Epidemiology of Hypertension in Japan
– Where Are We Now? –
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Analyses of data from national surveys of the Japanese population have shown a clear decreasing tendency in mean systolic blood pressure (BP) level over the past 50 years in all age groups of men and women; however, mean diastolic BP level clearly did not decrease in men. Hypertension prevalence is high among older people and may increase in the future, especially in men aged ≥50 years. The treatment and control rates of hypertension are not sufficiently high, although they have been continuously improving. Recent epidemiological studies also showed that the burden of cardiovascular diseases and total mortality because of the adverse BP level of the nation is still the highest among other preventable risk factors. To overcome this epidemic, the first priority should be primary prevention of a lifetime increase in BP through lifestyle improvement. Lowering the distribution of BP in the whole population and maintaining BP at optimal levels contributes to the achievement of this goal.

Key Words: Blood pressure; Epidemiology; Hypertension; Japan; Prevalence

Hypertension (HT) is acknowledged as one of the greatest and established risk factors for cardiovascular disease (CVD), heart disease and stroke.1–4 Compared with Western countries, East Asian countries experience higher rates of stroke morbidity and mortality, and measures to prevent HT are important for stroke prevention. Since the 1960s, a steady decrease in blood pressure (BP) levels in the Japanese population has contributed to a reduction in stroke mortality rates to approximately one-seventh of previous levels.5–7 However, increases in the morbidity of coronary artery disease (CAD) and in the prevalence of obesity8,9 in Japan suggest that an increasing prevalence of high BP should be viewed with concern.

We used data from national surveys and examined long-term trends in BP, and in the prevalence, treatment, and control of HT in the Japanese population. We also examined how the epidemic in HT has contributed to CVD, and present strategies to address this problem.

Trends in BP Prevalence
In any population, high-quality epidemiological surveys that are conducted at appropriate intervals are indispensable for monitoring BP status. These surveys should use epidemiologically sound methodology and include sufficient sample sizes from each age-sex stratum of the general population. They should also include subpopulations of special concern (eg, lower socioeconomic strata) because these populations often have higher than normal BP distributions and prevalence rates of HT. High-quality standardized methods are essential, as are trained and certified staff. To establish trends over time, these surveys need to be repeated periodically and continuously.

Approximately every 10 years, the Japanese government conducts a survey that includes information on circulatory disorders in representative populations. Two of these surveys, the National Surveys of Adult Diseases, were conducted in 1961 and 1971. After 1971, and up to 2000, 3 additional surveys (The National Surveys of Circulatory Disorders) were conducted. All adults aged ≥30 years from 300 randomly selected health districts throughout Japan were invited to participate. The surveys were conducted at the same time as the National Nutrition Surveys. In 1980 and 1990, survey participants were also the baseline population for prospective cohort studies that were part of the National Integrated Project for Prospective Observation of Non-communicable Disease and its Trends in the Aged (NIPPON DATA).10,11 In 2010, the Ministry of Health, Welfare, and Labour funded a research group to conduct the NIPPON DATA2010, which was also conducted at the same time as the National Health and Nutrition Survey.12

Using standardized methods, the NIPPON DATA research group recently analyzed the 30-year trend (1980–2010) in HT prevalence in Japanese men and women aged 30–79 years (Figure 1).13 HT was defined as a systolic/diastolic BP ≥140/90mmHg or the taking of an antihypertensive medication. In all surveys, BP values at the first measurement were used as the standardized comparison. In 2010, HT prevalence was higher in older age groups; prevalence was higher than 60% in men aged ≥50 years and in women ≥60 years. HT prevalence decreased during the 30 years in all 10-year age groups of women (30–79 years) and younger men (30s and 40s). This...
all of the sex-age groups. In 2010, greater than 50% of hypertensive people aged \( \geq 60 \) years were treated. However, the treatment rate was still not high enough in younger age groups. Control rates increased dramatically during the past 30 years and were approximately 3-fold greater in 2010 than in 1980 (Figure 4). Control rates were not significantly different among age groups and were somewhat higher in women. However, treatment and control rates together indicated that only 15–30% of all hypertensive people were controlling their BP at less than 140/90 mmHg.

Population Trends in Mean BP

During the 50 years from 1961 to 2010, mean systolic BP
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However, the large decrease in mean systolic BP in older age groups could be explained by progress in early detection, medical treatment, and control of HT. The decrease in systolic BP in younger age groups and corresponding decrease in HT prevalence is most likely largely related to a population-wide decrease in BP caused by lifestyle changes in the Japanese population.

Diastolic BP in men did not show a clear decreasing trend over the past 50 years. This phenomenon could be explained by decreased in all age groups and in both men and women (Figure 5). In the 60–69 years age group, systolic BP declined by 19.0 mmHg in men and by 25.4 mmHg in women. In the 30–39 years age group, systolic BP decreased by 7.6 mmHg in men and by 15.1 mmHg in women. The decrease was larger in women than in men and was larger in the older age groups. On the other hand, there were no clear trends in mean diastolic BP in any age group of men (Figure 6). Mean diastolic BP declined in all age groups of women.

There has only been a small change in the high prevalence of HT in older men and women in the past decades (Figure 1). However, the large decrease in mean systolic BP in older age groups could be explained by progress in early detection, medical treatment, and control of HT. The decrease in systolic BP in younger age groups and corresponding decrease in HT prevalence is most likely largely related to a population-wide decrease in BP caused by lifestyle changes in the Japanese population.

Figure 3. The 30-year trend in the treatment rate among hypertensive people in the national surveys in Japan (1980–2010). Treatment rate was calculated as the proportion of those on antihypertensive medication among the population of hypertensive people. Data are from the 1980, 1990, 2000, and 2010 national surveys described in Figure 1.

Figure 4. The 30-year trend in the control rate among treated hypertensive people in the national surveys in Japan (1980–2010). Control rate was calculated as the proportion of those with blood pressure was <140/90 mmHg among the population of treated hypertensive people. Data are from the 1980, 1990, 2000, and 2010 national surveys described in Figure 1.
by an increasing trend in obesity and alcohol consumption, decreasing physical activity, and insufficient treatment of diastolic HT.

**Disease Burden and High BP**

The Evidence for Cardiovascular Prevention from Observational Cohorts in Japan (EPOCH-JAPAN) is a meta-analysis of individual participant’s data from 13 high-quality cohort studies, including NIPPON DATA. Data from more than 180,000 participants were included in the EPOCH-JAPAN analysis. Approximately 10 years of follow-up, and estimation of sex- and age-specific risks (relative and attributable) of all-cause mortality were included in the meta-analysis. In all age groups, adjusted all-cause mortality increased as BP increased. The population-attributable fraction (PAF) for all-cause deaths with above-optimal BP (>120/80 mmHg) was 23% in men and 18% in women.

The EPOCH-JAPAN also estimated the PAF for CVD deaths with above-optimal BP in a 10-cohort meta-analysis (a total of 67,309 men and women). The PAF was 60% in the middle-aged group (40–64 years), 49% in the elderly group.
(65–74 years), and 23% in the very elderly group (75–89 years). The PAF by cause of death was 50% for all CVD deaths, 52% for stroke deaths, and 59% for CAD deaths. The largest contribution to the PAF for CVD deaths was from stage 1 HT (systolic/diastolic BP 140–159/90–99 mmHg). Other cohort studies conducted in the Japanese population have reported similar findings.\textsuperscript{5,10–20}

A recent comparative assessment of preventable risk factors in Japan showed that high BP was second only to tobacco smoking as a distinctive determinant of adult mortality from noncommunicable diseases.\textsuperscript{21} Of 834,000 deaths from noncommunicable diseases and injuries, high BP accounted for 104,000 deaths. In women, high BP was the first determinant of death from noncommunicable diseases in Japan.

An analysis of the NIPPON DATA80 reported the effect of HT on life expectancy in Japan, which has the highest life expectancy worldwide.\textsuperscript{22} The life expectancy difference between normotensive and hypertensive participants at the age of 40 was 2.2 years for men and 2.9 years for women. Life expectancy decreased with increasing stages of HT.

These findings indicate that to reduce the burden of CVD, prevention and management of HT must be a primary objective.

**Reducing the Population-Wide Prevalence of Adverse BP Levels**

Data from many populations show that frank high BP is the upper end of the adverse BP levels for most people aged $\geq$35 years, and leads to significant excess risk of sickness, disability, and death, particularly from CVD. Only a minority of people have optimal BP ($<$120/$<$80 mmHg). Shifting the population BP downward is the central strategic challenge.

For this purpose, improving lifestyles, particularly improving the eating and drinking patterns, is the key—not pharmacologic therapy.\textsuperscript{23} Improvements in nutrition can be accomplished by applying 3 complementary approaches. (1) A population strategy that involves the entire community to prevent age-related increases in BP and to achieve a downward shift in the overall BP distribution. This is “primordial prevention”; that is, primary prevention of this major risk factor from developing in the first place. Its objective is a progressive increase in the proportion of the population with life-long optimal BP. With a population average BP at ages 18–24 that is $<$120/$<$80 mmHg for both men and women, the epidemic of adverse BP would cease in many countries and result in large-scale prevention of increases in BP during adulthood. Even modest progress toward this goal would be valuable; a 2 mmHg average reduction in population diastolic BP results in a 17% decrease in HT prevalence.\textsuperscript{24} (2) A strategy that emphasizes better nutrition through intense dietary counseling for those at greater risk of developing HT. This approach focuses on people with BP in the high-normal range, a family history of HT, obesity, and those with especially unfavorable lifestyles. (3) The third component of the strategy emphasizes improved nutrition to lower BP in people who are hypertensive. This approach represents secondary prevention of HT through non-pharmacologic means.

**Improving the Detection, Treatment, and Control of High BP**

As shown by the Japanese data and in many other countries, control rates in hypertensive people are less than 50%.\textsuperscript{25} More effective approaches to earliest possible detection, evaluation and treatment, and for sustained control of the epidemic of high BPs must be a high priority for physicians and the public health community.

While noting a need to deal more effectively with implementation of a strategy focused on people with high-risk HT, we must emphasize the serious limitations of an exclusive focus on high risk. Detection and treatment (usually drug therapy) only of people with already established high BP has many limitations. It is late, defensive, reactive instead of proactive, costly, only partially successful (ie, it rarely reduces BP to optimal levels), and endless. It does not reduce the excess risks of BP-related CVD in nonhypertensive people with above-optimal BP. Approximately 20% of all BP-related excess CVD deaths occur in nonhypertensive individuals with above-optimal BP.\textsuperscript{6} Furthermore, for young adults with high BP, evidence for drug treatment of high BP is rare; there have been very few clinical trial reports on drug treatment involving young adults with high BP. The 25-year follow-up data on men aged 18–39 years in the Chicago Heart Association Detection Project in Industry indicate that above-normal BP is significantly related to increased long-term CVD mortality and shortened life expectancy for this age group.\textsuperscript{26}

To solve the problem of population-wide adverse BP levels, including frank high BP, a strategy of targeting only those at high risk is not enough. Primordial prevention through lifestyle improvement must be emphasized.

**Conclusions**

The long-term trends in BP level and in the prevalence of HT in the Japanese national surveys have been highlighted. Japan has achieved a significant decrease in mean population BP levels during the past 50 years. However, the prevalence of HT (especially in men) may increase in the future. Although they have been improving, treatment and control rates are unacceptable. Adverse BP levels remain the most preventable risk factor for CVD and total mortality. To overcome this national epidemic, maintenance of optimal BP levels and primary prevention of an increase in BP throughout life should be the first priority.

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