

# May Measurement Month 2018: an analysis of blood pressure screening results from Benin

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## KEYWORDS

High blood pressure;  
Awareness;  
Treatment;  
Control

Hypertension is the strongest cardiovascular risk factor worldwide. May Measurement Month (MMM) is an international campaign for blood pressure (BP) screening initiated by the International Society of Hypertension. This work aims to estimate the proportion and the levels of awareness, treatment, and control of hypertension in participants of the MMM survey in Benin in 2018. A cross-sectional survey focused on people aged  $\geq 18$  years was conducted in May 2018 in nine rural and urban areas in Benin. A sampling of volunteers was done. BP was measured following the MMM protocol. Hypertension was defined as a systolic BP  $\geq 140$  mm Hg and/or a diastolic BP  $\geq 90$  mm Hg (mean of the second and third readings) and/or taking antihypertensive medication. Linear regression was used to identify BP associations. A total of 2035 people were screened, including 55.9% women. The mean age was  $44.2 \pm 15.9$  years. The percentage with hypertension was 35.4%. Of 721 participants with hypertension, 56.2% were aware of their diagnosis, 39.7% were on antihypertensive medication, and 13.6% were controlled ( $< 140/90$  mmHg). The results confirm the significant proportion of hypertension in Benin. Education programs on risk factors, early detection, and better management strategies should be developed.

## Introduction

Hypertension is a major risk factor for cardiovascular disease.<sup>1</sup> It is a serious chronic condition largely attributable to behavioural factors such as unhealthy diets, physical inactivity, and alcohol intake.<sup>1</sup> An estimated 1.13 billion people have hypertension worldwide, and most (two thirds) live in low- and middle-income countries.<sup>1</sup>

An epidemiological transition is ongoing in Sub-Saharan African, including the rising burden of hypertension.<sup>2</sup> In Benin, a prevalence of hypertension was estimated at 25.9% in 2015 among people aged 18-69 years; of those with hypertension, 96.2% were not taking antihypertensive medication.<sup>3</sup> In Benin, stroke is one of ten top causes of death.<sup>4</sup> In-hospital mortality rate of heart attacks was estimated at 7.5% at University National Hospital Hubert Koutoukou Maga in Cotonou.<sup>5</sup> Despite the availability of generic drugs in poor resource settings, data in Benin have shown low detection, treatment, and control rates

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**Table 1** Total participants and percentages with hypertension, awareness, on medication, and with controlled blood pressure

Total participants	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
2035	721 (35.4)	405 (56.2)	286 (39.7)	98 (47.3)	98 (13.6)

of hypertension.<sup>3,6</sup> This situation leads to rising rates of cardiovascular diseases, the management of which remains difficult considering the lack of health workers, medical equipment, health insurance, and low financial resources of the population. Interventions are, therefore, needed to improve prevention, early detection, and adequate treatment of hypertension.

The ‘May Measurement Month’ (MMM) project aims to increase awareness of hypertension. It was initiated by the International Society of Hypertension in 2017. This work aimed to evaluate the levels of awareness, treatment, and control of hypertension among people who participated in the MMM survey in Benin, in 2018.

## Methods

A cross-sectional survey was conducted following the MMM project protocol.<sup>7</sup> It was co-ordinated by the Benin Cardiology Society, which created an MMM committee. The authorization for the survey was obtained from the Ministry of Health. Adults aged 18 years and over were screened using convenience sampling. Promotion of the survey was done through classical media (radio, television), social media, churches, mosques, and town criers. Sites of screening were created in rural, semi-urban, and urban settings. One or two cardiologists were identified by site and were responsible for the preparation and supervision of the survey. Nine sites had been created in six municipalities over four regions (Atlantique-Littoral, Ouémé-Plateau, Zou-Collines, and Borgou-Alibori). Six volunteers, trained on blood pressure (BP) measurement and data collection, were involved by site. The screening sessions took place in May 2018 over one or two days per site, according to a pre-established schedule. The locations of screening sites were peripheral health centres, public places, or school classrooms.

After obtaining written informed consent from the participant, the questionnaire of MMM 2018 survey was administered. Then, height and weight were measured; three BP measurements were taken (with 1 minute between readings) in the left arm, in the seated position, after five minutes of rest, using a validated electronic device (Model M3, OMRON, Japan) with a suitable cuff (22–42 cm). The BP devices were provided by the MMM project team, thanks to a donation by OMRON Healthcare. The BP values used in the analysis correspond to the mean of second and third readings. Hypertension was defined by a systolic BP  $\geq 140$  mmHg and/or diastolic BP  $\geq 90$  mmHg and/or in those on antihypertensive medication. Uncontrolled BP was defined in those on antihypertensive medication with a systolic BP  $\geq 140$  mmHg or diastolic BP  $\geq 90$  mmHg.

Data were filled on the hard copy of MMM forms, recorded on Microsoft Excel sheets, and sent to the MMM project management team. Analyses were done centrally and multiple imputations performed to impute the mean of the second and third

readings where this was missing, based on global data.<sup>7</sup> Linear regression was performed to identify factors associated with systolic and diastolic BP.

## Results

### Participant characteristics

A total of 2035 participants were screened, of whom 55.9% were women. The mean age (SD) was  $44.2 \pm 15.9$  years. The sample was entirely composed of people of black ethnic backgrounds (100%). Among the participants, 2.4% smoked and 15.9% drank alcohol once or more per week. Obesity was frequent (19.8%). More than half of the participants (52.7%) never previously had their BP checked. The mean BP (age and sex standardized) of those not taking antihypertensive medication was 124.8/77.2 mm Hg and of those taking antihypertensive medication was 146.3/90.6 mm Hg.

### Numbers with hypertension

Data on the percentages with hypertension, and awareness, treatment, and control in people with hypertension are presented in *Table 1*. Of all 2035 participants, 721 (35.4%) had hypertension. Of 721 participants with hypertension, 405 (56.2%) were aware of their status, and 286 (39.7%) were on antihypertensive medication. Of 286 participants on antihypertensive medication, 98 (34.3%) had controlled BP. Among all 721 participants with hypertension, 13.6% had controlled BP.

### BP associations

In linear regression models, after adjustment for age, sex, and use of antihypertensive medications, mean systolic and diastolic BP were significantly higher in participants with known hypertension and those with a previous stroke compared with those without known hypertension or a history of stroke (See [Supplementary material online, Figure S1](#)). After adjustment for age and sex, mean systolic BP and diastolic BP were significantly higher by 16.7 mm Hg and 8.4 mmHg:  $P < 0.001$  in those on antihypertensive medication compared with those not on medication (see [Supplementary material online, Figure S1](#)). Participants who were obese or overweight had a significantly higher mean systolic BP and diastolic BP compared with those with a healthy weight (see [Supplementary material online, Figure S2](#)). Participants who were fasting at the time of BP measurement had a higher diastolic BP (2.32 mm Hg,  $P < 0.001$ ) compared with those who had eaten but had no difference in the average systolic BP (see [Supplementary material online, Figure S2](#)).

## Discussion

The MMM18 survey in Benin involved measuring BP in a large sample of people aged 18 years old and above. Among 2035 participants screened, more than a third had hypertension. Among those with hypertension, just over half were aware of their status, four in ten were on antihypertensive medication, and one in eight had controlled BP (<140/90 mmHg).

The proportion of hypertension estimated from this survey (34.3%) is similar to the global MMM result (33.4%).<sup>7</sup> It is lower than that observed in the Republic of Congo (41%) but higher than the result from Côte d'Ivoire (24.4%);<sup>8,9</sup> the difference could be linked to the mean age of participants. The proportion of hypertension is also higher than the result reported during a national STEPS survey in Benin in 2015.<sup>3</sup> The difference could be explained by different sampling techniques. The participants of the STEPS (Stepwise approach of World Health Organisation) survey were randomly selected, while those of the MMM 2018 survey were volunteers screened opportunistically. There were probably more hypertensives among volunteers who, aware of their status, were, therefore, more interested in checking their BP. Treatment and control rates in this survey are lower than those reported for the global MMM 2018 results (59.5% and 33.2%, respectively). But they were higher than those reported in Benin previously.<sup>3,6</sup>

In contrast to the MMM global results, systolic and diastolic BPs were significantly higher in participants with previous stroke compared with those without. The difference could be explained by the higher level of hypertension treatment in the global sample. There were probably more survivors of stroke who were taking their treatment and had lower BP in the global sample compared with the Benin sample. A link noted between BP and body mass index status is in line with the global MMM result<sup>7</sup> and consistent with previous data from Benin.<sup>3,6</sup>

## Limitations

MMM 2018 participants were volunteers. Selection bias due to non-random sampling could have overestimated the proportion of hypertension and the proportion of people with hypertension aware of their status. Medical histories were self-reported and information bias could have been introduced. As such, the results may not be generalizable to the whole adult Beninese population.

## Future directions

The results of the MMM 2018 survey in Benin confirm the high frequency of hypertension locally and highlight the need for targeted interventions to reverse the trend. The results could provide a direction to authorities and communities and could be used for advocacy and social mobilization in tackling hypertension. Screening campaigns such as MMM should be continued and mixed with education sessions on risk factors. For better control of hypertension, the integration of adequate management of non-complicated hypertension in primary care, ongoing in Benin, should be scaled up. The promotion of

generic drugs and therapeutic education programs should be encouraged.

## Supplementary material

[Supplementary material](#) is available at *European Heart Journal* online.

## Acknowledgements

The authors thank all local investigators, volunteers, and health authorities.

## Funding

The survey was made possible thanks to the financial support of the Benin Society of Cardiology (SBC) and the International Society of Hypertension (ISH).

**Conflict of interest:** None declared.

## Data availability

The data underlying this article are available in the article and its online [supplementary material](#).

## References

1. World Health Organization. Hypertension fact sheet [Online]. 2021 [Cited dec 27, 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/hypertension>.
2. World Health Organization Regional Office for Africa. Health report on African region 2014 [Online]. 2014 [Cited dec 27, 2021]. Available at: <http://www.who.int/sites/default/files/publications/2446/ARHR-2014-fr.pdf>.
3. Health Ministry of Benin. Final Report of the STEPS Survey in Benin [Online]. 2016 [Cited dec 27, 2021]. Available at: <https://www.who.int/teams/noncommunicable-diseases/surveillance/data/benin>
4. The Institute for Health Metrics and Evaluation (IHME). Country profile: What causes the most deaths? 2020 [Cited dec 27, 2021]. Available at: <https://www.healthdata.org/benin>.
5. Sonou A, Codjo L, Hounkponou M, Adjagba PM, Wachinou P, Bognon R, Houéhanou-Sonou C, Yaméogo D, Sacca J, Houénassi M. Déterminants de l'insuffisance cardiaque aiguë au cours de l'infarctus du myocarde. *PAMJ* 2018; **29**:130.
6. Desormais I, Amidou SA, Houéhanou YC, Houinato SD, Gbagoudi GN, Preux PM, Aboyans V, Lacroix P. The prevalence, awareness, management and control of hypertension in men and women in Benin, West Africa: the TAHES study. *BMC Cardiovasc Disord* 2019; **19**:303.
7. Beaney T, Burrell LM, Castillo RR, Charchar FJ, Cro S, Damasceno A. May measurement month 2018: a pragmatic global screening campaign to raise awareness of blood pressure by the international society of hypertension. *Eur Heart J* 2019; **40**:2006-2017.
8. Ellenga Mbolla BF, Landa CM K, Bakekolo PR, Makani Bassakouahou JK, Bouithy SN, Eyi-Sinomono T, Bianza J-R, Ossou-Nguet P-M, Bani AM, Kimpamboudi A, Beaney T, Ster AC, Poulter NR, Xia X, Kimbally Kaky S-G. May Measurement Month 2018: an analysis of blood pressure screening results from Republic of the Congo. *Eur Heart J Suppl* 2020; **22**:H47-H49.
9. Euloge KK, Daniel E, Audrey A, Florent KK, Justin KDB, Benedict B, Evelyne A-T, Marie-Paule N, Micesse T, Kouakou NYN, Christophe K, Jean-Baptiste A-K, Roland N, Coulibaly I, Xia X, Beaney T, Poulter NR, Rémi SA. May Measurement Month 2017: an analysis of blood pressure screening results in Cote d'Ivoire-Sub-Saharan Africa. *Eur Heart J Suppl* 2019; **21**(Suppl D):D47-D49.