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# May Measurement Month 2017: an analysis of blood pressure screening results from Australia—South-East Asia and Australasia

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Increased blood pressure (BP) is the single biggest contributing risk factor to the global disease burden. May Measurement Month (MMM) is a global initiative of the International Society of Hypertension aimed at raising awareness of high BP. In Australia, hypertension affects around six million adults and continues to remain the greatest attributable cause of cardiovascular mortality and morbidity (48.3%), stroke deaths (28%), and kidney disease (14%). An opportunistic cross-sectional survey was carried out during May 2017 predominantly in capital cities across Australia which included adult volunteers. Blood pressure measurement, the definition of hypertension and statistical analysis followed the standard MMM protocol. Additional information obtained included anthropometric data and responses to questionnaires on demographic, lifestyle, and environmental factors. Data were collected from 3817 individuals. After multiple imputation, of the 3758 individuals for whom a mean of the second and third BP reading was available, 1188 (31.2%) had hypertension. Of 3213 individuals not receiving antihypertensive treatment, 591 (18.4%) were hypertensive, and 239 (40.1%) of the 596 individuals receiving treatment had uncontrolled BP. Adjusted BP was higher in association with antihypertensive medication, cerebrovascular disease, smoking, and alcohol consumption. Blood pressure was higher when measured on the right arm and on Tuesdays. MMM17 was one of the largest BP screening campaigns undertaken in Australia using standardized BP measurements. In line with previous surveys, around one-third of screened adults had hypertension and approximately 40% of treated individuals remained uncontrolled. These results suggest that opportunistic screening can identify significant numbers with raised BP.

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## Introduction

In Australia, hypertension continues to remain the greatest attributable cause of cardiovascular mortality and morbidity (48.3%), stroke deaths (28%), and kidney disease (14%).<sup>1</sup> Despite the availability of effective antihypertensive medications through an efficient and affordable health care system, the management of blood pressure (BP) remains a national challenge. May Measurement Month 2017 (MMM17) in Australia was part of the global BP screening campaign initiated by the International Society of Hypertension (ISH) and endorsed by the World Hypertension League (WHL) and the High Blood Pressure Research Council of Australia and the National Heart Foundation.

## Methods

The Australian MMM cross-sectional survey was set up between October 2016 and April 2017, with the involvement of most states including Western Australia, New South Wales, Victoria, and Tasmania. One or more of the national/state-wide leaders in the field of cardiovascular disease and hypertension from each state were identified and invited to participate and to co-ordinate the screening efforts locally. The Dobney Hypertension Centre at the University of Western Australia—Royal Perth Hospital Campus served as the national coordinating centre. Ethics approval was obtained centrally through the Alfred Hospital HREC, Melbourne and further approved locally where required. Volunteer staff training, communication and distribution of the MMM17 protocol designed by the Head Office of the campaign in London through the ISH, as well as essential training materials, videos and marketing information were developed and shared using a bespoke MMM website. Around 25 sites were set up in a wide range of locations across the various Australian states, including universities, libraries, supermarkets, shopping malls, places of worship, hospitals, and existing clinics in primary and secondary health care facilities. Blood pressure measurements, data collection, cleaning and transfer, as well as analysis, have been described previously.<sup>2</sup> Hypertension was defined as a systolic BP  $\geq 140$  mmHg or diastolic BP  $\geq 90$  mmHg, or in those on antihypertensive medication.

## Results

Data were obtained from 3817 Australian participants and were cleaned, collated centrally, and analysed. The mean age of the multi-cultural cohort was 41 years with more women than men screened in Australia and comprising multiple ethnicities (Supplementary material online, *Table S1*). Of the 3817 screened participants, 597 (15.6%) were on antihypertensive treatment, 240 (6.3%) reported having Type 2 diabetes, 98 (2.6%) reported a history of myocardial infarction, and 40 (1.1%) reported a history of stroke. Two hundred and ninety-nine (7.8%) respondents reported smoking, 1418 (37.2%) reported alcohol consumption once or more per week, and 29 women (1.3% of female

respondents) reported being pregnant. The mean body mass index (BMI) of respondents was  $25.7 \pm 5$  kg/m<sup>2</sup>.

Of 3758 respondents with three BP readings, BP decreased on average by 3.2/2 mmHg between the first and third readings (Supplementary material online, *Table S2*). The age-standardized and sex-standardized mean BP was 123.3/78.7 mmHg in those not on treatment, and 131.5/83.2 mmHg in those on treatment.

After imputation, of the 3810 individuals for whom a mean of the second and third reading was available, or of those who were on antihypertensive treatment, 1188 (31.2%) participants were hypertensive. Excluding participants taking antihypertensive medication, 591 (18.4%) of 3213 participants with hypertension were not receiving treatment. Among participants who were receiving treatment for hypertension, 239 of 596 (40.1%) had uncontrolled BP.

Based on a linear regression analysis, the association between age and sex with systolic BP in people who were not receiving antihypertensive treatment showed a linear increase, with the mean BP in female exceeding the mean BP in men at 85–90 years of age. For diastolic BP, the relationship shows an inverted U shape, with highest levels at age 50–55 years in males and 40–45 in females, and with BP in women lower than in men until aged 85–90 years (Supplementary material online, *Figure S1*). After adjustment for age and sex (allowing for an interaction), significantly higher systolic and diastolic BP were apparent in people receiving antihypertensive treatment (Supplementary material online, *Figure S2*). Adjusting for age, sex, and antihypertensive treatment, systolic and diastolic BP were also significantly higher in those measured on the right arm. Diastolic BP readings in pregnant women and in people with a previous history of myocardial infarction were significantly lower than readings from the comparator groups. Increasing BMI was associated with significant increases in both systolic and diastolic BP (Supplementary material online, *Figure S3*).

## Discussion

In Australia, MMM17 detected 1188 adults (31.2% of those screened) with hypertension, of which 591 (18.4%) were untreated and 239 (40.1%) were uncontrolled. This data is commensurate with global MMM17 and previously collated data indicative of relatively low levels of hypertension control rates.<sup>2</sup> Results from a National Blood Pressure Screening day in Australia that screened around 14 000 adults on a single day revealed similar results with 34% of the subjects tested demonstrating elevated BP.<sup>3</sup> The relevance of good BP measurement techniques is reinforced by the data from MMM17. With standardized measurement of three readings BP decreased significantly with each subsequent reading, with a marked difference in the proportion of people with BP levels fulfilling criteria of hypertension depending on which reading was used. The prevalence of hypertension was lowest when derived from the mean of the second and third reading. Further emphasis and education on adequate BP measurement techniques seems therefore relevant.

The proportion of participants with hypertension (including those on treatment) was high in Australia (31.2%) and on par with the worldwide (34.9%) and previous national estimates.<sup>3,4</sup> The findings of lower BP in pregnant women, the usual patterns of systolic and diastolic BP with age, and the association of alcohol consumption with increased BP were consistent with the global MMM17 data.<sup>2</sup> Our findings also highlight that people with treated hypertension and cerebrovascular disease have less well controlled BP, emphasizing the need for more assertive treatment in such high-risk patients.

Reporting bias by participants or the inability to distinguish duration and degree of exposure may not clearly reveal the association of smoking status with increased BP. However, smoking and alcohol consumption are also likely to be under-reported, and the accuracy of reported intake might differ by region and culture. Limitations of these data include, the likelihood of a proportion of false-positive diagnoses as in any screening taking place on a single occasion. By design, they were not intended to be based on representative samples of the Australian states where screening took place. They involved predominantly major cities, not so much rural areas, and hence true prevalence cannot be reported. Furthermore, although BP readings were standardized and taken using automated devices by trained volunteers, the environment in which these were obtained was diverse.

Overall, MMM17 emerged as an effective campaign, carried out with extensive support from volunteer staff, donations of devices to measure BP, and local support with an estimated expenditure of around 1\$per patient screened. Even if only around half of new hypertension cases were correctly identified, at worst, useful advice such as healthy diet, lifestyle advice and appropriate follow-up was provided to those who had BP in the high end of the normal range rather than truly elevated BP.

## Supplementary material

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

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## List of collaborators

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**Conflict of interest:** none declared.

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