

# May Measurement Month 2017: an analysis of blood pressure screening results in Cote d'Ivoire—Sub-Saharan Africa

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Elevated blood pressure (BP) is a growing burden worldwide, leading to over 10 million deaths each year. In Cote d'Ivoire, high BP is the first risk factor for stroke and myocardial infarction. May Measurement Month (MMM) is a global initiative of the International Society of Hypertension aimed at raising awareness of high BP and to act as a temporary solution to the lack of screening programmes worldwide. An opportunistic cross-sectional survey of volunteers aged  $\geq 18$  was carried out in May 2017. BP measurement, the definition of hypertension and statistical analysis followed the standard MMM17 protocol. A Coordinators Team was created. All doctors in cardiology training of Abidjan Institute of Cardiology ( $N = 72$ ) were briefed to carry out the MMM study as investigators, and 55 sites were created. These were major urban transport stations, supermarkets and markets, and churches. BP was calculated from the mean of the 2nd and 3rd readings, and hypertension was defined as a systolic BP of at least 140 mmHg and/or a diastolic BP of at least 90 mmHg or being on BP-lowering treatment. We screened 24 563 individuals during MMM17, with mean age of 37 years. After multiple imputations, 5015 (20.4%) had hypertension. Of individuals not receiving anti-hypertensive medication, 3943 (16.8%) were hypertensive. Of individuals receiving anti-hypertensive medication, 583 (54.4%) had uncontrolled BP. MMM17 was the largest BP screening campaign undertaken in Cote d'Ivoire. MMM allowed us to identify many undiagnosed and inadequately treated hypertension cases and could usefully lower the burden attributed to increased BP. MMM should be continued.

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## Background

High blood pressure (BP) is a factor that exposes individuals to cardiovascular events and increase mortality.<sup>1,2</sup> In Cote d'Ivoire, high BP is the leading risk factor for stroke and myocardial infarction.<sup>3-5</sup> Unfortunately, Cote d'Ivoire, as a Sub-Saharan African country, has a large proportion of the population with high BP which remains undiagnosed,

untreated, or uncontrolled, contributing to the rising burden of cardiovascular disease in the region.<sup>6,7</sup>

In order to address the significant burden of hypertension in Africa, the Hypertension Task Force of the Pan African Society of Cardiology (PASCAR) elaborated an action plan with 10 points, to be implemented by Health African ministries with a view to achieve 25% control of hypertension in Africa by 2025.<sup>7</sup>

Within Africa, the prevalence of high BP varies by region.<sup>6</sup> In Cote d'Ivoire, prevalence data on hypertension are not recent, with one general population study carried

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out in 1974 and one restrictive study in Abidjan district in 2005.<sup>8,9</sup>

Therefore, in 2017 the May Measurement Month initiative (MMM17) of the International Society of Hypertension represented an excellent opportunity to not only update the national data on high BP, start the implementation of the PASCAR road map in Cote d'Ivoire, but also to increase public awareness of measuring BP.

## Methods

### Study design

After an MMM planning meeting in Cape Town in January 2017, it was presented to the Minister of Health who agreed to support the project. The Program of Non Communicable Disease Control has been involved. The regional and departmental health directors that we planned to visit were contacted as well as the local elected representatives.

A Coordinators Team was created. All doctors in cardiology training of Abidjan Institute of Cardiology (72) were briefed to carry out the MMM study as investigators. Ethical clearance was obtained in April 2017 by the National Ethics Committee. We chose 55 sites across the country. These were: major urban transport stations, supermarkets and markets, churches, community health centres, and the main university. At each stage, authorizations were obtained from the local authority to conduct the activity.

Several communication channels were used for outreach and community mobilization for MMM: the national television, the local radio, and announcements in the churches visited. Local government officials joined and facilitated the MMM survey by providing logistics. Inter-urban transport, housing and catering teams were provided either through local authorities, the Ministry of Health or the direction of the Abidjan Cardiology Institute. Several pharmaceutical laboratories supported the project.

The volunteers involved were mainly in Abidjan, and included 100 students at the 4th year of medical study. In the interior of the country, nurses, caregivers, and community agents were recruited and involved. Each day of activity, groups made of 10 investigators coached and supervised by two doctors, were set-up and spread over the sites. Target participants were volunteer adults ( $\geq 18$  years). One hundred BP automated devices donated by Omron Healthcare (model M3 [HEM-7131-E]) were used exclusively. Volunteer staff were trained to measure BP by standard methods including three seated recordings taken on the left arm (preferably) with 1-min interval between readings. Weight and height were directly recorded when known by participants, if not, it was measured by volunteers.

BP was calculated from the mean of the 2nd and 3rd readings. The definition of hypertension was BP of at least 140/90 mmHg or on anti-hypertensive medication. Among participants on treatment, controlled BP was defined as a BP of less than 140/90 mmHg.

### Data handling and statistical analysis

Data cleaning was done first locally then centrally. Submitted data from 24 892 participants were centralized and analysed using Stata version 14.2.

## Results

Data from 24 563 participants were cleaned, centralized, and analysed. Because data collection was in complete for some of the variables in the study form, numbers used in different analyses vary. We have specified this number in brackets for each variable. Participants' characteristics are available in Supplementary material online, *Table S1*. More men than women were screened. Mean age was 37.2 years (SD 14.5) and the mean body mass index (BMI) was 23.7 (SD 4.2).

Of 24 251 participants with three BPs readings, BPs decreased on average by 4.4 for systolic and 3 mmHg for diastolic between the 1st and 3rd readings. The mean of the 2nd and 3rd readings, which was used in subsequent analyses, generated the lowest prevalence of hypertension.

We found 3943 hypertensive participants who had not previously reported to have hypertension. After adding them to 1072 participants known to be on anti-hypertensive treatment, hypertension prevalence was 20.4% of all the participants. Among 1072 participants who were receiving treatment for hypertension, 583 (54.4%) had uncontrolled BP (see Supplementary material online, *Table S1*).

After adjustment for age and sex, significantly higher systolic and diastolic BPs were apparent in people receiving anti-hypertensive treatment (see Supplementary material online, *Figure S1*). Adjusting for age, sex, and anti-hypertensive treatment, systolic and diastolic BPs were significantly higher in those with a history of stroke. Alcohol intake, and increasing BMI were also associated with significantly higher systolic and diastolic BPs.

## Discussion

MMM17 is the largest synchronized, standardized, screening campaign of any cardiovascular risk factor ever done in Cote d'Ivoire. For its implementation, more than 500 dedicated people were involved. We identified 3943 participants unaware of their hypertension status. Furthermore, for the diagnosed and treated hypertensive participants, 54.4% had uncontrolled hypertension. Both populations received information and advice about hypertension. The level of hypertension control in treated patients we found in the MMM study (45.6%) was very close to the 43.7% we found in a hospital study in 2011.<sup>10</sup>

The limitation of this study is that it was not designed to establish the prevalence of hypertension in Cote d'Ivoire. However, the large amount of measurements taken, never previously done in Cote d'Ivoire, gives a clear idea of the burden of hypertension. The prevalence in the general population with a mean age of 37 years was found to be 20.4%, close to the STEPS study (21.7%), and quite different for the Bertrand study (13.9%). Several comments can be

made. Hypertension definition was different in Bertrand study (160/95 mmHg) compared with the more recent studies (140/90 mmHg). Furthermore, measurement devices were different, non-electronic device for Bertrand study and electronic OMRON type device for the STEPS and MMM studies. In addition, MMM17 used the mean of the 2nd and 3rd measurements to identify BP level whereas the previous studies used a single measure. Analyses of BP measurements in the MMM study demonstrated that BPs decreased between the 1st and 3rd readings and so by excluding the 1st measure, the MMM study limited hypertension prevalence overestimation.

We estimated that the MMM screening programme of the general population allowed us to identify many undiagnosed and inadequately treated hypertension cases in Cote d'Ivoire and could usefully lower the burden attributed to increased BP. We therefore propose that MMM should be continued.

## Supplementary material

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

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