

Title: May Measurement Month 2023: results of an opportunistic blood pressure screening campaign in Ukraine

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9 Abstract

10 The May Measurement Month (MMM) campaign was conducted in Ukraine in 2023 to raise awareness of
11 high blood pressure (BP). Adults aged ≥ 18 years were recruited through convenience sampling at central
12 (Kyiv), eastern (Kharkiv and Zaporizhzhia), southern (Odesa) and western (Ivano-Frankivsk, Ternopil and
13 Uzhorod) Ukraine. Three seated BP readings were taken from each participant, and a questionnaire
14 collected information on demographics, lifestyle factors, and comorbidities. Hypertension was defined as
15 a systolic BP ≥ 140 mmHg or a diastolic BP ≥ 90 mmHg or being on BP-lowering medication. Controlled BP
16 was defined as being on BP-lowering medication with a BP $< 140/90$ mmHg. Multiple imputation was used
17 to estimate missing BP readings. In total, 2,438 adults were screened, with a mean age of 50.1 years and
18 58.7% were female. Of all participants, 1,493 (61.2%) had hypertension, of whom 1,177 (78.8%) were
19 aware, and 1,076 (72.1%) were on antihypertensive medication. Of those on antihypertensive medication,
20 431 (40.1%) had controlled BP, and of all participants with hypertension, 28.9% had controlled BP. The
21 gender and age-related differences in the rates of awareness, treatment involvement and BP control were
22 revealed.

23 **Key Words:** Hypertension, Blood Pressure, Screening, Treatment, Control.

1 Introduction

2 Raised blood pressure (BP) is the largest contributor to the global burden of disease.¹ Hypertension remains
3 one of the key public health problems in Ukraine. A high prevalence of hypertension, coupled with the
4 negative impact of elevated BP on target organs, make hypertension the leading factor in cardiovascular
5 morbidity and mortality both worldwide and particularly in Ukraine. The problem of timely diagnosis and
6 effective treatment of hypertension in our country remains; moreover, its urgency has significantly
7 increased since the start of the full-scale war in Ukraine in 2022. Evidence of this is the increase in
8 hospitalisations for stroke and worsening access to care and strain on chronic disease management,
9 including cardiovascular conditions.^{2,3}

10 The World Health Organization (WHO) Hypertension Report of 2019 data show that even in peacetime in
11 Ukraine, about 43.0% of adults aged 30–79 years had hypertension, which is substantially higher than the
12 global (33.0%) and European regional (37.0%) averages.⁴ It is also important to note the gaps in
13 hypertension detection — for every third adult with elevated BP, hypertension had not been previously
14 diagnosed.⁴ These data also indicate insufficient treatment coverage — 49.0% of patients with diagnosed
15 hypertension received drug therapy, and only 14.0% achieved target BP levels (<140/90mmHg), which is
16 significantly lower than both European (26.0%) and global (21.0%) averages.⁴

17 May Measurement Month (MMM) was initiated in 2017 by the International Society of Hypertension (ISH)
18 with an aim to raise awareness of the dangers of raised BP and act as a temporary measure addressing a
19 lack of systematic BP screening worldwide. It has since run annually, except for 2020 due to the COVID-
20 19 pandemic. In 2023, Ukraine participated in the MMM campaign to continue raising awareness of high
21 BP (Gabriele K Kerr, Submitted for Publication).

22 Ukraine participated in the MMM 2017, 2018, 2019, 2021 and 2023 campaigns. In this paper, we report on
23 the findings of the MMM23 campaign in Ukraine.

Methods

MMM is a cross-sectional survey of consenting adults aged 18 years or over, using convenience sampling. The programme in Ukraine was coordinated by the State Institution “National Scientific Centre M.D. Strazhesko Institute of Cardiology, Clinical and Regenerative Medicine National Academy of Medical Science of Ukraine” over the three months (May, June, July). Screening sites were set up in hospitals, clinics, workplaces, and public spaces, in Kyiv (two sites), Kharkiv (two sites), Zaporizhzhia (one site), Odesa (one site), Ivano-Frankivsk (one site), Ternopil (one site) and Uzhhorod (one site). The team of investigators (medical students, nurses, physicians) was well trained in standardised BP measurement. The campaign was advertised on Facebook.

MMM uses a standardised protocol across all sites, in which participants have three seated BP readings measured at one-minute intervals.⁵ Automatic devices were used to measure BP. In addition, a questionnaire was completed, collecting information on demographics, comorbidities, lifestyle risk factors and use of BP-lowering medication. Hypertension was defined as a raised BP (systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg based on the mean of the second and third readings) or being on BP-lowering medication. Controlled BP was defined as being on BP-lowering medication with a BP $< 140/90$ mmHg; we also evaluated a more contemporary target of $< 130/80$ mmHg. Participants found to have raised BP were provided with diet and lifestyle advice and were advised to attend a family doctor or therapist for further evaluation and treatment.

Data were collected locally via paper forms and submitted to the central MMM team for cleaning and analysis. In cases where a participant did not have all three BP readings measured, to ensure comparability between participants, the average of the second and third readings was estimated by multiple imputation using chained equations, based on global data as described previously.⁵ To aid comparison with other countries participating in MMM, results are also presented after age and sex standardisation using the WHO world standard population, and assuming an equal gender split.⁶ Servier and Omron supported the MMM23 campaign in Ukraine through donation of BP devices.

Analyses of associations between patient characteristics and BP level used linear regression models run separately for systolic and diastolic BP. Age, sex, an interaction between age and sex, and BP-lowering medication use were included as a priori predictors. Model coefficients and 95% confidence intervals (CIs) were extracted.

Results

In total, 2,438 people were screened during MMM23 in Ukraine. Participants were screened in hospitals and clinics (56.8%), workplaces (20.6%), and public spaces (16.1%). The mean (standard deviation) age was 50.1 (15.3) years, and 1,430 (58.7%) were female. The majority (93.4%) of participants reported being of White ethnicity. Of all participants, 104 (4.3%) reported never having had a BP measured before.

Multiple imputation was used to estimate missing BP readings for 16 (0.7%) participants missing data on the second and/or third BP reading. Among all participants, the mean BP was 133.8/81.9mmHg. Of all participants, 1,493 (61.2%) were found to have hypertension, of whom 1,177 (78.8%) were aware, and 1,076 (72.1%) were on BP-lowering medication (Table 1). Of those on BP-lowering medication, 431 (40.1%) had a BP controlled to <140/90mmHg and 158 (14.7%) had a BP controlled to <130/80mmHg. Of those on BP-lowering medication, 25.8% were taking only one agent. Of all participants with hypertension, 431 (28.9%) had a BP controlled to <140/90mmHg and 158 (10.6%) had a BP controlled to <130/80mmHg. Of participants who were not taking BP-lowering medication, 417 (30.6%) were found to have raised BP ($\geq 140/90$ mmHg). In total, 1062 (43.6%) were found to have either untreated or inadequately treated hypertension. After age and sex standardisation, 1,237 (51.0%) were found to have hypertension, of whom 852 (68.9%) were aware, 723 (58.4%) were on BP-lowering medication and 292 (23.6%) were controlled to <140/90mmHg (Table 1).

Table 1: Total participants and numbers with hypertension, awareness, on medication and with controlled blood pressure, before and after age and sex standardisation

	Total participants	Number (%) with hypertension	Number (%) of hypertensives aware	Number (%) of hypertensives on medication	Number (%) of those on medication with BP <140/90	Number (%) of all hypertensives with BP <140/90	Number (%) of those on medication with BP <130/80	Number (%) of all hypertensives with BP <130/80
Actual	2,438	1493 (61.2%)	1177 (78.8%)	1076 (72.1%)	431 (40.1%)	431 (28.9%)	158 (14.7%)	158 (10.6%)
Standardised*	2,425	1237 (51.0%)	852 (68.9%)	723 (58.4%)	292 (40.4%)	292 (23.6%)	125 (17.3%)	125 (10.1%)

* Standardised totals include only those participants with complete age and sex.

In models adjusted for age, sex, and use of BP-lowering medication, current tobacco smoking was associated with higher systolic BP (2.1mmHg, 95% CI: 0.4 to 3.7, $p=0.014$), while completing WHO-recommended physical activity guidelines (150 minutes of moderate, or 75 minutes of more vigorous, activity per week) was associated with lower systolic (-2mmHg, 95% CI: -3.3 to -0.7, $p=0.003$) and diastolic (-2.5mmHg, 95% CI: -3.4 to -1.7, $p<0.0001$) BP.

The percentage of women with hypertension was lower than in men (56.1 vs 68.3%, respectively). In contrast, women with hypertension had higher rates of awareness (81.4 vs 75.7%), treatment (76.7 vs 66.6%), and BP control to <140/90mmHg (36.3 vs 19.9%) than men with hypertension. In regression models adjusted for age and BP-lowering medication use, women with hypertension in a previous pregnancy had significantly higher average systolic (4.4mmHg, 95% CI: 1.0 to 7.8, $p=0.011$) and diastolic (2.7mmHg, 95% CI: -0.5 to 4.8, $p=0.014$) BP, than women with no history of hypertension in pregnancy.

More than half (52.2%) of 40–49-year-old participants had hypertension, with the proportion of hypertensives dramatically increasing in older age groups to 80.9% in 50–59-year-olds, 87.3% in 60–69-year-olds, and 91.6%

in participants ≥ 70 years old. In contrast, only 19.1% of participants aged < 40 years were hypertensive. BP-lowering medication use in hypertensive participants increased with older age from 31.4% in those < 40 years, to 90.9% in those aged ≥ 70 years. Of those on BP-lowering medication, the percentages with controlled BP ($< 140/90$ mmHg) ranged from 32.1% in 30-39-year-olds to 47.6% in 40-49-year-olds, without a clear trend with age.

Discussion

The MMM23 campaign screened 2,438 people and identified a total of 1,062 (43.6%) participants with untreated or inadequately controlled hypertension, highlighting the scale of hypertension in Ukraine. In comparison with the results of the combined analysis of MMM 2017 - 2019, the proportion of participants with hypertension was lower (61.2% vs 71.6%) and the percentage of hypertensives on medication was also lower (72.1% vs 82.6%).⁷ These proportions are almost twice as high as the prevalences in the 2019 STEPS survey - 34.8% of adults aged 18–69 years were identified to have hypertension, of whom 48.8% were treated.⁸ The difference between MMM and STEPS results could be explained by different age range, methodology, and the site of screening, as the MMM screening was done in mostly in health care facilities, while STEPS used household measurements.⁸ However, both surveys demonstrate a gap in hypertension detection and highlight the problem of a huge cohort of the population living with high BP without diagnosed hypertension. In general, the proportion of hypertensives with BP $< 140/90$ mmHg is still critically low – 25.9% in MMM 2017 to 2019 and 28.9% in 2023.⁷ The poor BP control rate may be partially a result of the harmful impact of war on civilians due to systemic disruption of healthcare access in near-frontline regions and additional load on health care system in regions with internal displaced people. It may also be explained by individual factors including psychosocial stress, mental health disorders, lifestyle risk factors like increased tobacco and alcohol consumption, food insecurity, or poor nutrition.^{7,4,9}

Strengths and limitations

A strength of the MMM campaign is the use of a standardised protocol across countries, which aids comparability of findings. Participants were recruited opportunistically via convenience sampling, with more than half screened

in hospitals or clinics, so estimates should not be interpreted as estimates of national prevalence. Also, hypertension was defined based on single-visit BP readings, as ambulatory or home BP-monitoring recommended by many guidelines was not feasible here and so may represent an overestimate.¹⁰

Conclusion

The MMM23 campaign in Ukraine identified a substantial number of participants (43.6%) with untreated or inadequately treated hypertension. The situation requires systemic improvement in the detection and treatment of hypertension to achieve better BP control at the population level. The importance of MMM campaigns in Ukraine is not only about attention-grabbing BP measurements and hypertension; it is also a source of information on the detection, treatment, and control of hypertension at the population level, in the absence of current epidemiological studies.

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Conflict of Interest

None declared

Data Availability

Data are not publicly available but access can be requested with permission from the MMM Management Board, on request through the MMM website: maymeasure.org

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