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May Measurement Month 2018: results of blood pressure screening from 41 countries

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Background

In May 2017, the International Society of Hypertension (ISH) introduced the first in a series of annual blood pressure (BP) screening programmes with the simple aim of raising awareness of the importance of raised BP as the single biggest contributor to the global burden of disease and to global mortality.[1]

After the success of this initial May Measurement Month (MMM) campaign—which included over 1.2 million screenees from 80 countries,[2] MMM expanded in 2018 and again in 2019. The global results of MMM17 and MMM18 have been

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published elsewhere[2,3] and the national data from 39 of 40 countries who screened at least 2500 adults in 2017 were collated as a *European Heart Journal (EHJ) Supplement*.[4] Here, we present a second collation of data from 41 countries with the highest number of participants who took part in MMM18.

MMM18 summary

The methods and results of MMM18 were published in full elsewhere.[3] As in 2017, the MMM18 campaign was a cross-sectional opportunistic survey of the BPs of adults (aged ≥18 years) who wished to take part. Three sitting BPs were measured on each screenee in any of a wide range of locations from places of worship to hospital premises. Limited data on social, demographic, and lifestyle variables were also recorded and for those whose BPs (using the mean of the second and third reading) were deemed potentially in the hypertensive range (systolic ≥140 mmHg and/or diastolic ≥90 mmHg) were given non-pharmacological advice to lower their BP and advised to seek further BP recordings on a time scale depending on the degree of BP elevation and the availability of local healthcare facilities.

Over 1.5 million adults were screened in 89 countries of whom 33.4% were considered hypertensive (BPs in the hypertensive range and/or on antihypertensive medication to lower BP). Among the hypertensive population, 55.3% were on antihypertensive medication and of those 60.0% had their BPs controlled to <140 mmHg systolic and <90 mmHg diastolic. Therefore, of 502 079 hypertensive adults identified overall, 33.2% had their BPs controlled and over one-third of a million adults were identified with either untreated or inadequately treated raised BP. MMM18 was the largest synchronized and standardized survey of any cardiovascular risk factor ever to take place (with MMM17 the next largest!). The vast majority of those screened in MMM18 were new to MMM, with only 7.0% having participated in MMM17. Furthermore, over half a million people (518 168) reported never having had a BP measurement taken before the campaign.

From global to national data in MMM18

In order to bring focus at a more local level around the world, but at the same time include reasonably valid data observed at a national level, those 42 countries who had screened at least 2500 adults were invited to report their data for compilation in this *EHJ Supplement*. Forty-one countries accepted this invitation and have been included. The key results across these countries are summarized in *Table 1*.

The protocol for MMM18 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.

Methodological issues

Usually for logistical reasons, the data on some variables in some countries were insufficient in quality or number for analyses to provide reasonably valid results and hence they were not carried out.

However, even when carried out, given 41 separate national analyses chance alone would predict two significantly inconsistent results when compared with the global analyses. Hence, comparisons across countries should only be made with extreme caution.

Importantly, three seated BP measurements could not always be taken and so multiple imputation based on the global data[3] was used to generate the mean of the second and third BP readings in the analyses, for the 375 427 people (25.2%) for whom the mean readings were not available. Our previous analyses showed that this combination of readings gave the most conservative estimate of hypertension prevalence which is likely to be spuriously elevated when based on a single set of readings.[3]

For these national-level analyses, we have used the same imputed data from the global analyses which may result in an 'averaging' of any country-specific effects, as for many countries, there were insufficient data to allow individual imputations. Two imputation models were run: a full model requiring complete information on participants age, sex, ethnicity, and use of antihypertensive medication, and where one or more of these were missing, a reduced model, requiring only individual BP readings. Imputations using the two models were combined, and sensitivity analyses showed only small differences between the results using each model.

The national data presented in this supplement tend to give focus to those measures of association which differ from the reported global findings[3] despite the cautions outline above. Meanwhile less focus is placed on those associations—particularly those between BP and age, sex, and body mass index—that are essentially consistent across countries and with the global results.

Challenges for MMM18

Having carried out MMM17, the set up and running of MMM18 was less time-pressured and was easier to conduct at both local and central levels. Most national coordinators and volunteer staff in each country were already in place from MMM17 (and prepared to be involved again) but even so, ethical clearance remained a major hurdle in some countries. Similarly, the distribution of the BP machines, kindly donated by OMRON Healthcare, caused variably large difficulties associated with customs charges and delays in delivery.

Data collection and delivery for central analyses were greatly improved in terms of quality and quantity compared with MMM17. However, the use of the MMM App (available on Windows and Mac computers, Android, and Apple mobile devices, as well as a web-based browser) remained low at 12.4% and central data cleaning remained a large task, taking several months. Consequently, once again we were only able to lock the database and initiate

Table 1 National MMM18 results summary with total participants from MMM17 for comparison

Country	Total participants 2017	Total participants 2018	Number with hypertension	Proportion with hypertension (%)	Proportion of hypertensives aware (%)	Proportion of hypertensives on medication (%)	Proportion of those on medication with uncontrolled BP (%)
India	122 685	345 234	111 462	32.3	56.9	55.3	25.3
China	125 236	288 342	85 835	29.8	62.3	57.3	37.4
Philippines	271 604	177 176	69 126	39.0	50.3	49.9	42.0
Indonesia	69 307	91 222	27 331	30.0	47.6	47.4	78.0
Argentina	32 346	70 418	30 851	43.8	77.7	69.1	44.0
Kenya	14 847	49 548	8469	17.1	30.7	26.6	51.0
Sudan	44 413	40 779	11 497	28.2	20.7	18.2	45.4
Colombia	22 258	35 548	9475	26.7	69.9	65.0	33.7
United Arab Emirates	6193	31 316	6243	19.9	40.7	37.3	39.4
Venezuela	21 645	28 649	13 861	48.4	87.7	82.6	33.7
Pakistan	5333	25 076	14 641	58.4	79.9	73.5	51.4
Armenia	9199	21 112	8179	38.7	76.7	67.4	52.9
Democratic Republic of Congo	Not included	18 719	4885	26.1	46.3	29.6	57.0
Vietnam	10 993	17 332	5260	30.3	66.4	62.8	46.6
Nepal	5972	15 561	4321	27.8	49.9	39.1	47.4
Taiwan	52 514	15 365	7393	48.1	83.7	81.3	32.3
Angola	17 481	14 433	4844	33.6	54.2	46.3	57.4
Oman	934	12 689	3783	29.8	52.4	47.8	34.9
Brazil	7260	12 413	8435	67.9	84.4	81.7	40.3
Ecuador	6984	11 922	4563	38.3	71.5	71.5	28.6
Malawi	4009	10 791	2404	22.3	14.7	12.6	33.3
Georgia	6144	10 756	6037	56.1	82.8	77.9	61.8
Mexico	1116	10 139	2187	21.6	42.0	38.0	33.5
Chile	4754	9344	2726	29.2	64.0	56.1	38.0
Cameroon	16 093	8883	1867	21.0	34.5	27.2	52.2
Cabo Verde	2630	8008	2666	33.3	74.8	55.8	60.9
Spain	3849	7646	3058	40.0	74.4	69.6	36.4
Libya	Not included	7279	2567	35.3	63.4	55.8	49.1
Albania	1008	7046	2624	37.2	52.1	48.3	49.6
Ghana	Not included	6907	2354	34.1	48.4	35.2	52.2
Poland	5834	6450	2114	32.8	61.3	53.1	39.2
Nigeria	19 904	6398	2328	36.4	51.1	41.8	56.9
Republic of the Congo	3842	6169	1371	22.2	40.2	36.0	55.5
Italy	10 076	5554	1462	26.3	[a]	[a]	[a]
Mauritius	2302	5471	786	14.4	[a]	[a]	[a]
Bangladesh	11 418	5208	1750	33.6	75.0	64.7	33.6
United Kingdom and Ireland	7714	5000	1716	34.3	51.3	42.8	48.5
Slovenia	Not included	4883	2841	58.2	78.4	70.1	51.5
Malaysia	4116	4866	1405	28.9	76.3	71.0	37.6
Botswana	1657	4599	1510	32.8	47.1	35.2	45.6
Australia	3817	3352	1026	30.6	49.0	40.5	57.1
South Africa	3250	2965	1025	34.6	56.7	49.2	42.5

[a]Use of antihypertensive medication not recorded for these countries.

the full analyses in October 2018—nominally 5 months after MMM18 ended.

Limitations of MMM

Feedback from local investigators who participated in MMM17 included a request not to extend the amount of data collected from each participant due to the extra time needed during the screening. Consequently, data from MMM18 remain limited to BP and heart rate measurements and self-reported observations, while blood and urine sampling or more sophisticated measurements of obesity, for example, were beyond the capacity of the personnel and budget for the campaign.

For similar reasons and also by design, the samples screened were not randomly selected and therefore not necessarily representative of the general population from which they were drawn. While standardizing of results could partially account for differences in the age and sex distributions amongst those screened in each country, there is likely to be residual confounding, most notably a

selection bias resulting from the recruitment method and a potential favouring of those with pre-existing hypertension or with greater hypertensive awareness, to participate. Consequently, in order not to mislead that the proportions found to be hypertensive, or on treatment for hypertension may be directly comparable, we present in each paper the unadjusted proportions within each country.

It might, however, be less unreasonable to compare control rates among treated patients, since, by stratifying on one of the major confounding factors, we may reduce some of the sampling bias. These potential shortcomings notwithstanding, as in the MMM17 national analyses, it is remarkable how often the various measures of hypertension detection and management are similar to previously available representative data.

A clear limitation of MMM, as a cross-sectional study, is the lack of definitive evidence of benefit for those individuals identified as having raised BP either on or off antihypertensive medication. The cost and logistic implications of incorporating follow-up of these screenees on such a large scale pre-empt our being able to do so. However, we know that about one-third of a million adults were given non-pharmacological lifestyle and dietary advice to lower their BPs and advised to obtain further follow-up of their BP measurement. We also know that MMM has generated significant coverage in traditional and social media outlets, and hopefully this will translate into increased awareness, treatment, and control and thereby reduced BP-associated disease burden.

Prospects for the MMM campaign

Both the numbers of countries and screenees involved with MMM have increased in each of the three annual campaigns to date. We plan to continue the campaign as long as funding can be raised with only small changes to the data collected each year. Meanwhile, we intend to use the MMM data for the development of documents designed to influence governments and health policymakers to improve the detection and management of raised BP at a national and international level.

Supplementary material

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

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