

ORIGINAL ARTICLE

Practice and awareness of physicians regarding home blood pressure measurement in Japan

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The Japanese Society of Hypertension published guidelines for home blood pressure (HBP) measurement in 2003 and for the management of hypertension in 2004. The objective of this study was to investigate the status of physicians' practice and awareness of HBP measurement based on the Japanese guidelines and compare the status between immediately after and 4 years after publication of the guidelines. A questionnaire survey regarding HBP was conducted among physicians who attended educational seminars on hypertension in 2004–05 and in 2007–08. This questionnaire was distributed, completed, and collected just before the start of the seminars. Of the 1966 and 2995 respondents to the 2004–05 and 2007–08 surveys, respectively, 90.2 and 94.6% recommended HBP measurement to their patients. The majority of physicians recommended use of the upper-arm cuff device, and recommendation of the number of measurements, documentation and evaluation of the measured values varied widely among physicians, both in 2004–05 and in 2007–08. About 10% of physicians showed sufficient understanding of the optimal methods for HBP measurement based on Japanese guidelines both in 2004–05 and in 2007–08. Only 21.6 and 23.9% of physicians correctly recognized the reference values of hypertension based on HBP measurement (systolic/diastolic, 135/85 mm Hg) in 2004–05 and in 2007–08, respectively. Although most Japanese physicians recognized the importance of HBP measurement, many had inadequate knowledge of HBP measurement, both in 2004–05 and in 2007–08. More aggressive promotion of HBP measurement among physicians is warranted.

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INTRODUCTION

Despite the enormous burden of hypertension, it has not been effectively controlled.¹ One of the causes underlying this unsatisfactory control of blood pressure (BP) is insufficient compliance of physicians with evidence-based medicine and the recommendations of guidelines.^{2,3}

Recently, several national hypertension guidelines have emphasized the importance of self-measurement of BP at home (HBP) in clinical practice.^{4–8} HBP measurement allows multiple BP measurements to be obtained over a long observation period under relatively controlled conditions.^{4–6} Multiple BP measurements reportedly eliminate observer bias, random error and the white-coat effect, so that HBP measurement may be more reliable than the casual clinic BP (CBP) measurements.^{4–6,9,10} The predictive power for cardiovascular diseases is higher with HBP than with CBP.^{9–11} HBP measurement may also provide patients with a better understanding of BP and improve patients' BP control and compliance with therapy.^{12–15}

In Japan, both the Japanese Society of Hypertension (JSH) Guidelines for Self-Monitoring of Blood Pressure at Home (Japanese HBP guidelines)⁶ and the JSH Guidelines for the Management of Hypertension 2004 (JSH 2004 guidelines)⁸ state that HBP should be measured using upper-arm cuff devices, for a lifelong period and at least once in the morning and once in the evening under the following conditions. Morning HBP should be measured within 1 h after waking, after micturition, in a sitting position, after 1–2 min of rest and before taking any antihypertensive drugs and breakfast. Evening HBP should be measured just before going to bed, in a sitting position, after 1–2 min of rest. All HBP values should be recorded, and the mean of the first measurement on each occasion should be taken over a certain period of time. Individual values should also be evaluated.

About 30 million HBP measurement devices have already been distributed in Japan.¹⁶ However, how well general practitioners in

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Japan recognize the guidelines for HBP measurement and the usefulness of HBP remains uncertain. The objective of this study was to investigate and compare the status of physicians' practice and awareness of HBP measurement based on the Japanese guidelines between immediately after and 4 years after publication of the guidelines and clarify what needs to be done in the future.

METHODS

A questionnaire survey regarding HBP/CBP was conducted among physicians who attended educational seminars on hypertension from September 2004 to June 2005, and from November 2007 to July 2008, in 32 and 40 prefectures in Japan, respectively (Appendix A). This questionnaire was distributed and collected just before the start of the seminars. The questionnaire that was developed consisted of questions relating to the practical use of HBP measurement, technical issues involved in HBP measurement, evaluation of HBP measurement, procedures for HBP measurement and awareness of reference values for HBP. Furthermore, the reason for recommending HBP measurement to their patients was investigated in the 2007–08 survey. Of the 2190 and 3416 physicians who attended the educational seminars in 2004–05 and in 2007–08, 1966 (89.8%) and 2995 (87.7%) responded to the questionnaire, respectively.

RESULTS

The characteristics of attending physicians on the seminars were comparable between surveys (Table 1). Almost all physicians recommended HBP measurement to their patients with hypertension (90.2% in 2004–05, 94.6% in 2007–08). More than 90% of physicians answered that HBP was equally (41.8% in 2004–05, 38.2% in 2007–08) or more (48.7% in 2004–05, 56.7% in 2007–08) important than CBP. Furthermore, most physicians answered that morning HBP was equally (46.5% in 2004–05, 41.9% in 2007–08) or more (50.0% in 2004–05, 55.6% in 2007–08) important than evening HBP.

Practical use of HBP measurement among physicians recommending HBP measurement to their patients

Technical issues for HBP measurement in practice. The majority of physicians, in both surveys, recommended use of the upper-arm cuff device when their patients measured HBP (Figure 1). Approximately 70% of physicians answered that the accuracy of upper arm cuff devices for HBP measurement was high in both surveys. Furthermore, approximately 70% of physicians answered that they regularly validated devices' accuracy by comparing with auscultation in both surveys. In response to the question, 'How long should HBP be measured?', the most frequent answer was 'for a lifelong period' (51.8% in 2004–05, 56.2% in 2007–08), followed by 'several months' (15.2% in 2004–05, 13.7% in 2007–08) and 'several years' (13.4% in 2004–05, 13.9% in 2007–08). In response to the question, 'What weekly HBP measurement frequency do you recommend to patients?', the most frequent answer was 'Every day' (69.8% in 2004–05, 74.0% in 2007–08), followed by '3 days' (11.2% in 2004–05, 9.5% in 2007–08). The proportion of physicians answering that patients should measure HBP 'once on each occasion', was small (Figure 2). However, the most frequent answer was 'twice on each occasion' in 2004–05 and 'no instruction' in 2007–08.

Evaluation of HBP measurement. The proportion of physicians who instructed their patients to document 'all measurements' was approximately 20% in both surveys (Figure 3). The proportion of physicians who evaluated values obtained by HBP measurements as 'mean of the 1st measurement on each occasion averaged over a certain long-term period' was approximately 15% in both surveys. However, the most frequent answer was 'both mean and individual values', followed by 'not mean but individual values' in both surveys (Figure 4).

Table 1 Characteristics of physicians

	2004–05 (n=1966)	2007–08 (n=2995)
Gender		
Male (%)	90.8	90.2
Age		
<40 years (%)	13.9	11.0
40–49 years (%)	28.2	27.2
50–59 years (%)	27.4	33.8
60–69 years (%)	14.2	15.1
≥70 years (%)	16.3	13.0
Specialty		
Internal medicine (%)	83.2	82.6
Work place		
Hospital (public, private) (%)	39.8	32.4
Clinic (%)	56.5	65.2

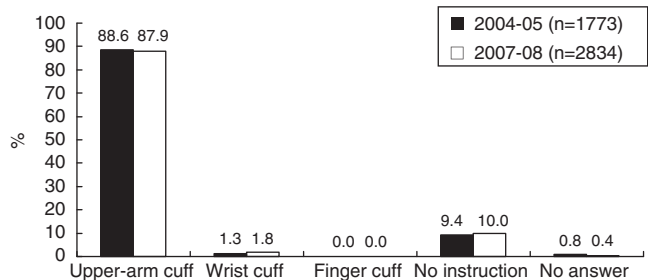


Figure 1 Responses to the question 'Which devices do you recommend when your patients measure HBP?' among physicians recommending HBP measurement to their patients. HBP: home blood pressure.

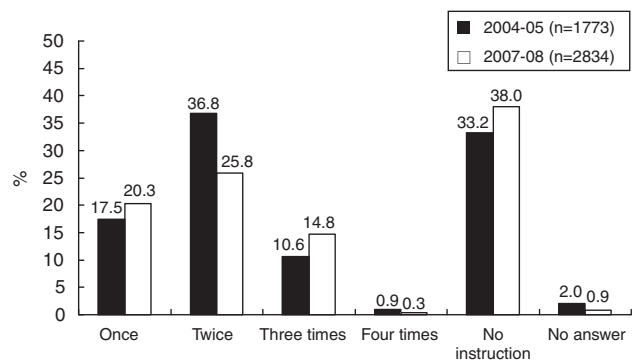


Figure 2 Responses to the question 'How many times should HBP be measured on each occasion?' among physicians recommending HBP measurement to their patients. HBP: home blood pressure.

Procedure for HBP measurement. About 10% of physicians instructed patients to measure HBP under conditions of the 'Japanese guidelines', in both surveys (Table 2).

The reason for recommending HBP measurement to their patients. The most frequent reason was to diagnose white-coat hypertension, followed by to diagnose masked hypertension, to evaluate the

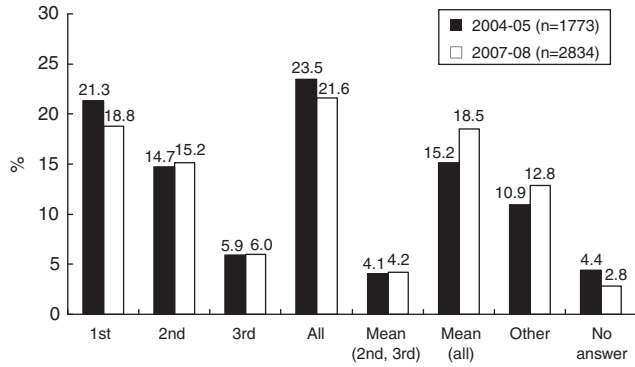


Figure 3 Responses to the question 'How do you instruct patients to document HBP measurement?' among physicians recommending HBP measurement to their patients (multiple-choice). First, first measurement; second, second measurement; third, third measurement; All, all measurements; Mean (second, third), mean of second and third measurements; Mean (all), mean of all measurements. HBP: home blood pressure.

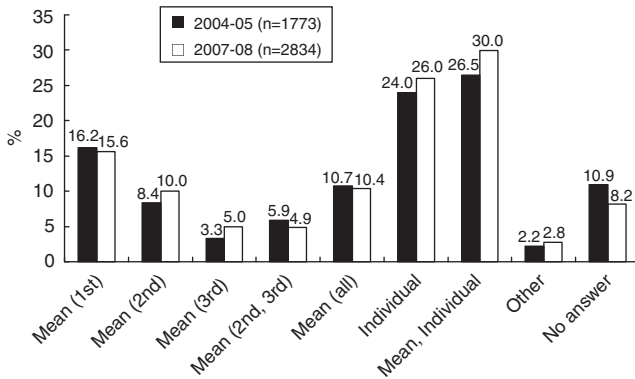


Figure 4 Responses to the question 'How do you evaluate values obtained by HBP measurement?' among physicians recommending HBP measurement to their patients (multiple-choice). Mean (first), mean of the first measurement on each occasion averaged over a certain long-term period; Mean (second), mean of the second measurement on each occasion averaged over a certain long-term period; Mean (third), mean of the third measurement on each occasion averaged over a certain long-term period; Mean (second, third), mean of the second and third measurements on each occasion averaged over a certain long-term period; Mean (all), mean of all measurements averaged over a certain long-term period; Individual, not mean, but individual values; Mean, individual, both mean and individual values. HBP: home blood pressure.

efficacy of antihypertensive drugs and to manage patients based on their HBP (Figure 5).

Awareness of reference values for HBP

The proportion of physicians who correctly recognized the reference values for hypertension based on HBP was approximately 30% for systolic BP, approximately 40% for diastolic BP and approximately 20% for systolic/diastolic BP both in surveys (Table 3). About 20% of physicians identified the reference values for hypertension based on CBP (140/90 mm Hg) as those for HBP in both surveys.

In the 2007–08 survey, compared with older physicians, younger physicians were more likely to prefer HBP measurement, to instruct patients to document HBP measurement and to recognize the reference values for hypertension based on HBP measurement

Table 2 Procedure for HBP measurement among physicians who recommend HBP measurement to their patients

	2004–05 (n=1773)	2007–08 (n=2834)
All the following items completed (%)	10.4	12.7
<i>Morning</i>		
Within an hour after waking (%)	88.7	89.1
After micturition (%)	48.7	55.5
In the sitting position (%)	70.7	71.2
After 1–2 min of rest (%)	28.6	31.7
Before taking antihypertensive drugs (%)	71.9	74.7
Before breakfast (%)	73.7	79.2
<i>Evening</i>		
Before bedtime (%)	53.4	55.8

Abbreviation: HBP, home blood pressure.

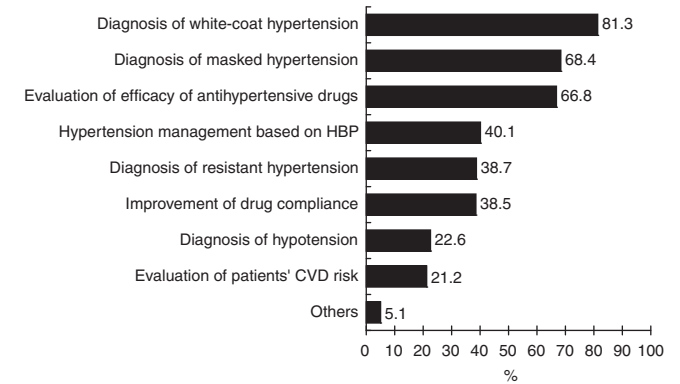


Figure 5 The reason for recommending HBP measurement among physicians recommending HBP measurement to their patients. HBP: home blood pressure, CVD; cardiovascular disease.

Table 3 Awareness of the reference values of hypertension for HBP

	2004–05 (n=1966)	2007–08 (n=2995)
<i>(a) Systolic blood pressure</i>		
< 135 mm Hg (%)	29.5	29.2
135 mm Hg (%)	29.6	30.4
> 135 mm Hg (%)	36.1	34.7
No answer (%)	4.9	5.7
<i>(b) Diastolic blood pressure</i>		
< 85 mm Hg (%)	26.5	24.4
85 mm Hg (%)	39.2	40.4
> 85 mm Hg (%)	29.7	29.1
No answer (%)	4.6	6.1
<i>(c) Systolic/diastolic blood pressure</i>		
135/85 mm Hg (%)	21.6	23.9
140/90 mm Hg (%)	20.9	21.6

Abbreviation: HBP, home blood pressure.

Table 4 The answers among participants according to age and specialty or working place in 2007–2008 survey

	Age (years)					P-value	Specialty		P-value
	< 40	40–49	50–59	60–69	>=70		Internal medicine	Others	
<i>Practical use of HBP measurement</i>									
a. Do you recommend the patients with HT to measure the HBP?									
Yes (%)	97.8	96.3	95.0	94.0	88.9	<0.0001	94.9	93.3	0.13
b. Of which BP information, CBP or HBP, do you think much as a tool for diagnosis and treatment of HT?									
HBP (%)	71.3	66.0	56.0	47.4	39.7	<0.0001	56.2	60.2	0.09
c. Which measurement is important, morning or evening?									
Morning (%)	52.5	59.0	54.8	59.3	49.5	0.009	55.4	56.5	0.65
<i>Awareness of the reference values for HBP</i>									
Systolic/diastolic BP									
^a 135/85 mm Hg (%)	23.1	30.2	26.0	21.2	9.3	<0.0001	25.3	17.3	0.0001
<i>Technical issue on HBP measurement in the practice^b</i>									
a. Which devices do you recommend when your patients measure HBP?									
^a Upper arm-cuff (%)	78.3	87.8	90.1	89.4	88.7	<0.0001	89.4	80.4	<0.0001
b. How long HBP should be measured?									
^a For life (%)	57.5	57.3	56.4	52.5	56.5	0.56	57.6	49.3	0.0008
c. Which measurement frequency for HBP do you recommend to a patient in a week?									
^a Everyday (%)	70.6	74.5	74.5	75.8	72.8	0.55	73.1	78.1	0.02
d. How many times HBP should be measured on each occasion?									
^a Once (%)	18.5	21.8	20.8	21.4	14.8	0.07	20.3	20.2	0.10
<i>Evaluation of HBP measurements^b</i>									
a. How do you instruct to document HBP measurement?									
^a All (%)	31.6	21.9	21.6	17.9	16.8	<0.0001	22.1	19.6	0.23
b. How do you evaluate values obtained by the HBP measurement?									
^a Mean(first) or Individual (%)	61.3	67.5	65.6	64.5	67.3	0.36	66.2	63.1	0.20
<i>Procedure for HBP measurement^b</i>									
Optimal methods for HBP measurement	7.7	15.7	13.9	10.4	10.4	0.001	13.5	9.3	0.01

Abbreviations: HBPM, home blood pressure measurement; HT, hypertension; CBP, casual clinic blood pressure.

^aRecommendation by the guidelines.^bAmong physicians who recommend HBP measurement to their patients.

(Table 4). The awareness of the optimal methods for HBP measurement varied among age groups. Compared with other physicians, internists were more likely to be aware of the reference values for HBP hypertension and the optimal methods for HBP measurement. These results from the 2007–08 survey were broadly similar to those from the 2004–05 survey.

DISCUSSION

Based on questionnaires that were completed by physicians before the start of seminars dealing with hypertension, we found that the majority of Japanese physicians recognized the importance of HBP measurement for diagnosis and treatment of hypertension and recommended HBP measurement to their patients. Some previous surveys have assessed primary care physicians' awareness of the usefulness of HBP measurement.^{17–19} In 2003, Cheng *et al.*¹⁷ reported that the majority of 138 physicians (94%) in the USA agreed with the statement that 'HBP measurement could be useful to me as a primary care provider in treating hypertension'. Recently, Tisler *et al.*¹⁸ also reported that HBP measurement seems to have a major influence on the process of hypertensive patient management in Hungary. On the other hand, in the Canadian survey, only 13% of the physicians

preferred HBP to office or ambulatory readings for diagnostic purposes and 19% to guide therapy.¹⁹

This study confirmed that most Japanese physicians recognized the importance of HBP measurement and used HBP measurement for the purpose of diagnosis of white-coat hypertension or masked hypertension, as well as for the evaluation of drug effects in clinical settings. However, the majority of Japanese physicians displayed insufficient knowledge of the correct use of HBP measurement on the basis of Japanese guidelines,^{7,8} even in the 2007–08 survey. Recommendations for the number of measurements, documentation and evaluation of measured values varied widely among physicians, both in surveys. There is considerable controversy about the number of HBP measurements on each occasion.²⁰ The Japanese guidelines^{7,8} recommended that HBP should be measured at least once on each occasion over a long period, because 'at least once on each occasion' may improve compliance with measurement, and the reference values for home hypertension were based on the first measurement obtained on each occasion over a certain period of time. Recently, we showed that systolic HBP variability and heart rate variability based on the first measurement obtained on each occasion over a certain period of time have predictive power for cardiovascular mortality.²¹ In contrast, other

guidelines recommended that HBP should be measured in duplicate or more on each occasion, because the value of the first measurement is generally the highest among consecutive measurements on one occasion.^{22,23} Therefore, these controversies may be caused by different recommendations for the number of measurements, documentation and evaluation of measured values among domestic and international guidelines. In addition, even when physicians recommended that their patients measure HBP once on each occasion, there were some patients who measured HBP several times on each occasion, and they often reported the lowest value.^{24,25} Therefore, the use of devices with a memory function would be preferred to eliminate this problem, because devices with a memory function have recently been developed.^{26,27}

Only 20% of physicians correctly recognized the reference values for home hypertension (135/85 mm Hg), even in the 2007–08 survey. Conversely, approximately 20% stated that 140/90 mm Hg was the reference value for HBP measurement, whereas this value is actually the standard reference value for hypertension according to CBP measurement. Moreover, the recommendations for the optimal methods for HBP measurement based on Japanese guidelines^{7,8} were identified by about 10% of physicians in both surveys, suggesting that the majority did not have adequate knowledge of HBP measurement. It is essential for physicians to recognize the reference values for home hypertension and the procedure for HBP measurement to evaluate patients' HBP comparably. In previous studies, although most responders believed that HBP measurement could be useful in the management of hypertension,^{17,18} respondents suggested that proper patient training is lacking, better patient training facilities are needed and protocols for HBP measurement must be established.^{18,19} The standardization of various factors in HBP measurement is indispensable for maintaining the quality and comparability of BP information, and a lack of standardization affects the acceptance of HBP measurement as a tool for clinical decision-making. Standardization of the HBP measurement procedure may improve the accuracy of screening and diagnosis for hypertension and accurate assessment of BP control during treatment. HBP measurement under such controlled conditions is expected to improve the medical economics of the diagnosis and management of hypertension.²⁸

Younger physicians might understand the importance of HBP measurement and might recommend HBP measurement, because they may have studied the importance of HBP measurement when they were students. However, middle-aged (40–59 years old) physicians had more knowledge of the reference value of HBP and the procedure for HBP measurement. Because middle-aged physicians not only understood the importance of HBP measurement but also had clinical experience, they might have had more knowledge of the practical aspects of HBP measurement. As expected, internists frequently examined hypertensive patients and were familiar with the HBP measurement. Therefore, they might more adequately understand the HBP measurement than other physicians. However, we did not collect information on the number of patients cared for per day or week.

The majority of physicians answered that the accuracy of upper arm cuff devices for HBP measurement was high. These results might be because of the fact that the accuracy of upper arm cuff devices for HBP measurement made by Japanese companies is assured by the accuracy tests of devices (www.dablededucational.org or http://www.bhsoc.org/blood_pressure_list.stm).

This study had several limitations. As the subjects in this study were physicians attending educational seminars on hypertension, they might have had a greater interest in the diagnosis and treatment of hypertension, regardless of their amount of knowledge about hyper-

tension compared with Japanese general physicians. However, even among such physicians, knowledge of HBP measurement was insufficient. In addition, the impact of the seminars to improve the performance of physicians was not known, because we did not collect the information to identify physicians who attended for both surveys. Therefore, additional surveys might be needed to clarify the impact of the seminars. However, as most of the seminar lecturers were core members of the JSH and the contents of the seminars were similar, the characteristics of physicians attending the seminars were comparable between surveys, and there may have been many physicians who attended both seminars. Therefore, these results might suggest that more aggressive campaigns would be needed, even though JSH published the HBP guidelines and JSH 2004 guidelines in the formal website apart from publication and pharmaceutical companies advertised these guidelines. The answers of physicians to questionnaires do not always accurately reflect their actions in their practices. Previous surveys have found that a considerable number of physicians who recognized the recommendations of guidelines disagreed with them.^{23,29} We have also actually noted in the Hypertension Objective Treatment Based on Measurement by Electrical Devices of Blood Pressure (HOMED-BP) study that even when physicians know the recommended BP goal, they do not necessarily control their patients to this goal.³⁰ In the Japan Home versus Office Blood Pressure Measurement Evaluation (J-HOME) study, conducted among treated hypertensive patients, the proportion of patients evaluated by physicians as having 'poor' control was only 30–40%,³¹ even though patients' home and office BPs were not properly controlled. Therefore, both recognition of and compliance with guideline recommendations need to be clarified. In this study, we did not collect the information on the role of the physicians in the management of HBP measurement. As HBP values often have variability in each measurement, some patients are concerned about this variability. Therefore, one of the roles of physicians might be adequate counseling regarding patients' HBP values, taking into consideration their variability.

We found that the status of physicians' practice and awareness of HBP measurement did not change over 4 years. Therefore, more aggressive promotion of HBP measurement among physicians is warranted. Subsequently, further investigation is needed to assess the influence of new guidelines, which would emphasize the clinical significance of HBP on physician practice and awareness of HBP measurement.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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APPENDIX A
Questionnaire

1. Gender
 1. Male 2. Female
2. Age
 1. 20–29 years 2. 30–39 years 3. 40–49 years 4. 50–59 years 5. 60–69 years 6. 70–79 years 7. 80 years or more
3. Specialty
 1. Internal medicine 2. Surgery 3. Others
4. Work place
 1. Hospital 2. Clinic 3. Others
5. Do you recommend HBP measurement to your patients with hypertension?
 1. Yes 2. No 3. Impossible to select either

6. Which BP is important when you judge or treat patients with hypertension?
 1. CBP 2. HBP 3. Equally
7. Which HBP is important when you judge or treat patients with hypertension?
 1. Morning HBP 2. Evening HBP 3. Equally
8. Which device do you recommend to your patients with hypertension to measure their HBP?
 1. Upper-arm-cuff device 2. Wrist device 3. Finger device 4. None specified
9. How do you think about the accuracy of device for HBP measurement?
 1. High 2. Low 3. Impossible to select either
10. Do you regularly validate devices' accuracy by comparing with auscultation?
 1. Yes 2. No
11. How long should HBP be measured?
 1. For a week 2. For a month 3. For several months 4. For a year 5. For several years 6. For a lifelong period
12. What weekly HBP measurement frequency do you recommend to patients?
 1. One day 2. Two days 3. Three days 4. Four days 5. Five days 6. Six days 7. Everyday
13. How many times HBP should be measured on each occasion?
 1. Once 2. Twice 3. Three times 4. Four times 5. No instruction
14. How do you instruct to document HBP measurement?
 1. First measurement 2. Second measurement 3. Third measurement 4. All measurements 5. Mean of the second and third measurements 6. Mean of all measurements 7. Other 8. No answer
15. How do you evaluate values obtained by the HBP measurement?
 1. Mean of the first measurement on each occasion averaged over a certain long-term period
 2. Mean of the second measurement on each occasion averaged over a certain long-term period
 3. Mean of the third measurement on each occasion averaged over a certain long-term period
 4. Mean of the second and third measurements on each occasion averaged over a certain long-term period
 5. Mean of all measurements on each occasion averaged over a certain long-term period
 6. Not mean but individual values
 7. Both mean and individual values
 8. Other
16. Please select your instruction of HBP measurement in the morning to your patients with hypertension from each question?
 - a. Timing of measurement after waking
 1. Just after 2. Within 30 min 3. Within an hour 4. No instruction
 - b. Micturition
 1. After 2. Before 3. No instruction
 - c. Body position
 1. Sitting position 2. Recumbent position 3. No instruction
 - d. Time of rest before measurement
 1. None 2. 1–2 min 3. 3–4 min 4. 5 min or more 4. No instruction
 - e. Taking antihypertensive drug
 1. After 2. Before 3. No instruction
 - f. Breakfast
 1. After 2. Before 3. No instruction
17. Please select your instruction of timing of HBP measurement in the evening to your patients with hypertension?
 1. Before dinner 2. After dinner 3. Before bedtime 4. No instruction
18. Please select the reason for recommending HBP measurement to your patients with hypertension.*
 1. Diagnosis of white-coat hypertension
 2. Diagnosis of masked hypertension
 3. Diagnosis of resistant hypertension
 4. Evaluation of efficacy of antihypertensive drugs
 5. Diagnosis of hypotension
 6. Improvement of drug compliance
 7. Evaluation of patients' CVD risk
 8. Hypertension management based on HBP
 9. Others
19. Please indicate the reference values of hypertension for HBP recommended by in JSH 2004 guidelines.

Systolic () mm Hg, Diastolic () mm Hg
20. Please indicate the reference values of hypertension for CBP recommended by in JSH 2004 guidelines and JSH 2000 guidelines.

Systolic () mm Hg Diastolic () mm Hg

*This question was included only in 2007–08 survey. HBP, Home blood pressure; CBP, Casual-clinic blood pressure; CVD, Cardiovascular disease; JSH, Japanese Society of Hypertension.