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May Measurement Month 2019: results of blood pressure screening from 47 countries

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Background

There continues to be an inexorable rise in the death toll due to raised blood pressure (BP) which remains the biggest single contributor to global death and the global burden of disease.[1] It is estimated that in 2019 about 19% of all deaths (10.8 million) were due to raised BP, having risen from 9.4 million deaths in 2014.[2]

Hypertension causes over 50% of cases of heart disease, stroke, and heart failure[3] and it is estimated that about 10% of global healthcare spending arises from raised BP and its complications.[4] Moreover, hypertension-mediated organ damage increases risk of severe infections from COVID-19, including risk of death.[5] For any of these reasons, it is critical to prevent and, failing that, identify and manage raised BP that appears to differentially affect the most vulnerable groups in society.

Given that BP is easy and inexpensive to measure and that several relatively inexpensive and effective drug classes are available to control hypertension, it is remarkable that a large proportion of people with hypertension remain unaware of their condition and that only a small proportion get their BPs controlled even to the now conservative target of $<$140/90 mmHg.[6,7]

This is the background that stimulated the launch of May Measurement Month (MMM) which began as an initiative of the International Society of Hypertension (ISH) in 2016.[8] The primary aim of MMM is to raise awareness of the importance of BP measurement at the individual and population level both nationally and globally. The first screening campaign took place in 2017 (MMM17), screening over 1.2 million adults worldwide,[9] followed by increasingly successful campaigns in 2018 (MMM18)[10] and 2019 (MMM19),[11]

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screening over 1.5 million each. Sadly, due to the COVID-19 pandemic, the 2020 campaign had to be deferred.

This supplement presents the data from the 47 individual countries each of which screened at least 2500 adults during MMM19 to complement the two previous supplements reporting national data from the highest screening countries in MMM17[12] and MMM18.[13]

MMM19 summary

Details of the methods and results of MMM19 have been published previously.[10] In summary, the MMM19 campaign was a cross-sectional opportunistic survey of the BP levels of adults (aged ≥18 years) who volunteered to be screened. Screening sites were set up in a wide range of places from clinical settings such as hospitals and pharmacies to public spaces, such as supermarkets. Three sitting BP readings were obtained on each screenee using standardized methods and the mean of the last two was used in the analyses.

Those screenees found to have BP levels in the hypertensive range (systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg) were given advice on diet and lifestyle to help reduce their BP and locally tailored advice to facilitate further follow-up of their raised BP. Prior to BP measurement, a brief questionnaire was administered collecting data on demographic, medical, social, and lifestyle variables.

Data were collected from 1 508 130 screenees from 92 countries in 2019.[10] Almost one third (32%) of screenees had never had their BP measured previously and 34% of all screenees were found to be hypertensive (systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg, or taking antihypertensive medication). Of those with hypertension, 59% were aware of their condition and 55% were receiving antihypertensive treatment. Of those on treatment, 58% were controlled to <140/90 mmHg and 29% to <130/80 mmHg and only 50% were taking two or more antihypertensive agents. Overall, only 32% of hypertensive screenees were controlled to <140/90 mmHg and 350 825 (23%) of all screenees had untreated or inadequately treated hypertension.

From global to national data from MMM19

For many countries, the data collected during the MMM campaigns reflect the largest BP screening ever to take place in their country.[8] In order to make these data available and bring focus to the national level, we asked all 51 countries who had screened at least 2500 adults in MMM19 to produce their individual national report to collate in this *European Heart Journal Supplement* issue. Although to some extent arbitrary, the 2500 cut-off point was set to ensure a database of sufficient size to generate reasonably valid results from the analyses carried out.

A summary of the key results of the 47 countries who accepted the invitation to generate their national reports and of the other four countries is shown in *Table 1*.

The protocol for MMM19 was common to all participating countries and so the methods for each country are essentially the same. However, data from previously available BP screening in each country vary as did the logistics and the sources of the convenience samples screened. These details potentially impact significantly on the interpretation of the results obtained in each country and the observed differences among them.

Challenges for MMM19

Similar challenges to those which pertained in MMM18 persisted in 2019. Namely—acquiring ethical approval (where it was needed) and the distribution of BP measuring devices (once again kindly donated by OMRON Healthcare) caused delays and financial difficulties in some countries.

The quality of data collection in terms of missing data and the speed of transfer of the data to allow central analyses were both improved compared with 2018 which in turn improved on 2017.

Nevertheless, despite improvements to the bespoke MMM app, its use was limited to only 15.8% of participants, albeit increased from 12.4% in 2018. Consequently, central data cleaning remained a large, time-consuming task and we were only able to lock the database and initiate analyses in October 2019–4 months after screening for MMM19 had in theory ended.

Methodological issues

The completeness of data collection varied across sites, with some sites systematically not collecting certain variables. Key demographic variables such as age (99.0%) and sex (99.6%) were well-documented, but others, particularly questions newly added in 2019, such as number of antihypertensive medications (86.0%) were less consistently recorded. Analyses of associations between BP and any variables for which recorded responses were limited in number at the national level were not carried out. Although the protocol advised three BP measurements in each participant, this was not possible in 25% of cases for various reasons, including logistical and time pressures, or participant preference. Our findings from MMM17, MMM18, and MMM19 showed significant declines in BP levels on average across the first to second, and to third readings, with the mean of the second and third resulting in the lowest proportion identified as hypertensive.[9–11] In order to provide comparative readings for those with only one or two readings, multiple imputation using chained equations was used, based on at least one BP measurement and other available participant characteristics, running on the global dataset as described previously.[11] Consideration was given to running imputations individually for each country; however, for many countries, the relatively small numbers involved, made an averaging over the global dataset more suitable. Furthermore, there was a priori no strong rationale for differential variation in subsequent BP measurements across countries.

Although efforts have been made to ensure consistency between individuals based on the number of BP readings, comparisons between countries should be interpreted cautiously. Participants were screened opportunistically, and samples at screening site and national level are not

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Table 1 Summary statistics for 51 countries with at least 2500 participants from May Measurement Month 2019

Country	Total participants	Proportion of all participants with hypertension	Proportion of hypertensives aware	Proportion of hypertensives on medication	Proportion of those on medication with controlled BP	Proportion of all hypertensives controlled
India	362 708	29.4%	43.8%	42.0%	55.5%	23.3%
China	238 387	27.8%	51.5%	48.4%	60.2%	29.1%
Argentina	94 523	52.5%	81.1%	77.7%	59.2%	46.0%
Philippines	89 941	53.3%	65.0%	62.8%	61.1%	38.4%
Nepal	74 205	27.5%	46.3%	37.5%	54.3%	20.3%
Colombia	48 324	27.9%	63.7%	60.0%	64.0%	38.4%
Mexico	39 700	25.5%	43.8%	41.7%	66.8%	27.8%
Kenya	33 992	26.1%	34.5%	31.5%	59.7%	18.8%
United Arab Emirates	32 152	23.9%	54.5%	49.6%	59.7%	29.6%
Cameroon	30 187	20.8%	29.9%	24.0%	46.7%	11.2%
Democratic Republic of Congo	29 857	25.5%	33.1%	23.2%	51.5%	11.9%
Vietnam	25 887	33.8%	69.8%	65.5%	51.2%	33.5%
Saudi Arabia	25 023	29.2%	60.8%	60.8%	64.6%	39.3%
Bangladesh	24 941	28.0%	76.3%	71.6%	64.2%	46.0%
Taiwan	24 851	49.7%	84.7%	82.1%	72.0%	59.2%
Venezuela	24 672	48.9%	86.2%	82.6%	64.5%	53.3%
Albania	19 154	38.6%	64.7%	62.0%	48.3%	29.9%
Cabo Verde	17 627	34.0%	68.4%	51.3%	46.5%	23.8%
Ecuador	15 885	41.9%	65.0%	64.2%	76.5%	49.1%
Brazil	13 476	50.9%	68.8%	65.3%	55.2%	36.1%
Georgia	13 267	64.1%	85.4%	85.0%	34.8%	29.6%
Tunisia	11 271	38.1%	72.5%	67.5%	56.6%	38.2%
Italy	10 182	31.1%	62.1%	16.2%	45.8%	7.4%
Republic of Korea	9975	47.6%	76.2%	74.0%	68.2%	50.5%
Armenia	9818	41.6%	72.8%	65.4%	46.5%	30.4%
Malawi	9723	26.3%	17.4%	15.2%	51.9%	7.9%
United Kingdom and Ireland	9233	33.4%	33.5%	29.7%	38.2%	11.4%
Zambia	9232	30.7%	42.6%	27.6%	35.0%	9.7%
Libya	8686	42.8%	64.8%	59.2%	48.2%	28.5%
Mauritius	8262	29.4%	64.7%	60.8%	57.3%	34.8%
Angola	7112	38.6%	59.8%	50.6%	41.2%	20.8%
Ghana	7102	25.9%	36.5%	30.0%	46.1%	13.8%
Poland	7072	55.4%	83.0%	80.4%	58.2%	46.7%
Lebanon	7019	36.6%	64.1%	62.3%	62.6%	39.0%
Pakistan	6919	52.1%	56.2%	49.5%	40.0%	19.8%
Chile	6876	35.4%	65.9%	60.1%	57.2%	34.4%
Mongolia	6522	32.5%	62.2%	50.1%	54.1%	27.1%
Greece	5814	41.6%	78.7%	73.1%	66.1%	48.3%
Botswana	5459	32.1%	44.8%	41.5%	47.0%	19.5%
Russia	5447	30.6%	72.8%	63.0%	46.8%	29.5%
Slovenia	4974	61.1%	76.4%	68.0%	46.2%	31.4%
South Africa	4727	31.9%	42.5%	36.1%	51.5%	18.6%
Spain	4433	42.5%	77.2%	71.1%	64.9%	46.1%
Paraguay	4301	41.4%	70.0%	65.3%	44.6%	29.1%
Nigeria	3646	39.2%	62.9%	55.4%	46.8%	25.9%
Benin	3637	37.5%	64.5%	43.9%	34.9%	15.3%
Republic of the Congo	3157	33.5%	42.6%	37.3%	62.4%	23.3%
Malaysia	3062	18.7%	63.2%	57.2%	70.3%	40.2%
Australia	2877	31.3%	50.5%	40.6%	54.3%	22.0%
Hungary	2766	46.5%	74.4%	69.8%	53.2%	37.1%
Jamaica	2550	41.4%	69.9%	62.5%	44.4%	27.8%

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expected to be representative at the population level. An understanding of the local context of screening is required, in terms of target populations and sites of screening, which the national papers in this supplement aim to provide.

Limitations of MMM19

Although MMM19 was just larger in terms of the number of countries included (92) and the total number of screenees (1 508 130) a few countries including Sudan and Cote D'Ivoire that had made large contributions in previous years, were unable to take part due to civil upheavals or financial constraints.

Once again, we were limited in the scope of data collection by the very reasonable request of local investigators to restrict the time and complexity of the interaction spent with each screenee. Consequently, our database is limited in terms of the number of variables evaluated and blood, urine and more complex anthropometry are beyond the capacity of the personnel and available budget.

By design, as discussed, MMM does not attempt to collect nationally representative samples from each country in which it takes place. Nevertheless, analyses in progress show significant associations between national stroke mortality and various measures of national BP management and control seen in MMM.[14]

Although effective intervention on raised BP was not the primary aim of MMM, the detection in the three campaigns to date, of almost one million adults with either untreated or inadequately treated hypertension begs the question of whether MMM improves the health outcomes of those detected. Due to the cross-sectional design, collection of follow-up data was beyond the scope of the campaign and we do not know whether participants instigated lifestyle changes, modified health-seeking behaviours, or were started on or had any anti-hypertensive medication increased. However, a study of a cohort of older adults in China reported that an approach very similar to that used in MMM to detect raised BP was associated with a significant and important reduction in systolic BP two years after screening.[15] Nevertheless, an MMM pilot study is in discussion to evaluate the efficacy of a collaboration with the RESOLVE to Save Lives programme[16] to facilitate more direct links with effective drug treatment and thereby to ensure improved BP levels.

Strengths of and prospects for the MMM campaign

In MMM17, 34 of the 80 countries included, reported that MMM was the largest BP screening to have taken place in their country.[9] Since then, coverage has increased to 92 countries and the number of screenees included has risen from over 1.2 million in MMM17 to over 1.5 million in MMM19. It is not easy to produce hard data to confirm whether the primary aim of MMM—to raise awareness of BP measurement—has been achieved. However, significant numbers of participants (almost half a million in 2019 alone) had never had a BP measured previously, while across all three campaigns almost one million adults have been found with untreated or inadequately treated hypertension. This suggests that at the individual level, at least in these groups, awareness has been improved. We are further persuaded by the extent of television, radio, media, and social media coverage around the world that, at the population level, awareness has also been raised, although this is difficult to quantify.

Due to the COVID-19 pandemic, MMM20 had to be deferred. Despite persisting uncertainties surrounding this pandemic, we expect that MMM21 will take place, but it seems that 'May' is unlikely to be the central month of the campaign. Indeed, the window for data collection will be extended to anytime between May and November 2021, depending on local pandemic conditions and the critical acquisition of local ethical clearance.

Because all the MMM investigators and volunteers measuring BPs around the world do so pro bono and the campaign receives many charitable donations centrally, and at the national level, the MMM campaign remains an inexpensive but very effective means of detecting large numbers who require additional help with their raised BP—the most putative of cardiovascular risk factors. In addition to demonstrating associations between measures of BP detection, management and control at a national level and national stroke mortality, analyses are in progress to evaluate the potential utility of MMM-based data for characterizing nationally representative BP data.

Together these two sets of analyses will allow MMM to address one of its four key objectives—to use MMM data to motivate governments to improve BP screening facilities and management. Meanwhile, annual MMM surveys will continue to provide an inexpensive and hopefully temporary substitute for systematic screening in many countries worldwide.

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Data availability

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

Funding

Most of the financial burden of MMM within each country falls on local resources and as ever we are indebted to those who have provided the necessary financial and

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logistical support within each country and to all those who have volunteered their time to the project. We shall continue to seek further sources of funding to supplement the generous annual donation made by Servier Pharmaceuticals Co to at least offset a greater proportion of the local costs of running MMM. We must also thank OMRON Healthcare for their continued support with the supply of BP measuring devices.

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