohort: results of the JAMP Study. *Hypertension*. 2021; 78: 894-896.
29. Kario K. Home blood pressure monitoring: current status and new developments. *Am J Hypertens*. 2021; 34: 783-794.
30. Khoury AF, Sunderajan P, Kaplan NM. The early morning rise in blood pressure is related mainly to ambulation. *Am J Hypertens*. 1992; 5(6 Pt 1): 339-344.
31. Guo QH, Cheng YB, Zhang DY, et al. Comparison between home and ambulatory morning blood pressure and morning hypertension in their reproducibility and associations with vascular injury. *Hypertension*. 2019; 74: 137-144.
32. Kario K. Nocturnal hypertension: new technology and evidence. *Hypertension*. 2018; 71: 997-1009.
33. Kario K, Tomitani N, Iwashita C, Shiga T, Kanegae H. Simultaneous self-monitoring comparison of a supine algorithm-equipped wrist nocturnal home blood pressure monitoring device with an upper arm device. *J Clin Hypertens*. 2021; 23: 793-801.
34. Tomitani N, Kanegae H, Kario K. Comparison of nighttime measurement schedules using a wrist-type nocturnal home blood pressure monitoring device. *J Clin Hypertens*. 2021; 23: 1144-1149.
35. Kario K, Tomitani N, Morimoto T, Kanegae H, Lacy P, Williams B. Relationship between blood pressure repeatedly measured by a wrist-cuff oscillometric wearable blood pressure monitoring device and left ventricular mass index in working hypertensive patients. *Hypertens Res*. 2022; 45: 87-96.
36. Kario K, Shimbo D, Tomitani N, Kanegae H, Schwartz JE, Williams B. The first study comparing a wearable watch-type blood pressure monitor with a conventional ambulatory blood pressure monitor on in-office and out-of-office settings. *J Clin Hypertens*. 2020; 22: 135-141.
37. Zhang W, Zhang S, Deng Y, et al. Trial of intensive blood-pressure control in older patients with hypertension. *N Engl J Med*. 2021; 385: 1268-1279.
38. Kario K, Nomura A, Harada N, et al. Efficacy of a digital therapeutics system in the management of essential hypertension: the HERB-DH1 pivotal trial. *Eur Heart J*. 2021; 42: 4111-4122.
39. Mahfoud F, Kandzari DE, Kario K, et al. Long-term efficacy and safety of renal denervation in the presence of antihypertensive drugs: results from the randomised, sham-controlled SPYRAL HTN-ON MED trial. *Lancet*. 2022; 399: 1401-1410.
40. Kario K, Iwashita M, Okuda Y, et al. Morning home blood pressure and cardiovascular events in Japanese hypertensive patients. *Hypertension*. 2018; 72: 854-861.
41. Fujiwara T, Hoshide S, Kanegae H, Kario K. Clinical impact of the maximum mean value of home blood pressure on cardiovascular outcomes: a novel indicator of home blood pressure variability. *Hypertension*. 2021; 78: 840-850.
42. Narita K, Hoshide S, Kario K. Difference between morning and evening home blood pressure and cardiovascular events: the J-HOP Study (Japan Morning Surge-Home Blood Pressure). *Hypertens Res*. 2021; 44: 1597-1605.
43. Kario K, Tomitani N, Morimoto T, Kanegae H, Lacy P, Williams B. Relationship between blood pressure repeatedly measured by a wrist-cuff oscillometric wearable blood pressure monitoring device and left ventricular mass index in working hypertensive patients. *Hypertens Res*. 2022; 45: 87-96.
44. Kario K, Matsui Y, Shibasaki S, et al. An alpha-adrenergic blocker titrated by self-measured blood pressure recordings lowered blood pressure and microalbuminuria in patients with morning hypertension: the Japan Morning Surge-1 Study. *J Hypertens*. 2008; 26: 1257-1265.
45. Kario K, Hoshide S, Shimizu M, et al. Effect of dosing time of angiotensin II receptor blockade titrated by self-measured blood pressure recordings on cardiorenal protection in hypertensives: the Japan Morning Surge-Target Organ Protection (J-TOP) study. *Hypertens*. 2010; 28: 1574-1583.
46. Hoshide S, Yano Y, Kanegae H, Kario K. Effect of lowering home blood pressure on subclinical cardiovascular disease in masked uncontrolled hypertension. *J Am Coll Cardiol*. 2018; 71: 2858-2859.
47. Kario K, Okada K, Kato M, et al. 24-hour blood pressure-lowering effect of an SGLT-2 inhibitor in diabetic patients with uncontrolled nocturnal hypertension: results from the randomized, placebo-controlled SACRA study. *Circulation*. 2019; 139: 2089-2097.
48. Kario K, Okada K, Murata M, et al. Effects of luseogliflozin on arterial properties in patients with type 2 diabetes mellitus: the multicenter, exploratory LUSCAR study. *J Clin Hypertens*. 2020; 22: 1585-1593.
49. Kario K, Williams B. Angiotensin receptor-neprilysin inhibitors for hypertension -hemodynamic effects and relevance to hypertensive heart disease. *Hypertens Res*. 2022; 45: 1097-1110.
50. Wang JG, Yukisada K, Sibulo A Jr, Hafeez K, Jia Y, Zhang J. Efficacy and safety of sacubitril/valsartan (LCZ696) add-on to amlodipine in Asian patients with systolic hypertension uncontrolled with amlodipine monotherapy. *J Hypertens*. 2017; 35: 877-885.
51. Kario K, Ito S, Itoh H, et al. Effect of the nonsteroidal mineralocorticoid receptor blocker, esaxerenone, on nocturnal hypertension: a post hoc analysis of the ESAX-HTN study. *Am J Hypertens*. 2021; 34: 540-551.
52. Bhatt DL, Kandzari DE, O'Neill WW, et al. A controlled trial of renal denervation for resistant hypertension. *N Engl J Med*. 2014; 370: 1393-1401.
53. Kario K, Yokoi Y, Okamura K, et al. Catheter-based ultrasound renal denervation in patients with resistant hypertension: the randomized, controlled REQUIRE trial. *Hypertens Res*. 2022; 45: 221-231.
54. Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: executive summary: a report of the American college of cardiology/American heart association task force on clinical practice guidelines. *Hypertension*. 2018; 71: 1269-1324.
55. Umemura S, Arima H, Arima S, et al. The Japanese society of hypertension guidelines for the management of hypertension (JSH 2019). *Hypertens Res*. 2019; 42: 1235-1481.
56. Williams B, Mancia G, Spiering W, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension: the Task Force for the



- management of arterial hypertension of the European Society of Cardiology and the European Society of Hypertension: the Task Force for the management of arterial hypertension of the European Society of Cardiology and the European Society of Hypertension. *J Hypertens*. 2018; 36: 1953-2041.
57. Neutel JM, Rotenberg K. Comparison of a chronotherapeutically administered beta blocker vs. a traditionally administered beta blocker in patients with hypertension. *J Clin Hypertens*. 2005; 7: 395-400.
58. Kario K, Matsuda S, Nagahama S, et al. Single-pill combination of cilnidipine, an l-/n-type calcium channel blocker, and valsartan reduces the day-by-day variability of morning home systolic blood pressure in patients with treated hypertension: a sub-analysis of the HOPE-combi survey. *J Clin Hypertens*. 2021; 23: 392-397.
59. Kario K, Kim BK, Aoki J, et al. Renal denervation in Asia: consensus statement of the asia renal denervation consortium. *Hypertension*. 2020; 75: 590-602.

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