May Measurement Month 2018: an analysis of blood pressure screening results from China

Xin Chen1, Yan Li2, Zhe Hu1, Min Liu3, Jing Yu4, Hong-Yu Wang5, Li-Ying Xu6, Bi-Rong Zhou7, Wei Yu8, Li Li9, Guo-Bao Tang10, Thomas Beaney11,12, Anca Chis Ster11, Neil R. Poulter11, and Ji-Guang Wang1,2*

1Department of Hypertension, Ruijin Hospital North, Shanghai Jiaotong University School of Medicine, Xiwang Road 999, Shanghai 201801, China; 2The Shanghai Institute of Hypertension, Ruijin Hospital, Shanghai Jiaotong University School of Medicine, Ruijin 2nd Road 197, Shanghai 200025, China; 3Department of Hypertension, Henan Provincial People’s Hospital, Weiwu Road 7, Zhengzhou 450003, Henan Province, China; 4Department of Cardiology, Lanzhou University Second Hospital, Cuiyingmen 82, Lanzhou 730030, Gansu Province, China; 5Department of Cardiology, Second Hospital of Shanxi Medical University, Wuyi Road 382, Taiyuan 030001, Shanxi Province, China; 6Department of Cardiology, Fourth People’s Hospital of Datong, Gongnong Road 16, Datong 037008, Shanxi Province, China; 7Department of Cardiology, The First Affiliated Hospital of Anhui Medical University, Jixi Road 218, Hefei 230022, Anhui Province, China; 8Department of Cardiology, Zhejiang Hospital, Lingyin Road 12, Hangzhou 310013, Zhejiang Province, China; 9Department of Cardiology, The Second Affiliated Hospital of Zhengzhou University, Jingba Road 2, Zhengzhou 450014, Henan Province, China; 10Department of Cardiology, The First Affiliated Hospital of Xiamen University, Zhenhai Road 55, Xiamen 361003, Fujian Province, China; 11Imperial Clinical Trials Unit, Imperial College London, Stadium House, 68 Wood Lane, London W12 7RH, UK; and 12Department of Primary Care and Public Health, Imperial College London, St Dunstan’s Road, London W6 8RP, UK

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To further improve awareness, treatment, and control of hypertension, the May Measurement Month (MMM) campaign continued in 2018 in China. Study subjects were adults aged 18 years or more, ideally those who had not had their blood pressure (BP) measured for at least a year. Blood pressure was measured three times consecutively with a 1-min interval in the sitting position, using automated BP monitors in 288,342 participants and transmitted to a central database by a smartphone app. Questionnaire data were collected with the same app. After imputation, the overall proportion of hypertension was 29.8%. Of those with hypertension, the rates of awareness, treatment, and control were 62.3%, 57.3%, and 35.9%, respectively. In analysis based on linear regression models, both systolic and diastolic BP were higher with cigarette smoking, alcohol intake, and overweight and obesity. Our study results suggest that hypertension management is improving in comparison with the data in MMM 2017 and the nationwide survey in 2012–15, and several known lifestyle factors are key to hypertension management.

*Corresponding author. Tel: +86 21 64370045 610911, Fax: +86 21 64662193, Email: jiguangwang@aim.com

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Introduction

In 2017, we conducted the May Measurement Month (MMM) project in China.\(^1\) We measured blood pressure (BP) in a large number of people living in several provinces of China. In the 364,000 Chinese participants enrolled in the MMM 2017, the proportion of hypertension was 24.7%, and the rates of awareness, treatment, and control of hypertension were 60.1%, 42.5%, and 25.4%, respectively. The Chinese had a similar proportion of hypertension as the international collaboration of 1,201,570 participants,\(^2\) but somewhat lower awareness, treatment, and control rates of hypertension. However, these rates from an opportunistic screening for hypertension were similar to the data from the recent China nationwide BP survey.\(^3\) We felt that such an initiative was indeed encouraging and therefore repeated the MMM project in China in 2018.

Methods

The Chinese project strictly followed the MMM 2018 worldwide protocol and was conducted from May to September 2018.\(^4\) A team of experts from various parts of the Chinese mainland helped for the selection of measurement sites (\(n = 367\)), recruitment and training of volunteer investigators (\(\sim 2000\)), and organization of measurement work during the whole period of the project. The measurement sites included hospitals/clinics, public areas (indoor or outdoor), workplaces, pharmacies, and so on. The Ethics Committee of Ruijin Hospital, Shanghai Jiaotong University School of Medicine, Shanghai, China approved the study protocol. All study participants gave an informed written consent.

Study subjects were adults aged 18 years or more, ideally those who had not measured their BP for at least 1 year. Blood pressure was measured three times consecutively with a 1-min interval in the sitting position using validated automatic BP monitors (Omron HEM 9200, Omron Healthcare, Kyoto, Japan) and transmitted to a central database via a smartphone app. Questionnaire data including demographics, medical history, lifestyle, and use of medications were collected with the same app. Waist and hip circumferences were measured.

Hypertension was defined as a BP of at least 140 mmHg systolic or at least 90 mmHg diastolic, or as the use of antihypertensive drugs. Control of hypertension was defined as a BP below 140/90 mmHg.

Data analysis was performed by the MMM project international team, with multiple imputations for the mean of readings 2 and 3 where these were missing.\(^4\)

Results

The 288,342 study participants had a mean (standard deviation) age of 48.2 (16.4) years and included 53.3% (\(n = 153,811\)) women and 17.1% (\(n = 49,167\)) who took antihypertensive medication.

After imputation, the proportion of participants with hypertension was 29.8% (\(n = 85,835\)). The awareness, treatment, and control rates of hypertension were 62.3% (\(n = 53,453\)), 57.3% (\(n = 49,167\)), and 35.9% (\(n = 39,784\)), respectively. In those patients on antihypertensive medication, the control rate of hypertension was 62.6%. Of those

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Figure 1 Difference in mean systolic and diastolic blood pressure in those with each risk factor compared to those without, based on linear regression models, adjusted by age, sex (with an interaction), and antihypertensive medication (pregnancy adjusted by age and antihypertensive medication alone). Error bars represent 95% confidence intervals.
not on antihypertensive medication, the proportion with hypertension was 15.3% \((n = 36,668)\).

After adjustment for age, gender (with an interaction term), and use of antihypertensive medication, both systolic and diastolic BP were significantly \((P \leq 0.001)\) higher with cigarette smoking \((n = 28,227)\), alcohol intake \((n = 38,099, \text{Figure 1})\), and overweight and obesity \((n = 82,049)\). Indeed, systolic/diastolic BP was 1.9/1.2 mmHg higher in smokers than non-smokers, 3.2/2.6 mmHg higher in alcohol drinkers (one or more per week) than non-drinkers \((\text{Figure 1})\), and 3.0/1.8 mmHg lower in underweight subjects and 4.0/2.6 and 5.9/3.6 mmHg higher in overweight and obese subjects, respectively, compared with healthy weight subjects.

**Discussion**

Our study showed that the proportion of hypertension in Chinese adults in MMM 2018 was 29.8%, and the rates of awareness, treatment, and control of hypertension were 62.3%, 57.3%, and 35.9%, respectively. Compared with the data in MMM 2017, the proportion of hypertension was higher by an absolute percentage of 5.1% from 24.7%, treatment by 14.8% from 42.5%, the control rate by 10.5% from 25.4%, and the treated and controlled rate by 2.8% from 59.8%, respectively. However, our study was based on opportunistic screening and not random sampling. Hence selection differences may explain these findings.

Our data in MMM 2018 further showed that lifestyle factors played an important role in BP elevation in the Chinese population. The prevalence of cigarette smoking and alcohol intake in Chinese men were high. The prevalence of overweight and obesity was also high. These results suggest that lifestyle modification measures have to be seriously considered in the management of hypertension in China as in many other countries.

In conclusion, the results of the China MMM 2018 suggest that hypertension management is still quite challenging in line with the data in MMM 2017 and the nationwide survey in 2012-15, and several known lifestyle factors are key to hypertension management.

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**Conflict of interest:** J.-G.W. reports having received lecture and consulting fees from Astra-Zeneca, Bayer, Omron, Seriver, and Takeda. The others declare no conflict of interest.

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