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May Measurement Month 2017: an analysis of blood pressure screening results from the United Kingdom and the Republic of Ireland—Europe

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Elevated blood pressure (BP), or hypertension, is a growing burden worldwide, leading to over 10 million deaths each year. May Measurement Month (MMM) is a global initiative aimed at raising awareness of high BP and acting as a stimulus to improving screening programmes worldwide. In the United Kingdom (UK) nearly 1 in 5 people, and in the Republic of Ireland (RoI) 3 out of 10, have hypertension, of which a large proportion remains undiagnosed. An opportunistic cross-sectional survey of volunteers aged ≥18 years was carried out in May 2017. Blood pressure measurement, the definition of hypertension and statistical analysis followed a standardized protocol. Screenings sites in hospitals, universities, shopping centres, workplaces, sports clubs, community centres, GP practices, and pharmacies were set up across the UK and RoI as part of this initiative. Seven thousand seven hundred and fourteen individuals were screened during MMM17. After multiple imputation, 3099 (40.3%) had hypertension. Of individuals not receiving antihypertensive medication, 1406 (23.4%) were hypertensive. Of individuals receiving antihypertensive medication, 682 (40.5%) had uncontrolled BP. MMM17 was the largest BP screening campaign ever undertaken in the UK and RoI. These data prove for the first time that a relatively inexpensive, volunteer based, convenience sampling of screening BP in the community identified two out of five individuals as hypertensive, with one in four not receiving treatment. Of major concern is that these data demonstrate that of those individuals receiving treatment, two out of five still did not have controlled BP.

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Introduction

Elevated blood pressure (BP), or hypertension, is the greatest modifiable contributor to the global burden of mortality, disease and disability, leading to over 10 million deaths each year.[1,2] It has been proposed that only around half of the population with hypertension are aware of it.[3] Identifying those with high BP and making people aware of their condition is of critical importance for population health promotion and disease burden prevention.

In the United Kingdom (UK) and Republic of Ireland (RoI), high rates of awareness and BP surveillance systems are implemented through their respective health care services, occupational services, or more often through opportunistic screening.[4-7] However, prevalence of hypertension remains a problem and causes a significant burden on their respective healthcare services.

Data from 2011 reported prevalence of hypertension in England as 30%, with only 37% of those hypertensive patients controlled to target.[4] However, data from European Cardiovascular Disease Statistics report that, in 2014, age-standardized prevalence of raised BP ($\geq$140 and/or $\geq$90 mmHg) was 15.2% in the UK and 27.9% in RoI.[8] With high BP being the biggest risk factor for coronary heart disease and stroke globally,[1,2] understanding the extent of this disparity in the UK and RoI is critical.

In order to address this major public health problem, May Measurement Month (MMM) was initiated by the International Society of Hypertension (ISH) and undertaken globally as a pragmatic stimulus to increase the number of screening programmes and to increase awareness of the importance of BP as a risk factor. In 2017, members of the ISH and British and Irish Hypertension Society (BIHS) coordinated each country within the UK and RoI to promote and undertake screening throughout the month of May. The aim was to raise awareness of the importance of BP.

Methods

Volunteer-based convenience sampling of BP was undertaken across the UK and RoI. All screening volunteers were trained to comply with campaign procedures and guidelines. Volunteers were trained in measuring BP using a video demonstration and in delivering tailored guidance and information once BP was measured. Thirty-one days of screening were undertaken throughout hospitals, universities, shopping centres, workplaces, sports clubs, community centres, GP practices, and pharmacies in the RoI, Northern Ireland, Wales, England and Scotland. Ethical approval was awarded by the UK IRAS ethics committee and local approval obtained within each country.

The majority of BP monitors used as part of the screening sites were Omron and Microlife devices. During the BP screenings, BP was measured three times as per protocol, whilst in the sitting position, with an average of the last two readings used for analysis. Hypertension was defined as systolic BP $\geq$140 mmHg and/or diastolic BP $\geq$90 mmHg or on treatment of hypertension. In addition, a questionnaire collected individual demographic, lifestyle, and environmental information as part of the data collection process.

A mixture of measured or estimated height and weight values were collected, depending on the screening site. Data were captured using the dedicated MMM online application or on paper, with hard copy data imputed to Excel files before submission to the global MMM project team. These data were initially collated by country leads, cleaned by the global MMM project team and centrally analysed by the MMM project team statistician. Please refer to the Methods section of the MMM global paper for more information on data collection and analysis.[11]

Results

In the UK and Ireland, MMM17 screened 7714 participants (UK $n = 4935$; RoI $n = 2661$), with a mean age of 50 years (SD 17 years), with a gender distribution (female:male) of 61:39. The proportion of each ethnic group screened as part of the full data set were: 71.9% White, 3.3% Black, 3.7% South Asian, 1.6% East Asian, 0.8% Arabic, 0.9% mixed, 1.7% other, and 16.1% unrecorded.

Of the 7695 participants with an available mean BP reading after multiple imputation, 3099 (40.3%) participants presented with hypertension with only 1692 (21.9%) reported as taking regular antihypertensive medications. After imputation, the number of participants with hypertension of those not receiving treatment was 1406 (23.4%). Importantly, of those hypertensive participants receiving treatment and with an available mean BP reading, only 1001 (59.5%) were deemed to be controlled (BP $<$140 and/or $<$90 mmHg), with 682 (40.5%) being uncontrolled.

After excluding people on regular antihypertensive medications, the levels of BP (in particular systolic BP) tended to differ between genders and rose with age (Supplementary material online, *Figure S1*). Blood pressure differed according to individual characteristics (Supplementary material online, *Figure S2*). It was higher in those on treatment compared to untreated people, lower in those reporting a previous myocardial infarction (MI) and tended to be higher in regular alcohol drinkers. Finally, BP was increasingly higher in overweight and obese individuals compared to underweight (Supplementary material online, *Figure S3*).

Discussion

These data demonstrate for the first time that a relatively inexpensive, volunteer based, convenience sampling method of screening BP in the community identified 40.3% of individuals as hypertensive, with 23.4% of participants not receiving treatment found to be hypertensive. Importantly, of those individuals receiving treatment, 40.5% did not have controlled BP. Furthermore, the proportion of those considered as hypertensive in those not receiving treatment was higher in the UK and RoI compared to the Global MMM 2017 dataset (23.4% vs. 17.3%). However, levels of uncontrolled hypertension in those on treatment are lower in UK and RoI compared to the Global data (40.5% vs. 46.3%).

Data from UK and RoI have previously shown the age-standardized prevalence of raised BP as 15.2% in the UK and 27.9% in RoI.[8] Interestingly, data from the sample collected as part of MMM indicates the proportion with hypertension to be much higher than previously described. Potential reasons for this disparity may be due to where data were collected, with the MMM initiative measuring BP in opportunistic community settings, compared to data from the European Heart Network's statistics collected from GP and health board settings.[8]

These data align with the known trend of systolic BP to increase with age, and the tendency of diastolic pressure to rise and then fall with increasing age.

Interestingly, our data highlight that those with previous MI in UK and RoI had lower BP compared to the Global dataset for MMM17. Potential reasons for these variances may be due to the clinical guidelines for management of BP and other risk factors that patients receive post-MI and post-stroke in UK and RoI.

Our data confirm results from the global MMM17 paper[11] which demonstrate that levels of obesity have a dramatic role in determining the levels of high BP in the UK and RoI, highlighting further need for public health strategies linking obesity and hypertension to align and tackle cardiovascular risk going forward.

The convenience sampling design means the true prevalence of hypertension cannot be inferred here. In addition, recording BP on one occasion (albeit repeated three times) is clearly likely to involve capture of false positives (whom would have been provided with lifestyle advice and encouraged to see their GP for formal testing). Moreover, the proportion of people with hypertension volunteering to participate may have introduced a selection bias leading to overestimation of the true proportion of hypertensive people in the community. However, despite these important limitations, the aim of this study was to raise awareness and as such is unaffected by these limitations.

These results illustrate that opportunistic screening can identify large numbers of people with raised BP. Hypertension is a significant, yet preventable, public health burden and our results point to important unmet need in the British and Irish populations. In light of these data, policy makers should review how to better address the shortfall in diagnosis and control rates through wider screening programmes.

Supplementary material

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

References

1. Forouzanfar MH, Liu P, Roth GA, Ng M, Biryukov S, Marczak L, Alexander L, Estep K, Hassen Abate K, Akinyemiju TF, Ali R, Alvis-Guzman N, Azzopardi P, Banerjee A, Bärnighausen T, Basu A, Bekele T, Bennett DA, Biadgilign S, Catalá-López F, Feigin VL, Fernandes JC, Fischer F, Gebru AA, Gona P, Gupta R, Hankey GJ, Jonas JB, Judd SE, Khang Y-H, Khosravi A, Kim YJ, Kimokoti RW, Kokubo Y, Kolte D, Lopez A, Lotufo PA, Malekzadeh R, Melaku YA, Mensah GA, Misganaw A, Mokdad AH, Moran AE, Nawaz H, Neal B, Ngalesoni FN, Ohkubo T, Pourmalek F, Rafay A, Rai RK, Rojas-Rueda D, Sampson UK, Santos IS, Sawhney M, Schutte AE, Sepanlou SG, Shifa GT, Shiue I, Tedla BA, Thrift AG, Tonelli M, Truelsen T, Tsilimparis N, Ukwaja KN, Uthman OA, Vasankari T, Venketasubramanian N, Vlassov VV, Vos T, Westerman R, Yan LL, Yano Y, Yonemoto N, Zaki MES, Murray CJL. Global burden of hypertension and systolic blood pressure of at least 110 to 115 mm Hg, 1990–2015. *JAMA* 2017;**317**:165–182.
2. GBD 2016 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;**392**:1923–1994.
3. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, Bahonar A, Chifamba J, Dagenais G, Diaz R, Kazmi K, Lanas F, Wei L, Lopez-Jaramillo P, Fanghong L, Ismail NH, Puoane T, Rosengren A, Szuba A, Temizhan A, Wielgosz A, Yusuf R, Yusufali A, McKee M, Liu L, Mony P, Yusuf S. PURE (Prospective Urban Rural Epidemiology) Study Investigators. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *JAMA* 2013;**310**:959–968.
4. Falaschetti E, Mindell J, Knott C, Poulter N. Hypertension management in England: a serial cross-sectional study from 1994 to 2011. *Lancet* 2014;**383**:1912–1919.
5. Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K, Chen J, He J. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. *Circulation* 2016;**134**:441–450.
6. Maimaris W, Paty J, Perel P, Legido-Quigley H, Balabanova D, Nieuwlaat R, Mckee M. The influence of health systems on hypertension awareness, treatment, and control: a systematic literature review. *PLoS Med* 2013;**10**:e1001490.
7. Maurer J, Ramos A. One-year routine opportunistic screening for hypertension in formal medical settings and potential improvements in hypertension awareness among older persons in developing countries: evidence from the Study on Global Ageing and Adult Health (SAGE). *Am J Epidemiol* 2015;**181**:180–184.
8. WHO Global Health Observatory. http://www.who.int/gho/data base/en/ (22 February 2019).
9. *Hypertension Prevalence Estimates in England: Estimated from the Health Survey for England. Public Health England.* 2016. https://www.gov.uk/government/publications/hypertension-prevalence-estimates-for-local-populations (22 February 2019).
10. Barron S, Balanda K, Hughes J, Fahy L. National and subnational hypertension prevalence estimates for the Republic of Ireland: better outcome and risk factor data are needed to produce better prevalence estimates. *BMC Public Health* 2014;**14**:24.
11. 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**:736–743.