

May Measurement Month 2019: an analysis of blood pressure screening results from Armenia

Parounak Zelveian^{1,2*}, Samvel Hayrumyan², Svetlana Gourgenyan¹, Zoya Hakobyan^{1,2}, Hovhannes Kzhdryan^{1,2}, Avag Avagyan², Arsen Minasyan², Heggine Gharibyan^{1,2}, Tsiata Ustyan¹, Siranush Aroyan¹, Susanna Vatinyan¹, Thomas Beaney^{3,4}, Jonathan Clarke⁵, and Neil R. Poulter³

¹Research Institute of Cardiology named after Levon Hovhannisyanyan, P. Sevak 5, Yerevan 0014, Armenia

²Armenian Medical Association, H. Tumanyan 38/9, Yerevan 0002, Armenia

³Imperial Clinical Trials Unit, Imperial College London, Stadium House, 68 Wood Lane, London W12 7RH, UK

⁴Department of Primary Care and Public Health, Imperial College London, St Dunstan's Road, London W6 8RP, UK

⁵Department of Mathematics, Imperial College London, Huxley Building, South Kensington Campus, London SW7 2AZ, UK

KEYWORDS

Armenia;
Non-communicable diseases;
Hypertension;
Screening;
Blood pressure

Elevated blood pressure (BP) is an enormous public health problem and a growing burden worldwide and the biggest single risk factor for cardiovascular death. May Measurement Month (MMM) is a global initiative aimed to raise awareness of high BP and to act as a temporary solution to the lack of screening programmes worldwide. An opportunistic cross-sectional survey of volunteers aged ≥ 18 years was carried out in May to July 2019. Blood pressure measurement, the definition of hypertension and statistical analysis followed the standard MMM protocol. The study was conducted in public areas (23 sites in the capital city Yerevan and 13 in other regions), both indoor and outdoor, as well as in primary and secondary healthcare centres. In total, 9818 individuals (11.3% participated in either MMM2017/2018 or both) were screened of which 9786 had three BP measurements available, 1.6% of them reported never having had their BP measured. The mean age of screened participants was 47.6 (SD \pm 16.5) years, 61.9% were female. After multiple imputation, 41.6% of participants had hypertension and 72.8% of them were aware of their high BP, 65.4% were on treatment, and of those treated, 46.5% had controlled BP ($<140/90$ mmHg). Of 4088 participants with hypertension, 30.4% had controlled BP. Of all risk factors analysed, reported use of anti-hypertensive medication and a previous diagnosis of hypertension were the strongest predictors of higher levels of BP. We found that the prevalence of hypertension, untreated and treated, but uncontrolled hypertension is still substantial in Armenia, which maybe a vital contributor to the growing burden of non-communicable diseases.

Introduction

Globally, over 15 million people die prematurely every year due to non-communicable diseases (NCDs) and around 85%

of those deaths occur in low- and middle-income countries (LMICs).¹ Non-communicable diseases are prevalent conditions in Armenia also and account for a growing proportion of deaths (93%), including cardiovascular diseases (55.2%),

*Corresponding author. Tel: +374 (10) 288550, +374 (55) 288606, Fax: +374 (10) 288502, Email: zelveian@hotmail.com; zelveian@armeda.am

which require early detection to achieve disease control and prevent complications.²

Elevated blood pressure (BP) is an enormous public health problem and a growing burden worldwide and the biggest single risk factor for cardiovascular death.³ However, high BP is a modifiable risk factor and detecting hypertension is essential for initiating treatment, achieving disease control, and delaying the onset of and preventing cardiovascular disease. Unfortunately, a high proportion of people living with hypertension have never been diagnosed, particularly in LMICs. Data from 44 LMICs showed only 39.2% of those with hypertension had been diagnosed and only 10.3% had their BPs controlled.¹

May Measurement Month (MMM) was initiated by the International Society of Hypertension (ISH), aimed to identify individuals in need of improved hypertension care, to increase awareness of high BP and to improve BP screening worldwide.^{4,5} In response to the call of the MMM programme to improve screening and awareness, Armenia joined in 2017.

MMM19 is an excellent opportunity and critical importance not only to increase public awareness of one of the critical cardiovascular risk factors but also to update the national data on high BP.

Methods

This cross-sectional survey was conducted in May to July 2019, among the adult population (≥ 18 years) at 36 sites, distributed in public areas (23 in the capital city Yerevan and 13 in other regions), both indoor and outdoor, as well as in primary and secondary healthcare centres, following the ISH protocol.⁶ The study co-ordinator was Prof. P.Z. Ethical issues were clarified and approvals received from the Ethics Committee of the Institute of Cardiology. The campaign was promoted internationally by ISH and locally by the Armenian Medical Association and Armenian Cardiologist's Association. Sixty-four volunteers were trained in basic knowledge about hypertension and measurement techniques and were engaged in the study.

Screeners were recruited using posters and banners, distribution of flyers, advertisements on TV, in online and printed media, and as well as advocacy on social media. The recruiting of the screeners was volunteer-based, and they participated in the study after a short introduction about the programme and taking verbal informed consent.

Three measurements of BP were conducted in the sitting position, with 1-min intervals between readings using mostly Omron and A&D automated devices. Blood pressure was calculated from the mean of the 2nd and 3rd readings, and hypertension was defined as a systolic BP of ≥ 140 mmHg and/or a diastolic BP ≥ 90 mmHg or being on treatment with anti-hypertensive medication(s). Among those on treatment for hypertension, BP $< 140/90$ mmHg was considered as controlled.

A questionnaire was used to collect demographics, lifestyle information, and environmental factors. Data collection was done via an App, cleaning and transfer as well as analysis of data were implemented centrally by the MMM project team, as described previously.⁶ Where only one or

two BP readings were available, multiple imputation using chained equations was used to impute missing readings based on global data.⁶

Results

In total, 9818 individuals (11.3% participated in either MMM 2017/2018 or both) were screened of which 9786 had three BP measurements available, 1.6% of them reported never having had their BP measured. The majority of screening took place in outdoor public areas (40.5%) and hospitals or clinics (37.1%). The mean age of screened participants was 47.6 (SD \pm 16.5) years, 61.9% were female. 97.5% of those screened were white. In total, 1044 (10.6%) participants reported having diabetes, 712 (7.3%) reported a history of myocardial infarction (MI), 364 (3.7%) reported a history of stroke. About 2394 (24.4%) respondents were current smokers, 996 (10.1%) reported alcohol consumption once or more per week. The mean body mass index (BMI) of those screened was 27.1 (SD \pm 5.1) kg/m². Among women, 365 (6.0%) reported being pregnant at the time of screening, whereas 361 (5.9%) reported a history of hypertension in a previous pregnancy (Supplementary material online, Table S1).

In respondents with three BP readings, BP decreased on average by 4.4/2.4 mmHg between the 1st and 3rd readings. The mean values of the 2nd and 3rd readings were 126.1/81.1 mmHg.

After imputation, 4088 participants (41.6%) had hypertension (denominator 9818) and 2974 (72.8%) of them were aware of their high BP. Of 4088 participants with hypertension, 2675 (65.4%) were on anti-hypertensive medication, and of those where the number of medication classes was known, 42.7% were taking a single medication, 34.9% on two medications, and 22.4% on three or more. Only 46.5% of those on medication had controlled BP whereas of the 4088 participants with hypertension overall, 30.4% had controlled BP. At the time of screening 613 (6.2%), participants reported taking statins and 1618 (16.5%) reported aspirin use (Supplementary material online, Tables S1-S3).

Among all analysed risk factors, reported use of anti-hypertensive medication and a previous diagnosis of hypertension were the strongest predictors of higher levels of BP. After adjustment for age and sex, significantly higher systolic BP (11.1 mmHg higher, $P < 0.001$) and diastolic BP (5.6 mmHg higher, $P < 0.001$) were apparent in those on BP-lowering treatment and in patients with known hypertension (9.4/5.2 mmHg higher, $P < 0.001$). Significant differences in BP were observed in association with several conditions: participants with diabetes and with previous history of stroke had significantly higher systolic and diastolic BPs, whereas those with a history of MI had lower diastolic BPs than those without a history of MI (Supplementary material online, Figure S1 and Table S4).

In addition, drinking alcohol one or more times per week was associated with significantly higher systolic and diastolic BPs than those who drink alcohol never or rarely (Supplementary material online, Figure S2 and Table S5).

Increasing BMI categories were also strongly linked to both higher systolic and diastolic BPs. The difference in mean BP in those participants with a BMI in the obese and overweight ranges compared with those of healthy weight was 7.6/5.1 and 4.5/2.6 mmHg higher, respectively (Supplementary material online, Figure S3 and Table S6).

Discussion

The prevalence of hypertension among screenees in MMM 2017 and 2018 were 33.9% and 38.7%, respectively, compared with 41.6% in 2019.^{7,8} The proportion of hypertensives on medication in 2017 and 2018 were 52.9% and 67.4%, respectively, compared with 65.4% in 2019, whereas the proportion with controlled BP was 46.5% in 2019 compared with 23.0% in 2017 and 47.1% in 2018.^{7,8} The proportion of all hypertensives controlled to <140/90 mmHg was 30.4% in 2019, slightly lower than in 2018 (31.7%), but 2.5-fold higher than in 2017.^{7,8}

Participants with diabetes and a history of stroke had higher systolic and diastolic BPs, but, surprisingly, those with a history of MI had lower diastolic BPs. Strong positive associations, as found in previous years, were seen between BP and risk factors, such as increasing BMI and increasing alcohol intake.

In conclusion, we found that the prevalence of hypertension, among these MMM screenees—both untreated and treated but uncontrolled is still substantial in Armenia, which maybe a vital contributor to the growing burden of NCDs. Since hypertension is the leading risk factor associated with morbidity and mortality from NCDs, greater efforts should be devoted to improving effective hypertension control. We believe that further projects and population-based campaigns, which drive awareness of high BP, can help to get more people with hypertension identified and controlled. May Measurement Month is a handy and reasonably inexpensive tool, and it is hoped that it will continue on an annual basis as long as large numbers of people with increased BP can be identified and treated effectively.

Supplementary material

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

Conflict of interest: none declared.

Acknowledgements

We thank the staff of Institute of Cardiology and all volunteered MMM-Armenia staff, «KRKA, d.d, Novo mesto» and «Acino Pharma AG» representations in Armenia.

References

1. Geldsetzer P, Manne-Goehler J, Marcus M-E, Ebert C, Zhumadilov Z, Wesseh CS, Tsabedze L, Supiyev A, Sturua L, Bahendeka SK, Sibai AM, Quesnel-Crooks S, Norov B, Mwangi KJ, Mwalim O, Wong-McClure R, Mayige MT, Martins JS, Lunet N, Labadarios D, Karki KB, Kagaruki GB, Jorgensen JMA, Hwalla NC, Houinato D, Houehanou C, Msaidié M, Guwatudde D, Gurung MS, Gathecha G, Dorobantu M, Damasceno A, Bovet P, Picaba BW, Aryal KK, Andall-Brereton G, Agoudavi K, Stokes A, Davies JI, Bärnighausen T, Atun R, Vollmer S, Jaacks LM. The state of hypertension care in 44 low-income and middle-income countries: a cross-sectional study of nationally representative individual-level data from 1.1 million adults. *Lancet* 2019;**394**:652-662.
2. Andreasian D, Bazarchyan A, Sargsyan S, Torosyan A, Mirzoyan M, Bidzyan L. *Health System Performance Assessment, Armenia; 2019*. National Institute of Health after academican S. Abdalbekyan, MoH, RA; 2020. p72. <http://nih.am/assets/pdf/atvk/16c5040ee6ef2119d7977d1e60034553.pdf> (1 December 2020).
3. GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020;**396**:1223-1249.
4. Beaney T, Schutte AE, Tomaszewski M, Ariti C, Burrell LM, Castillo RR, Charchar FJ, Damasceno A, Kruger R, Lackland DT, Nilsson PM, Prabhakaran D, Ramirez AJ, Schlaich MP, Wang J, Weber MA, Poulter NR, MMM Investigators. May Measurement Month 2017: an analysis of blood pressure screening results worldwide. *Lancet Glob Health* 2018;**6**:e736-e743.
5. Beaney T, Burrell LM, Castillo RR, Charchar FJ, Cro S, Damasceno A, Kruger R, Nilsson PM, Prabhakaran D, Ramirez AJ, Schlaich MP, Schutte AE, Tomaszewski M, Touyz R, Wang J-G, Weber MA, Poulter NR, MMM Investigators. May Measurement Month 2018: a pragmatic global screening campaign to raise awareness of blood pressure by the International Society of Hypertension. *Eur Heart J* 2019;**40**:2006-2017.
6. Beaney T, Schutte AE, Stergiou GS, Borghi C, Burger D, Charchar F, Cro S, Diaz A, Damasceno A, Espeche W, Jose AP, Khan N, Kokubo Y, Maheshwari A, Marin MJ, More A, Neupane D, Nilsson P, Patil M, Prabhakaran D, Ramirez A, Rodriguez P, Schlaich M, Steckelings UM, Tomaszewski M, Unger T, Wainford R, Wang J, Williams B, Poulter NR, on behalf of MMM Investigators. May Measurement Month 2019: the global blood pressure screening campaign of the International Society of Hypertension. *Hypertension* 2020;**76**:333-341.
7. Zelveian P, Avagyan A, Minasyan A, Hakobyan Z, Ustyan T, Gharibyan H, Melkonyan A, Aroyan S, Vatinyan S, Gourgenyan S, Beaney T, Xia X, Poulter NR. May Measurement Month 2017: an analysis of blood pressure screening results in Armenia-Europe. *Eur Heart J Suppl* 2019;**21**:D11-D13.
8. Zelveian P, Avagyan A, Minasyan A, Hayrumyan S, Gourgenyan S, Hakobyan Z, Kzhdryan H, Hakobjanyan V, Ustyan T, Gharibyan H, Melkonyan A, Aroyan S, Vatinyan S, Beaney T, Ster AC, Poulter NR. An analysis of blood pressure screening of 21112 participants in Armenia: May Measurement Month 2018. *Eur Heart J Suppl* 2020;**22**:H14-H16.