

## Changes in Blood-pressure Control among Patients with Hypertension from 2008 through 2011: Surveys of Actual Clinical Practice

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### Abstract

We performed cross-sectional surveys to investigate changes in clinical practices regarding blood-pressure control in patients with hypertension from 2008 through 2011. Questionnaires regarding the care of patients with hypertension were mailed to members of the Kanagawa Physicians Association in Kanagawa Prefecture, Japan. Data were obtained on 675 patients in 2008, 332 in 2009, and 1,076 in 2011. The mean systolic blood pressure (BP) was significantly lower in 2011 than in 2008 ( $132.2 \pm 11.9$  mm Hg versus  $134.6 \pm 10.6$  mm Hg). The office-measured target BP, according to the 2009 guidelines of the Japanese Society of Hypertension for the management of patients with hypertension, was achieved in 53.9% of patients in 2008, 55.1% in 2009, and 57.1% in 2011. In nonelderly patients (younger than 65 years), the achievement rate was significantly greater in 2011 (41.2%) than in 2008 (23.6%). This analysis showed that the factor most significantly associated with a decrease in office-measured BP was treatment with a larger number and higher doses of antihypertensive agents. To investigate changes in clinical practices according to the guidelines, further follow-up surveys are necessary.

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**Key words:** blood pressure, physicians, guidelines

### Introduction

Elevated blood pressure (BP) is a common risk factors of both stroke and heart disease<sup>1,2</sup>. Accordingly, numerous studies and clinical trials have been performed to develop treatments to prevent hypertension and to clarify the factors associated with increased BP levels<sup>3–5</sup>. Because decreasing BP is markedly effective in decreasing

risk, several treatment guidelines have been established for patients with hypertension<sup>6–8</sup>. The Japanese Society of Hypertension (JSH) first published guidelines for the management of hypertension in 2000 (JSH 2000)<sup>9</sup> and published revisions in 2004<sup>10</sup> and 2009<sup>11</sup>. The aim of the present study was to investigate changes in clinical practices regarding BP control in patients with hypertension according to JSH 2009 guidelines in Kanagawa Prefecture.

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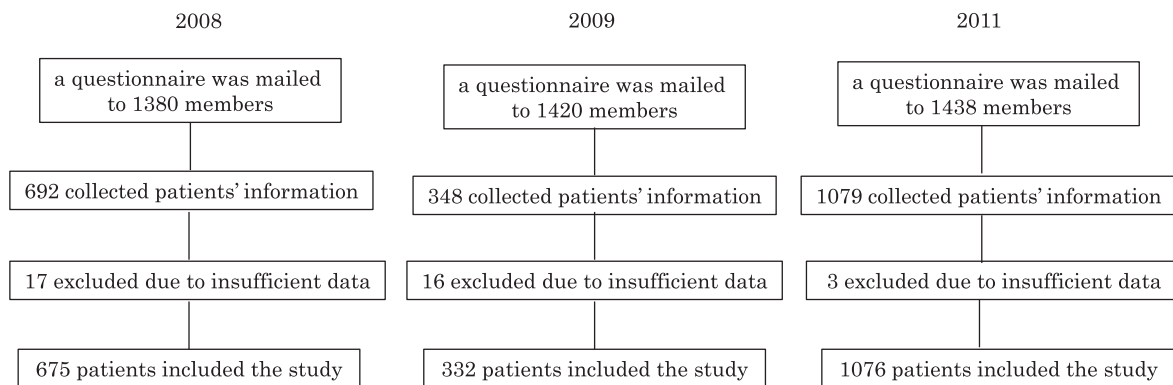


Fig. 1 Patient registration and flow chart

## Patients and Methods

### Data and Subjects

The present studies were performed in Kanagawa Prefecture, Japan, from October 16 to 31, 2008, and, in October 1 to 31, 2009 and 2011. The survey was based on our previous study, which has been described in detail<sup>12</sup>. A questionnaire was mailed each year to approximately 1,400 members of the Kanagawa Physicians Association. The questionnaire contained questions on the following: patient's age, sex, body-mass index, concomitant disorders (diabetes mellitus [DM], history of myocardial infarction [MI], stroke, and chronic kidney disease [CKD]), alcohol consumption, current smoking habits, office-measured systolic and diastolic BPs, home BP monitoring, and types of antihypertensive agents and their doses. To avoid selection bias, patients were selected as follows: if the final number of the patient's identification number or telephone number matched the final number of the patient's consultation date, he or she was enrolled in the study. To enable analysis of doses, the doses of all antihypertensive drugs were adjusted to standard doses that were in accordance with Japanese clinical practice. For example, the standard dose of valsartan is 80 mg, which was counted as 1.0 point<sup>12</sup>.

### Data Analysis

We divided patients into 4 groups according to JSH 2009 guidelines: 1) patients with DM, CKD, a history of MI; 2) patients with cerebrovascular disease (CVD); 3) elderly patients (65 years or older)

without DM, CKD, a history of MI, or CVD; and 4) nonelderly patients (younger than 65 years) without DM, CKD, a history of MI, or CVD. Within these groups, we analyzed in which patients office-measured BP targets were and were not achieved, according to JSH 2009 guidelines.

### Statistical Analysis

All data were entered into a computer and analyzed with the software program IBM SPSS Statistics 21.0 (IBM Inc., Armonk, NY, USA). Means and standard deviations were calculated for continuous variables and proportions were calculated for categorical variables. One-way analysis of variance was used for comparison among the 3 groups. If differences were found to be significant, further analysis was done with the Bonferroni *t*-test for multiple pair-wise comparisons. The chi-square test was used for comparisons between categorical variables. If differences were significant, further analysis was done using the chi-square test with a Bonferroni correction for multiple pair-wise comparisons. A *p* value of less than 0.05 was considered significant.

## Results

Data were collected on 692 patients in 2008, 348 in 2009, and 1,079 in 2011. Seventeen, 16, and 3 patients in each years were excluded owing to insufficient patient characteristics and office-measured BP. Thus, data on 675 patients in 2008, 332 in 2009, and 1,076 in 2011 were included in this study (**Fig. 1**).

Table 1 Characteristics of hypertensive patients

Years	2008	2009	2011	Statistics	
Number	675	332	1,076		
Age (years)	70.1 ± 10.6	69.4 ± 10.0	68.8 ± 11.2	ns	
Sex (male/female)	301/374	150/182	538/538	ns	
Body mass index (kg/m <sup>2</sup> )	24.1 ± 3.7	24.3 ± 3.7	24.4 ± 4.2	ns	
Current smokers	98 (14.5%)	36 (10.8%)	206 (19.1%)	<i>p</i> <0.0001	#1, #2
Current drinkers	164 (24.3%)	71 (21.4%)	355 (33%)	<i>p</i> <0.0001	#3, #4
Concomitant diseases					
CVD	57 (8.4%)	23 (6.9%)	43 (4%)	<i>p</i> <0.0001	#5
DM	144 (21.3%)	90 (27.1%)	218 (20.3%)	<i>p</i> =0.029	#6
CKD	35 (5.2%)	13 (3.9%)	49 (4.6%)	ns	
history of MI	8 (1.2%)	7 (2.1%)	23 (2.1%)	ns	
Patients measured BP at home	353 (52.2%)	169 (50.9%)	615 (57.1%)	<i>p</i> =0.047	

Abbreviations: CVD, cerebrovascular disease; DM, diabetes mellitus; CKD, chronic kidney disease; MI, myocardial infarction; #1, *p*=0.015 in 2008 vs. 2011; #2, *p*<0.0001 in 2009 vs. 2011; #3, *p*<0.0001 in 2008 vs. 2011; #4, *p*<0.0001 in 2009 vs. 2011; #5, *p*<0.0001 in 2008 vs. 2011; #6, *p*=0.01 in 2009 vs. 2011.

Table 2 Achievement ratio of target office BP according to JSH 2009 guidelines

Years	2008	2009	2011	Statistics	
Category					
Patients with DM, CKD, or history of MI (SBP<130 mmHg and DBP<80 mmHg)	29.7% (44/148)	32.2% (29/90)	35.3% (99/279)	ns	
Patients with CVD (SBP<140 mmHg and DBP<90 mmHg)	75.4% (43/57)	69.9% (16/23)	60.5% (26/43)	ns	
Elderly patients (SBP<140 mmHg and DBP<90 mmHg)	72% (247/343)	72.2% (117/162)	78% (380/487)	ns	
Nonelderly patients (SBP<130 mmHg and DBP<85 mmHg)	23.6% (30/127)	36.6% (21/57)	41.2% (110/267)	<i>p</i> =0.003	#
Office BP					
SBP (mmHg)	134.6 ± 10.6	133.9 ± 9.9	132.2 ± 11.9	<i>p</i> <0.0001	#
DBP (mmHg)	76.2 ± 8.3	75.6 ± 8.2	75.6 ± 8.7	ns	
Overall controlled ratio	53.9% (364/675)	55.1% (183/332)	57.1% (615/1,076)	ns	

Abbreviations: JSH, the Japanese Society of Hypertension guidelines for the management of hypertension 2009; BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; DM, diabetes mellitus; CKD, chronic kidney disease; MI, myocardial infarction; #, 2008 vs. 2011 with a *p*<0.0001

### Comparisons of Patient Characteristics

Comparisons of patient characteristics in the 3 years are shown in **Table 1**. There were no significant differences in age, sex ratio, or body-mass index among the 3 years. The percentages of current smokers and drinkers were significantly greater in 2011 than in 2008 and 2009. The prevalence of CVD in 2011 was 4%, which was lower than that in 2008 (8.4%). The prevalence of DM was significantly greater in 2009 (27.1%) than in 2011 (20.3%). The percentage of patients who measured BP at home was significantly different on intergroup comparison but was not significant on pair-wise

comparisons.

### Achievement Rate of Target Office-measured BP According to JSH 2009 Guidelines

The rates of control of office-measured BP in each of the 4 groups according to the JSH 2009 guidelines are shown in **Table 2**. There were no significant differences among the years in any of the 4 groups, except for the nonelderly patients. In nonelderly patients, the rate of control of office-measured BP in 2011 was 41.2% of patients (110 of 267 patients), which was significantly higher than that in 2008 (23.6%, 30 of 127 patients). The overall rate of control

Table 3 Antihypertensive agents

Years	2008	2009	2011	Statistics	
Total number of antihypertensive drugs	1.85 ± 0.93	1.75 ± 0.80	2.00 ± 1.08	$p < 0.0001$	#1, #2
Score (adjusted to standard dose)	1.78 ± 1.20	1.93 ± 1.31	2.06 ± 1.44	$p < 0.0001$	#3
Class of drugs (including combination therapy)					
Ca channel blockers	70.7% (477/675)	70.5% (234/332)	76.4% (822/1,076)	$p = 0.011$	#4
Score (adjusted to standard dose)	1.10 ± 0.51	1.18 ± 0.52	1.24 ± 0.62	$p = 0.0001$	#5
Angiotensin II receptor blockers	67.7% (457/675)	69.3% (230/332)	74.7% (804/1,076)	$p = 0.004$	#6
Score (adjusted to standard dose)	0.96 ± 0.44	1.00 ± 0.46	0.97 ± 0.43	<i>ns</i>	
Angiotensin-converting enzyme inhibitors	6.8% (46/675)	4.8% (16/332)	4.4% (47/1,076)	<i>ns</i>	
Score (adjusted to standard dose)	1.14 ± 0.48	1.15 ± 0.62	1.17 ± 0.75	<i>ns</i>	
Diuretics	15.4% (104/675)	17.5% (58/332)	16.2% (174/1,076)	<i>ns</i>	
Score (adjusted to standard dose)	0.77 ± 0.41	0.68 ± 0.38	0.61 ± 0.47	$p = 0.013$	#7
Beta-blockers	16.4% (111/675)	15.4% (51/332)	12.6% (136/1,076)	<i>ns</i>	
Score (adjusted to standard dose)	0.74 ± 0.35	0.74 ± 0.35	0.72 ± 0.35	<i>ns</i>	
Alpha-blockers	7.0% (47/675)	9.0% (30/332)	7.7% (83/1,076)	<i>ns</i>	
Score (adjusted to standard dose)	0.51 ± 0.39	0.68 ± 0.33	0.74 ± 0.40	$p = 0.005$	#8

Abbreviations: #1, 2008 vs. 2011 with a  $p = 0.004$ ; #2, 2009 vs. 2011 with a  $p < 0.0001$ ; #3, 2008 vs. 2011 with a  $p < 0.0001$ ; #4, 2008 vs. 2011 with a  $p = 0.009$ ; #5, 2008 vs. 2011 with a  $p = 0.009$ ; #6, 2008 vs. 2011 with a  $p = 0.002$ ; #7, 2011 vs. 2008 with a  $p = 0.004$ ; #8, 2008 vs. 2011 with a  $p = 0.002$ .

of office-measured BP in each of the 3 years was greater than 50%, but the rate did not differ significantly among the years. The mean office-measured systolic BP was significantly less in 2011 (132.2 ± 11.9 mmHg) than in 2008 (134.6 ± 10.6 mmHg).

### Antihypertensive Agents

The agents prescribed at the highest rates were CCBs in the each year. The mean number of antihypertensive agents used per patient was significantly greater in 2011 than in 2008 or 2009 (**Table 3**). The scores adjusted to standard doses were also higher in 2011 than in 2008. The rates of use of calcium channel blockers (CCBs) and the scores of their doses were significantly greater in 2011 than in 2008. Angiotensin II receptor blockers (ARBs) were also used more frequently in 2011 than in 2008. Although the scores of alpha-blockers were higher in 2011 than in 2008, the scores of diuretics were lower in 2011 than in 2008.

### Discussion

The total rates of achievement of target office-measured BPs, according to each of the 4 categories of the JSH 2009 guidelines, increased from 53.9% in 2008 to 55.1% in 2009 and 57.1% in 2011. However,

those changes did not reach to a statistical significance.

In each year of this study in Kanagawa Prefecture, the agents prescribed at the highest rates were CCBs. This finding can be explained by the fact that CCBs are first-line antihypertensive medications in Japan<sup>13</sup>. The tendency to favor CCBs may be related to the high incidence of CVD in Japan. ARBs were the second most frequently prescribed drugs and were prescribed more often than angiotensin-converting enzyme inhibitors (ACEIs). These results are consistent with those of other studies<sup>14,15</sup> in Japan. Prescription rates of ARBs gradually increased year by year to nearly match those of CCBs.

The JSH 2009 guidelines suggest that ACEIs or ARBs should be chosen as the first-line hypertensive drug in high-risk patients<sup>11</sup> and that diuretics and beta-blockers can be added later. ACEIs have been shown to improve cardiovascular outcomes<sup>16–18</sup>; thus, ARBs are thought to have the same effects as ACEIs<sup>19,20</sup>. The ARBs are believed to not only reduce BP but also to directly inhibit organ damage and, consequently, to prevent the occurrence of diseases<sup>11</sup>. Furthermore, ARBs were also prescribed as a substitute for ACEIs if the side effect of dry cough develop. Therefore, physicians have

preferentially prescribed ARBs in Japan. In the present study, ARBs were prescribed in 2011 for 74.7% of patients.

In spite of the promotion of hypertension management guidelines and the development of effective antihypertensive drugs, target BPs are rarely achieved<sup>21,22</sup>. In particular, rates of achieving BP goals are low among nonelderly patients without DM or CKD and among patients with DM or CKD or a history of MI<sup>23,24</sup>. In the present study, the rate of achieving target BPs in these patients improved from 23.6% in 2008 to 36.6% in 2009 and 41.2% in 2011. A possible explanation for this improvement was that the rate of ARB use was greater by patients who achieved target BPs than by patients with uncontrolled hypertension in 2011 (data not shown).

In the present study office-measured systolic BPs decreased significantly from 2008 to 2011. The stroke mortality rate in Japan decreased from 1961 to 1990. This decrease coincided closely with a decrease in the BP of the Japanese population<sup>11</sup>. In other studies<sup>25,26</sup>, high percentage of patients required 3 or more antihypertensive agents to achieve the specified BP targets. Although other factors, such as poor patient compliance, high drug costs, adverse effects of drugs, and the presence of resistant hypertension<sup>27,28</sup>, may contribute to poor BP control, the present results suggest that more aggressive antihypertensive treatment is necessary for adequate BP control.

An earlier study<sup>23</sup> emphasized the necessity of improving physicians' awareness of the management of hypertension according to treatment guidelines and the importance of a healthy lifestyle in maintaining good BP levels. To achieve this awareness, it is important to provide feedback to physicians regarding the current status of BP control among patients with hypertension using the results of this kind of study, year after year.

Our study had several limitations. First, this was a cross-sectional analysis. Second, the new JSH 2014 guidelines are going to be spread and further follow-up survey data are thus necessary.

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**Conflict of Interest:** The authors declare no conflict of interest.

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