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May Measurement Month 2017: an analysis of blood pressure screening results in China—East Asia

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Elevated blood pressure (BP) is a growing burden worldwide, leading to over 10 million deaths each year. May Measurement Month (MMM) is a global initiative aimed at raising awareness of high BP and to act as a temporary solution to the lack of screening programmes worldwide. In China, several hypertension screening programmes are undertaken in the elderly in the community and in youths at university entrance and graduation. However, most people, especially the middle-aged working population, do not often have their BP measured. The current awareness (46.9%), treatment (40.7%), and control rates (15.3%) of hypertension remain low, while the proportion of screenees with hypertension is high in adult Chinese (23.2%). An opportunistic cross-sectional survey of volunteers aged ≥ 18 years was carried out in May 2017. Blood pressure measurement, the definition of hypertension and statistical analysis followed the standard MMM protocol. About 125 236 individuals were screened. After multiple imputation, with 124 623 as denominator, 32 089 (25.7%) had hypertension. Of the 103 981 individuals not on antihypertensive medication, 11 447 (11.0%) were hypertensive. Of the 20 547 individuals on antihypertensive medication, 7392 (36.0%) had uncontrolled BP ($\geq 140/90$ mmHg). An opportunistic screening may effectively identify those with high BP regardless of the use of antihypertensive medication and shows similar information on BP as a survey in a randomly selected population sample.

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Introduction

According to the most recent China nationwide blood pressure (BP) survey in 2012–15, the prevalence of hypertension in 451 755 adults (≥ 18 years) was 27.9%, and the awareness, treatment, and control rates of hypertension were 46.9%, 40.7%, and 15.3%, respectively.¹ The estimated total number of hypertensive patients within the adult Chinese population was 244.5 million. In comparison to the preceding survey from 2002 in 141 892 people 18 years of age or older,² the prevalence, treatment, and control rates of hypertension increased substantially from 18.8%, 24.7%, and 6.1%, respectively,² and relatively by 48.4%, 64.8%, and 150.8%, respectively.^{1,2} However, the awareness and control rates in treated hypertensive patients remained intolerably low.^{1,2}

The high prevalence and low control rate of hypertension are major contributing factors to the fast increase in the number of strokes, coronary artery disease, and other cardiovascular diseases over the last decade.³ Without successful interventions, this trend is likely to continue over the next few decades. There is an urgent need for relevant action to improve BP control within a short period of time in China.

May Measurement Month (MMM) is an initiative of the International Society of Hypertension (ISH), with a primary goal of improving awareness by measuring BP in millions of people worldwide.⁴ The Chinese Hypertension League (CHL) actively responded to the call of the ISH and led the project in China.

Methods

Study design and participants

In line with MMM17 worldwide,⁴ the China project was conducted between May and September 2017. The China project strictly followed the standard MMM protocol.⁴ The CHL formed a dedicated panel of experts from various parts of China for the selection of measurement sites, the recruitment and training of volunteer investigators and the organization of measurement work during the whole period of the project. The measurement sites were mostly inside hospitals or community health centres but usually located in a public area instead of doctors' offices for routine clinical service.

The study participants were adults (≥ 18 years), in whom BP had not been measured in the previous year.

The Ethics Committee of Ruijin Hospital, Shanghai Jiaotong University School of Medicine, Shanghai, China approved the study. A written informed consent was obtained from each participant.

Measurements of blood pressure and anthropometry and administration of questionnaire

Trained volunteer investigators measured BP three times consecutively with 1-min intervals, after the participant had rested for at least 5 min in the sitting position. In most of the measurement sites, the validated automated BP monitor Omron HEM-9200T (Omron Healthcare, Kyoto,

Japan) was used with an appropriately sized cuff. Other validated automated BP monitors or manual sphygmomanometers could also be used if there was a lack of BP monitors. Hypertension was defined as a BP of at least 140 mmHg systolic or 90 mmHg diastolic or the use of antihypertensive medication. In patients on antihypertensive medication, control of hypertension was defined as a systolic/diastolic BP below 140/90 mmHg.

Trained investigators also measured body height, body weight, and waist and hip circumferences for each participant. Chinese cut-offs were used to classify body mass index < 18.5 , 18.5–23.9, 24.0–27.9, and ≥ 28 kg/m² as underweight, healthy weight, overweight, and obese, respectively.

A standard short questionnaire was administered to collect information on demographics, medical history, lifestyle, and use of medications.

Statistical analysis

Data management and statistical analysis were performed in collaboration with the ISH MMM core team. All statistical analysis methods were described in detail previously.⁴

Results

The 125 236 participants included 67 404 (53.8%) females and 20 642 (16.5%) were on antihypertensive medication. The mean [standard deviation (SD)] age was 53.9 years (16.7 years), and the mean (SD) body mass index was 23.4 kg/m² (3.2). Overall, the proportions of self-reported disease history were 4.7% for diabetes mellitus, 0.5% for myocardial infarction, and 0.8% for stroke. The proportions of current smoking and alcohol intake once or more per week were 13.2% and 5.6%, respectively. The proportions of high waist circumference, waist-to-height ratio, and waist-to-hip ratio were 41.4%, 43.6%, and 57.6%, respectively (Supplementary material online, *Table S1*).

In the 32 348 participants with all three individual BP readings, systolic/diastolic BP decreased from the first to the second and the third readings, on average, by 0.5/0.4 mmHg and 0.9/0.6 mmHg, respectively (Supplementary material online, *Table S2*).

After multiple imputation, with 124 623 as the denominator, the proportion of hypertension was 25.7% ($n = 32 089$). Of the 20 547 patients on antihypertensive medication and with three available BP readings, 36.0% ($n = 7392$) had uncontrolled BP. Of the 103 981 individuals not on antihypertensive medication, 11.0% ($n = 11 447$) were hypertensive.

In analyses, based on a linear regression model in those not on antihypertensive medication, systolic BP increased linearly with age in both male and female participants, whereas diastolic BP increased with age until 50 years and then levelled off or even decreased afterwards. Both systolic and diastolic BP were higher in men than women up to 60 years of age and became similar afterwards (Supplementary material online, *Figure S1*).

After adjustment for age, sex, and the use of antihypertensive medication, as appropriate, systolic and diastolic BP differed significantly across subgroups according to

several characteristics (Supplementary material online, *Figure S2*), especially body mass index (Supplementary material online, *Figure S3*).

Discussion

Our opportunistic screening showed that the proportion of hypertension in Chinese adults was 25.7%. Most of the hypertensive patients were taking antihypertensive medication. Nonetheless, 36.0% of those individuals on antihypertensive medication still had uncontrolled BP. The high prevalence and low control rate of hypertension have likely contributed to the increased risk of cardiovascular events and mortality in China.⁵

If the finding of our study was compared with the results of the most recent China nationwide BP survey in a randomly selected population sample,¹ the proportions of those with hypertension were similar. However, the treatment and control rates were higher in our study than the nationwide survey,¹ probably because treated hypertensive patients were more likely to attend a study like ours. Nonetheless, an opportunistic screening study may provide useful information on the management of hypertension even in a country with huge variances between regions.

The results of our study have shown that obesity is highly prevalent in the Chinese population and is an important risk factor for hypertension. Cigarette smoking is a well proven risk factor for increasing cardiovascular disease in those with hypertension. The absence of an association between smoking and BP is incompletely understood. A speculative explanation is that smokers are less likely participating in an opportunistic screening, such as the present one. Indeed, current smokers were much less represented in the present study (13.2%) than in the China nationwide BP survey (19.1%).¹

In conclusion, an opportunistic screening may not only effectively identify those with high BP regardless of the use of antihypertensive medication, but support information on BP as a survey in a randomly selected population sample.

Supplementary material

Supplementary material is available at *European Heart Journal - Supplements* online.

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Conflict of interest: none declared.

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