May Measurement Month 2019: an analysis of blood pressure screening results from Mexico

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May Measurement Month 2019 (MMM19) in Mexico was an opportunistic survey, aimed to improve blood pressure (BP) awareness at the individual and population levels. This survey followed the methodology of MMM19, previously published. The total number of participants screened was 39,700, 56.7% female, 36.6% were of mixed ethnicity, mean age [standard deviation (SD)] was 46.9 (17.4) years, and mean body mass index was 27.2 (SD: 4.4) kg/m². Seven per cent of the participants reported having diabetes, 2.4% reported having a myocardial infarction in the past, 1.1% stroke, 2.0% were pregnant at the time of the survey, 3.7% of women had suffered from hypertension in a previous pregnancy, 11.4% declared that they were smokers, and 47.0% drank alcohol at least once a week. After multiple imputations, of all 39,700 participants, 10,140 (25.5%) had hypertension; of all participants with hypertension, 43.8% were aware of their diagnosis, 41.7% were on antihypertensive medication, and 27.8% had controlled BP (systolic BP <140 mmHg and diastolic BP <90 mmHg). Of those on antihypertensive medication, 27.8% had controlled BP. In Mexico, MMM is the largest hypertension survey ever done, it provides complementary data to the existing information on arterial hypertension in the country and helps to increase the visibility of hypertension: a priority health problem.

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†The complete list of participants are given in the Supplementary appendix.
Introduction

Before the outbreak of the COVID-19 pandemic, cardiovascular diseases were the main cause of death in Mexico. Of the total of 722,611 deaths that occurred in the country, 149,368 (21%) were due to cardiovascular disease; the second cause of death was diabetes with 101,257 deaths (14%), of these diabetes deaths, probably more than 70% are explained by a cardiovascular complication. Stroke is the 6th leading cause of death with an annual total of 35,300 (5%) deaths. Unlike other countries in the region and other countries of the world, cardiovascular mortality continued to increase in Mexico, the death rate per 10,000 inhabitants being 9.2 in 2010 and 12.3 in 2019, and mortality from stroke has remained stable at 2.8 in 2010 and 2019. Although Mexico spent annually more than 3 billion dollars on preventing these diseases, the results have not been adequate. Correct treatment of arterial hypertension is the action with the highest cost-utility ratio in preventing premature death caused by cardiovascular diseases. So, more information on the subject could be of great help. Although a probabilistic health and nutrition survey has been carried out in Mexico every 4 years since 2000, the results regarding hypertension in Mexico are not entirely clear, and striking differences were found with these surveys compared with MMM18. In May 2019, a group of experts in Arterial Hypertension (GREHTA, Group of Experts in Hypertension), from different areas of the country, who had previously participated in a call for action paper participated in the survey, although the size and quality of the sample included could be significantly improved.

Methods

May Measurement Month 2019 (MMM19) in Mexico was an opportunistic survey, which followed the methodology previously published. Blood pressure (BP) measurements were carried out in various locations, mainly hospitals-clinics (31.5%), public areas (15.9%) in 10 different areas of Mexico. Volunteer doctors performed the physical measurements and medical students, or nurses trained in BP measurement also participated. Authorization for the collection and use of the results was asked orally to the participants, without writing down personal identification data, in order to keep the survey within the Mexican Federal Law on Protection of Personal Data Held by Private Parties. Information translated into Spanish was distributed to the participants. For BP measurements, validated semi-automatic measuring equipment of the Omron brand was used, and the pressure measurement guidelines contained in the Official Mexican Standard for the Management of Arterial Hypertension were followed. The definition of hypertension used was systolic BP $\geq$ 140 mmHg or diastolic BP $\geq$ 90 mmHg or if the participant declared to be on treatment for hypertension. The mean of the 2nd and 3rd BP measurements was used for the analyses. For missing data, multiple imputations were used to impute the missing reading, based on the global data. Data were collected during May and June 2019 mainly via an Excel document or in the app provided by MMM19 and were analysed centrally by the MMM project team.

Results

The total number of participants screened in Mexico was 39,700, 56.7% female, 36.6% were of a mixed ethnicity, mean age (SD) was 46.9 (±17.4) years, and mean body mass index was 27.2 (±4.4) kg/m². 7% self-reported diabetes, 2.4% had suffered a myocardial infarction in the past, 1.1% a stroke, 11.4% declared that they were smokers, 47% drank alcohol at least once a week. Five per cent were on aspirin and 3.9% were taking statins. Of all women, 2.0% reported being pregnant and 3.7% had suffered hypertension in a previous pregnancy.

After multiple imputations, of all 39,700 participants, 10,140 (25.5%) had hypertension. Of all participants with hypertension, 43.8% were aware of their diagnosis and 41.7% were on antihypertensive medication. Of 4244 participants on antihypertensive medication, 66.8% had controlled BP, and of all 10,140 participants with hypertension, 27.8% had controlled BP. Of those not taking antihypertensive treatment, 16.7% were classified as having raised BP.

Of the treated patients from whom information was received, 56% were treated with monotherapy, 32% with double therapy, and 9% with triple therapy.

Systolic BP increased with age, while diastolic BP increased until around the age of 40 years when levels appeared to plateau until a slight progressive decrease began around 60-65 years. Consequently, the differential pressure or pulse pressure increased from the age of 40 years (see Supplementary material online, Figure 5).

Based on linear regression models, adjusted for age and sex, including an interaction term, and antihypertensive medication, obesity was associated with the greatest impact on BP with an increase of 5.25 mmHg (95% CI: 4.62-5.86, $P<0.0001$), compared with those of normal weight.

Discussion

It is interesting to compare the data of this non-randomly sampled and not nationally representative, opportunistic survey, with those of the four probabilistic surveys previously conducted in Mexico and with the previous MMM-18 in Mexico.

The four probabilistic surveys ENSA-2000 (National Survey of Health 2000), ENSANUT-2012 (National Survey of Health and Nutrition 2012), ENSANUT-MC-2016 (National Survey of Health and Nutrition-2016), ENSanet 100K, carried out in communities of <100,000 inhabitants, is not comparable since it uses $\geq$130/80 mmHg as a cut-off point for arterial hypertension. The data to comment on the three selected national surveys show that the prevalence of hypertension decreased from 30.5% in 2000 and 31.6% in 2012 to 25.5% in 2016, probably due to the use in this latest survey of automated BP equipment. The proportion of hypertensives awareness has been increasing, being 39.0%, 50.0%, and 60.0% in the three subsequent surveys (2000, 2012, and 2016), respectively. The proportion of people...
receiving treatment has also increased from 47.0% in 2000 to 74.0% in 2012 to 79.3% in 2016. The prevalence, awareness, and proportion controlled between MMM-19 and MMM-18 are very similar. However, the proportion of patients treated is much lower in 2019 than in 2018 (41.7% vs. 62%), a phenomenon that requires subsequent investigation, considering that only 0.8% of the patients included in this survey declared having participated in MMM18, the similarities and differences may be interesting.

In conclusion, MMM18 and MMM19 in Mexico, although not nationally representative, provide information on aspects that were not analysed in the probabilistic surveys, such as the presence of other risk factors, complications and their impact on pressure levels, nor on the use of monotherapy or combinations and helps to increase the visibility of this priority health problem: arterial hypertension.

Supplementary material

Supplementary material is available at European Heart Journal Supplements online.

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