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OPPORTUNISTIC SCREENING FOR HYPERTENSION IN THE GENERAL POPULATION IN BULGARIA: INTERNATIONAL SOCIETY OF HYPERTENSION MAY MEASUREMENT MONTH CAMPAIGN

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ОПОРТЮНИСТИЧЕН СКРИНИНГ ЗА ХИПЕРТОНИЯ СРЕД ОБЩО НАСЕЛЕНИЕ В БЪЛГАРИЯ: КАМПАНИЯ МАЙ МЕСЕЦ ЗА МЕРЕНЕ НА МЕЖДУНАРОДНОТО ДРУЖЕСТВО ПО ХИПЕРТОНИЯ

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Abstract.

Cardiovascular diseases are not only the leading causes of mortality in Bulgaria but also the mortality rate is twice as high as the European Union average, so screening programmes identifying subjects with elevated blood pressure (BP) are of utmost importance. May Measurement Month (MMM) is an annual global initiative of the International Society of hypertension that began in 2017 aimed at raising awareness of high BP. Bulgaria joined the 3rd campaign of MMM in 2019 and an overview of the results of Bulgarian participation are presented in this paper. Hypertension was defined as systolic BP ≥ 140 mm Hg and diastolic BP ≥ 90 mm Hg or treatment for hypertension, statistical analysis followed the standard MMM protocol. In Bulgaria, 150 screening points were set up in primary and secondary care facilities, in pharmacies, and outdoor spaces across 21 administrative districts. Out of 3678 individuals screened, 2587 participants (70.3%) had hypertension. Of 2896 participants with hypertension, 35.6% had controlled BP. Out of 1760 participants not on antihypertensive medication, 669 (38%) had elevated BP. In the case of treated individuals ($n = 1918$), 997 (52%) had uncontrolled hypertension. In the untreated cohort, every 4th subject had elevated BP, whilst among patients on antihypertensive medication, every second had uncontrolled BP, the worst results in terms of diagnosis and treatment are observed in men. By identifying almost two-third of the whole screened cohort with the possibility of newly diagnosed or uncontrolled hypertension, our results confirm the importance of BP screening campaigns.

Key words:

Hypertension, Blood Pressure, Screening, Treatment, Control, Bulgaria

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Резюме.

Сърдечно-съдовите заболявания са не само водеща причина за смъртността в България, но и смъртността е два пъти по-висока от средната за Европейския съюз, така че скрининговите програми, идентифициращи лица с повишено артериално налягане (АН), са от изключително значение. Май Месец на Мереене (МММ) представлява годишна глобална инициатива на Международното дружество по хипертония, която започна през 2017 г. и има за цел да

повиши осведомеността за високото артериално налягане. България се присъедини към 3-та кампания на MMM през 2019 г. и в настоящата публикация е представен преглед на резултатите от българското участие. Хипертонията се дефинира като систолно АН ≥ 140 mm Hg и диастолно АН ≥ 90 mm Hg или провеждано лечение за хипертония, статистическият анализ следва стандартния протокол MMM. В България бяха създадени 150 пункта за скрининг в първична и вторична медицинска помощ, в аптеки и на открити пространства в 21 административни области. От 3678 скринирани лица, хипертония установяваме при 2587 участници (70,3%). Сред тях, 35,6% са с контролирано артериално налягане. От 1760 участници, които не са на антихипертензивно лечение, повишено АН установяваме при 669 (38%). В случай на лекувани лица ($n = 1918$), 997 (52%) имат неконтролирана хипертония. В нелекуваната кохорта всеки 4-ти субект е с повишено АН, докато сред пациентите на антихипертензивно лечение всеки втори има неконтролирано АН, като най-лоши резултати по отношение на диагнозата и лечението се наблюдават при мъжете. Чрез идентифициране на почти две трети от цялата изследвана кохорта с възможност за новодиагностицирана или неконтролирана хипертония, нашите резултати потвърждават важността на кампаниите за скрининг на АН.

Ключови думи: Хипертония, артериално налягане, скрининг, лечение, контрол, България

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INTRODUCTION

Despite sustained declines in cardiovascular disease (CVD) mortality in many countries across Europe, it remains the most common cause of death within the region [1]. According the data on e-atlas of European Society of Cardiology four of the 13 middle-income countries demonstrated an increase in crude premature mortality (deaths under the age of 70 years) rates from 2010 to the most recent year of data in females (Bulgaria, Egypt, Republic of Georgia and Turkey) and six did so in males (Bulgaria, Egypt, Republic of Georgia, Romania, Serbia and Turkey) [2]. Overall life expectancy at birth in Bulgaria temporarily fell by 1.5 years in 2020 compared to 2019, largely due to the high number of deaths from the COVID-19 pandemic. Stroke (number of death 20687; 19.3%), ischemic heart disease (12101, 11.3%) and lung cancer (3341; 3.1%) are the leading causes of death and accounted for one third of all deaths in 2018 in the county [3].

The early diagnosis and the proper treatment of hypertension, as a major contributor to CVD mortality merits a high priority to improve the CV outcome of the Bulgarian citizens. That is why the Bulgarian Hypertension League had decided in 2019 to join May Measurement Month (MMM), the hypertension awareness campaign from the International Society of Hypertension (ISH) [4]. In light of the clear inadequacies of BP screening and management facilities around the world, MMM provides an inexpensive and pragmatic temporary solution to identifying individuals in need of improved hypertension care, whilst also raising awareness of the importance of BP measurement at the population level. Ultimately, the data generated are intended to inform and persuade governments and health policymakers to improve BP screening and management facilities and thereby reduce the enormous global

health burden caused by raised BP.1 This publication provides the data of the first participation of Bulgaria in the global initiative.

MATERIAL AND METHODS

The May Measurement Month initiative of the International Society of Hypertension is lead globally by prof. Neil Poulter [4-5]. MMM is a cross-sectional survey of any adults (≥ 18 years) who wished to have their BPs measured at any of the MMM screening sites. These sites were set up by volunteer investigators who followed a common protocol (available on the MMM website: www.maymeasure.com). Ideally, by design, the survey sought out those who had not had their BP measured for at least a year, but no adults were excluded from the study. Training materials, critically including standardized BP measurement techniques and campaign promotional materials were made available via the MMM website. Those presenting for BP measurement, who gave informed consent to participate, provided data collected on a simple questionnaire, including demography and medical history and where facilities allowed, weight and height were measured and recorded. Hypertension was defined primarily as a systolic BP ≥ 140 mm Hg or a diastolic BP ≥ 90 mm Hg [6-7] using the mean of the second and third BP readings or being on treatment with antihypertensive medication(s). Hypertension based on the definition used in the most recent US guidelines ($\geq 130/80$ mm Hg) was also evaluated [8].

MMM 2019 in Bulgaria was organized by the Bulgarian Hypertension League. Altogether 150 screening points in 21 of 28 administrative districts were involved in MMM Bulgaria 19 campaign. Medical students and trained physicians performed triplicate sitting BP measurements using validated

upperarm oscillometric devices OMRON M7 Intelli IT AFib (n = 1603) and Microlife WatchBP Office BP monitor (n = 2075). Individuals with HTN or uncontrolled BP were provided with printed dietary and lifestyle advice and recommendations to visit their GP or dedicated hypertension centers. Collected data were analyzed centrally by the MMM project team and multiple imputation was performed to impute the mean of the 2nd and 3rd readings where they were missing. Statistical analysis was performed using SPSS Statistics 19. Chi-square tests and analysis of variance was used for categorical and continuous variables, respectively. Analysis of measures of association used only those individuals with complete data on age, sex, ethnicity, and use of antihypertensive medication. Linear mixed-effects models were run separately for systolic and diastolic BP, assuming a random intercept model to account for country level clustering effects. It was decided a priori to adjust for age, sex, and antihypertensive medication, along with an interaction between age and sex, given the known strong effects of these variables on BP.

RESULTS

In total, 3678 first time participating in MMM campaign Caucasian individuals were screened. Despite the fact that 2516 (71.2%) of them had their last BP measurement within 12 months, 212 (6%) reported never having had BP measured. The mean age of screened participants was 58.8 (SD±16.6) years, 62.8% were female, among them 2.1% reported a history of hypertension in a previous pregnancy. The characteristics for all participants are given in table 1, together with a comparison of the data from the global MMM 2019 publication. Of all screened, 11.5% reported having diabetes mellitus (either type I or type II),

13.8% a history of myocardial infarction, 6.4% a history of stroke, 20.3% were current smokers, and 20% reported drinking alcohol at least once per week. The mean BMI was 26.4 kg/m² (SD 6.04) in women and 28.1 kg/m² (SD 10.1) in men. 675 (35.2%) women and 472 (42.9%) men were overweight, and 421 (22%) women and 281 (25.5%) men were obese.

Based on the inclusion criteria, all participants had at least one BP reading and 2637 (71.7%) had all 3 BP readings recorded. Analysis of only those with all three readings showed that BP fell, on average, by 2.4/3 mm Hg, from a mean of 135.2/83.5 mm Hg for the first reading to a mean of 132.8/80.5 mm Hg for the third reading. The mean BP (based on individuals with the second and third BP reading available) was 135.2/82.3 mm Hg before and 133.7/81.5 mm Hg after age and sex standardization. In those patients who were not on antihypertensive medication, the mean BP was 131/81.3 mm Hg, while in those, who were on antihypertensive medication, it was 136.8/82.7 mm Hg.

Following imputation, of all 3678 participants, 2587 (70.3%) had hypertension (Table 2). Of those with hypertension, 73.8% were aware of their diagnosis, and 74.1% were on antihypertensive medication. Of the 1918 participants on medication, 921 (48%) had a BP controlled to < 140/90 mm Hg and 370 (19.3%) controlled to < 130/80 mm Hg. Of all hypertensive participants, 35.6% were controlled to < 140/90 mm Hg and 14.3% to < 130/80 mm Hg. Of those participants not taking antihypertensive medication, 669 (38%) were found to have hypertension. The highest proportion of untreated (50.6%) and inadequately treated hypertension (58.6%) were noticed in male participants in the campaign, the corresponding percentages in females were 29% and 48.7% respectively (table 3).

Table 1. Participants characteristics in Bulgaria and globally in MMM 2019

	Bulgaria MMM 2019	Worldwide MMM 2019	Bulgaria MMM 2019 40-50 years
Age	58.82 ± 16.6	45.3 ± 17	40-50
Female sex	62.8	51.4	58.6
Smoking	20.3	13.7	31.8
Alcohol at least 1 week	20	6.4	22.3
Diabetes	11.5	9	9.6
Overweight	38.7	30.8	34.9
Obesity	23.3	14.4	21.9
On antihypertensive medications	52.1	20.4	39.3
Previous infarction	13.8	4.2	8.4
Previous stroke	6.4	2.8	6.6

Table 2. Total participants and proportions with hypertension, awareness, on medication and with controlled BP

	Number (%) with hypertension	Number (%) of hypertensives aware	Number (%) of hypertensives on medication	Number (%) of those on medication with controlled BP	Number (%) of all hypertensives with controlled BP
Total participants 3678	2587 (70.3%)	1910 (73.8%)	1918 (74.1%)	921 (48%)	921 (35.6%)
Female 2309	1580 (68.4%)	1256 (79.5%)	1282 (81.1%)	658 (51.3%)	658 (41.6%)
Male 1369	1100 (73.6%)	654 (64.9%)	636 (63.2%)	263 (41.4%)	263 (26.1%)

Table 3. Untreated and inadequately treated hypertension according to sex

	Number (%) with hypertension	Number (%) of participants with hypertension of those not on antihypertensive medications	Number (%) of participants with uncontrolled BP of those on medication
Total participants 3678	2587 (70.3%)	669 (38%)	997 (52%)
Female 2309	1580 (68.4%)	298 (29%)	624 (48.7%)
Male 1369	1100 (73.6%)	371 (50.6%)	373 (58.6%)

In general, 1918 (52.1%) participants were taking antihypertensive medication, and of the 1546 with a recorded number of medication classes, 40.2% were taking a single medication, and 34.3%, 17.8%, and 6.5% were taking 2, 3, and 4, respectively. Only 1.2% were taking ≥ 5 antihypertensive drugs. In participants taking a single antihypertensive medication, 50.2% were uncontrolled, and in those taking 2 drug classes, 49% were uncontrolled. Proportions with uncontrolled BP were similar in those on 3 (49.8%) and higher in those on 4 (56.0%) or ≥ 5 (83.3%) medications. In total, 255 participants were defined as treatment-resistant, which is 16.5% of the hypertensive population included in the study for whom data on the number of medications were available. The proportion of treatment-resistant participants fell down to 13.4% if the definition excludes the patients with controlled BP of more than 4 medications.

Based on linear mixed models, mean systolic BP displayed a roughly linear increase with age in both men and women who were not using antihypertensive medication (Figure 1). In contrast, mean diastolic BP showed an inverted U-shaped curve, with BP peaking at 50 to 55 years and then gradually decreasing. Systolic BP was higher in males compared to females until the age of about 70 years, after which the mean systolic was higher in females. Similarly, diastolic BP was higher in males until 70 years, after which there were no significant differences between the sexes.

Of all risk factors analyzed, reported use of antihypertensive medication and a previous diagnosis of hypertension were the strongest predictors of high-

er levels of systolic and diastolic BP. After adjusting for age and sex, participants taking antihypertensive medication had a higher mean systolic BP (4.9 mm Hg higher, $P < 0.001$) and higher diastolic BP (1.4 mm Hg higher, $P < 0.001$) compared with those not taking medication (Figure 2). After adjusting for age, sex, and antihypertensive medication use, those with known hypertension had a significantly higher mean systolic (5.8 mm Hg higher, $P < 0.001$) and diastolic BP (1.7 mm Hg higher, $P < 0.001$) compared with those without known hypertension. BMI was also strongly linked to both systolic and diastolic BP, with a linear increase in both with increasing BMI category. The difference in mean systolic and diastolic BP in those participants with a BMI in the obese range, compared with those of healthy weight was 39 mm Hg and 2.4 mm Hg, respectively (Figure 3).

Several smaller but significant differences in systolic and diastolic BP were observed in association with several conditions or risk factors. For example, participants with a history of myocardial infarction or stroke had significantly higher systolic BPs, but significantly lower diastolic BPs (Figure 2). In addition, a significant dose-dependent increase in both systolic and diastolic BP was seen in alcohol drinkers compared with non-drinkers, after adjusting for age, sex, and antihypertensive medication use (Figure 3). Participants who currently smoked had a small, but statistically significant increase in diastolic BP. Conversely, participants, compliant with regular physical activity (150 mins of moderate exercise or 75 mins of more vigorous exercise per week) had significantly lower systolic and diastolic BPs than those who were not.

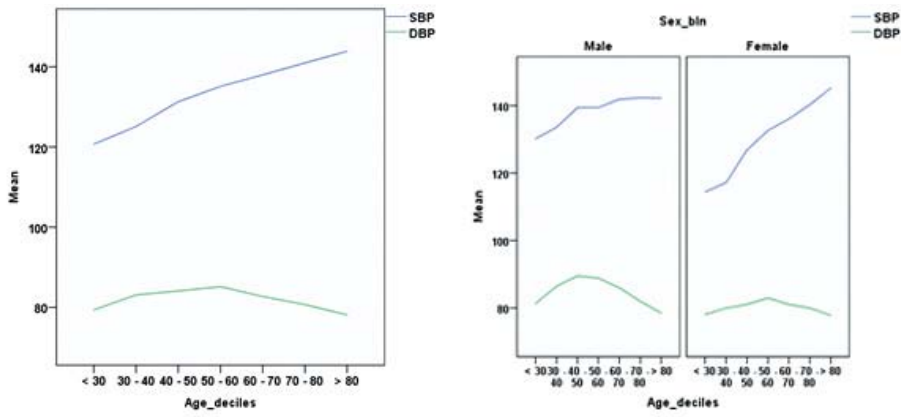


Fig. 1. Mean systolic and blood pressure by age and sex from linear mixed models, in participants not taking antihypertensive medication

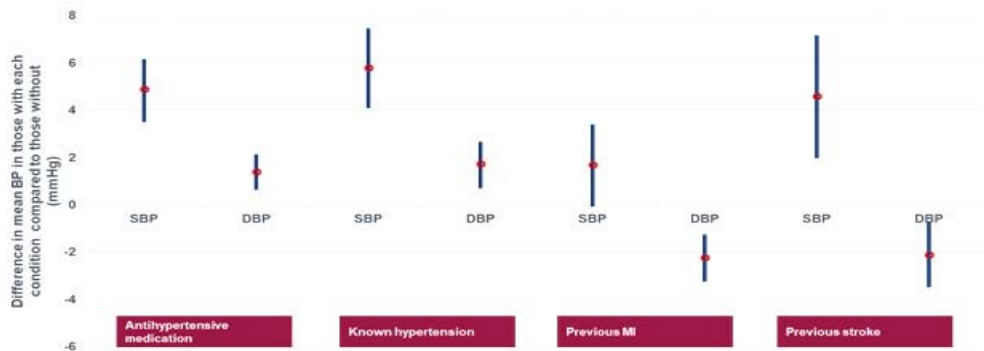


Fig. 2. Difference in mean systolic and diastolic blood pressure (BP; with 95% CI) in those with each condition compared to those without, from linear mixed models adjusted for age, sex, and antihypertensive medication. Antihypertensive medication adjusted for age and sex only.

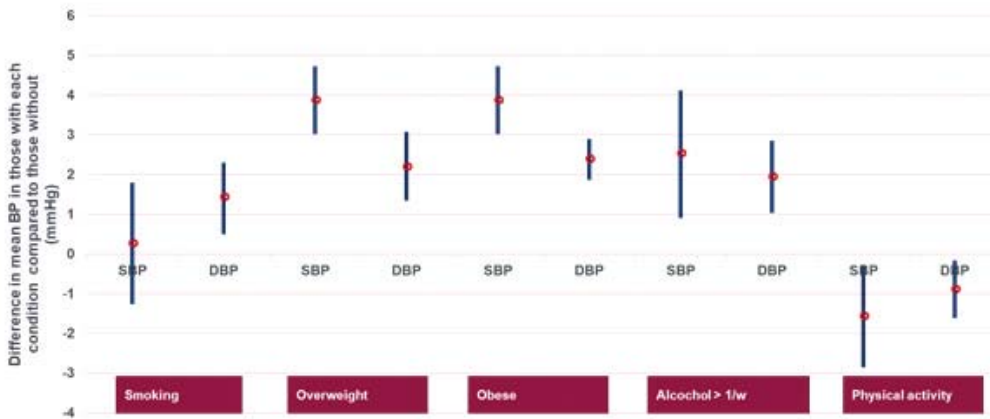


Fig. 3. Difference in mean systolic and diastolic blood pressure (BP; with 95% CI) in those with each condition compared to those without, from linear mixed models adjusted for age, sex, and antihypertensive medication

DISCUSSION

With 3678 participants, the MMM19 was the first participation of Bulgaria in the global MMM initiative of the International Society of Hypertension and the largest BP screening campaign in the country. More than half of the whole cohort had hypertension (treated or untreated). Every 4th untreated participant had elevated BP and almost every 2nd participant taking antihypertensive therapy had uncontrolled BP. We identified

684 subjects with possible undiagnosed HTN and 1140 inadequately treated subjects, which represents a total of 64.4% of the screened cohort. Men had lower rates of hypertension diagnosis and control than women, and young individuals lower than older ones. Strong positive associations were seen between BP and risk factors, such as increasing BMI and increasing alcohol intake. Patients with a history of myocardial infarction or previous stroke had a significantly higher level of systolic, but lower level of diastolic blood pressure. The

comparison of the risk profile in Bulgaria with that of the published data from the global initiative enables the establishment of important differences. At a relatively early age, between 40-50 years old, we find a reliably higher burden of all risk factors in Bulgaria – smoking, arterial hypertension, overweight, etc. As a result, cardiovascular events experienced are almost double those found in this age group globally. A half of treated hypertensive were on monotherapy and concomitant use of lipid lowering therapy was less than 30%, especially in patient population without cardiovascular disease. These findings suggest high level of medical inertia and poor patient adherence in intensifying treatment for achieving optimal control. Due to methodological limitations and opportunistic sampling, as well as higher age of individuals the sample cannot be considered representative of the entire Bulgarian population. Nevertheless, this is a large sample and obtained data are in line with reports from other European populations and with the available epidemiological studies conducted in the country [9-12].

In conclusion, there is considerable potential for improving the control of hypertension in the general population in Bulgaria. The MMM data should be used to press healthcare policymakers for implementing health campaigns and screening programmes at population level, and specifically targeted working-age individuals and men in whom undiagnosed hypertension is more common. Training programmes are also needed for practicing doctors to help to improve patient compliance and intensify the treatment of hypertension and other cardiovascular risk factors until optimal control is achieved.

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Не е деклариран конфликт на интереси

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