

May Measurement Month 2021: an analysis of blood pressure screening results from Venezuela

Rafael Hernández-Hernández^{1*}, Mónica L. Guzmán-Franulic², Yuly Rawik-Dagher², Thomas Beaney^{3,4}, Neil R. Poulter³, Amanda Duin-Balza¹, María J. Armas-Hernández¹, Egle Silva⁵, Igor Morr⁶, José Andrés Octavio-Seijas⁶, Sima Toopchiani³, and María C. Armas-Padilla¹

¹Hypertension and Cardiovascular Risk Factors Clinic, Dean of Health Sciences, Universidad Centro-Occidental Lisandro Alvarado, Ave. Libertador, Barquisimeto 3001, Venezuela; ²FARMATODO Pharmacy Group, Sector Piedra Azul, La Trinidad, Caracas 1080, Venezuela; ³Imperial Clinical Trials Unit, Imperial College London, Stadium House, 68 Wood Lane, London W12 7RH, UK; ⁴Department of Primary Care and Public Health, Imperial College London, St Dunstan's Road, London W6 8RP, UK; ⁵Research Institute of Cardiovascular Disease of the University of Zulia, Universidad del Zulia, Maracaibo, Venezuela; and ⁶Department of Experimental Cardiology, Tropical Medicine Institute, Universidad Central de Venezuela, Caracas 1053, Venezuela

KEYWORDS

Hypertension;
Screening;
Treatment;
Control

Cardiovascular diseases continue to be the main cause of death in Venezuela, and hypertension is the principal risk factor. The May Measurement Month (MMM) campaign is a global initiative aimed to raising awareness of hypertension, which has been conducted in Venezuela since 2017. May Measurement Month 2021 included 46 732 participants with a mean age of 56.4 years (SD 14.4), 57.9% of whom were female. The percentage with hypertension was 60.3% (57.9% of females and 63.7% of males), 82.3% (84.8% of females and 79.2% of males) were aware, and 80.2% were taking antihypertensive medication. Of those on antihypertensive medication, 44.2% (41.2% of females and 48.2% of males) were not controlled [blood pressure (BP) $\geq 140/\geq 90$ mmHg], with 61.3% receiving one drug, 30.0% two drugs, and 8.7% three or more drugs. 87.5% of those on treatment reported taking it regularly. Conditions associated with higher BP levels include fewer years of education, having a previous diagnosis of hypertension, and women who were hypertensive during a previous pregnancy. Physical activity and pregnancy were conditions associated with lower BP levels. A previous positive COVID-19 test was reported in 11.1%, and one or more COVID-19 vaccinations reported in 22.7% of participants. Of those on antihypertensive medication, 78.8% reported their treatment was not affected by COVID-19. Results are consistent with previous MMM campaigns and indicate that the screening campaign is feasible and useful to identify hypertension even in exceptional conditions such as the COVID-19 pandemic.

Introduction

In Venezuela, cardiovascular diseases continue to be the main cause of death, mostly from ischaemic heart disease and stroke¹; hypertension is the leading risk factor, commonly accompanied with diabetes mellitus, smoking, lipid abnormalities, and low physical activity.^{2,3}

*Corresponding author. Tel: +584149500658/+34633270519, Email: rafael.hernandez.h@gmail.com

The May Measurement Month (MMM) campaign is a global initiative aimed to raising awareness of raised blood pressure (BP), which has been conducted annually in Venezuela since 2017.

Previous studies in Venezuela indicated a prevalence of hypertension of 24.7% in the CARMELA representative sample study³ (mean age 44.2 years) and 37.1% in EVESCAM cross-sectional study⁴ (mean age 50.2 years). In contrast, in the MMM 2017, 2018, and 2019 campaigns, a higher frequency of hypertension was reported as 48.9%, 48.4%, and 48.9%, among screened populations of mean age 53.2, 54.2, and 54.7 years, respectively.^{5,6,7}

The COVID-19 pandemic had a large impact on Venezuela up to September 2021, including 337 359 cases with 4039 deaths, by which point 11.7% were vaccinated (either Sputnik V or Sinopharm brand) with one or more doses. The present MMM 2021 campaign has been carried out during May to September 2021 with the aim of raising awareness of the importance of measuring BP in the Venezuelan population and helping to improve knowledge of hypertension during the unique circumstances of the COVID-19 pandemic. The study also evaluated how the pandemic may have affected hypertension, treatment, and control in Venezuela.

Methods

May Measurement Month 2021 was a cross-sectional survey of BP in adults, initiated in 2017 by the International Society of Hypertension, and the protocol for Venezuela in 2021 was approved by the ethics committee at the Dean of Health Science of the University Centro-Occidental Lisandro Alvarado. Ninety screening sites in eight Venezuelan regions were included. Three to five people were involved in the collection of data for each site. The Venezuelan chain of pharmacies, FARMATODO, teamed up and shared space from their branches with a trained pharmacist and other staff collaborating to carry out the screening from May to September 2021.

Adult participants (≥ 18 years) were recruited at the screening sites and were included after giving informed consent to participate. Three BP and pulse rate measurements were taken using automated BP monitoring devices with 1-min intervals and after being seated for 5 min. A questionnaire was completed including data on demographics, medical history, lifestyle, and weight.

Hypertension was defined as a systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg based on the average of the second and third BP readings or taking antihypertensive medication. Controlled hypertension was defined as systolic BP < 140 mmHg and diastolic BP < 90 mmHg in those taking BP-lowering

medication. Data were submitted from screening sites via spreadsheets; pre-specified data cleaning rules, including cut-off values for continuous data, were applied. In cases where all three BP readings were not recorded, multiple imputation was used to estimate the mean of the second and third readings, based on global data as described previously.⁸

Results

The number of participants included from Venezuela was 46 732 with a mean age of 56.4 years (SD 14.4) and with more women included than men (57.9% vs. 41.9%). The mean weight was 71.2 kg (SD 15.3), and 5.4% participated in previous MMM screenings. The predominant ethnic groups included mixed (56.9%), White (35.1%), and Black (6.8%). 46.0% reported having had over 12 years of education, and 37.3% reported 7-12 years of education. Data were recorded from healthcare settings such as clinics or pharmacies for 88.7% of participants. Previous myocardial infarction was reported in 2.2% and previous stroke in 2.2% of participants. 7.2% reported being a current smoker, and 84.8% reported never or rarely drinking alcohol. 45.6% reported regular physical activity. 16.9% reported taking aspirin, and 10.2% were using statins.

Blood pressure readings were taken three times in 46 546 participants (99.6%), and the average BP (second and third readings) was 129.5/80.6 mmHg. After imputation and age and sex standardization to the World Health Organization standard population, the average BP for all participants was lower at 123.9/79.0 mmHg, 121.3/77.6 mmHg for participants not taking antihypertensive medication, and 131.6/83.3 mmHg for those taking antihypertensive medication.

After imputing the missing values in our data set, 60.3% (57.9% of females and 63.7% of males) of participants were estimated to have hypertension. [Table 1](#) shows the percentages with hypertension, awareness, on medication and with controlled BP stratified by sex. Of all hypertensive participants, 82.3% were aware, 80.2% were on medication, and 44.7% were controlled. Of those on medications, 61.3% took one medication, 30.0% two medications, 7.3% three, and 1.4% four or more medications.

After adjustments for age and sex, significantly higher systolic/diastolic BPs were apparent in participants who were taking antihypertensive drugs: 8.45/4.17 mmHg ($P < 0.001/P < 0.001$). Compared with having no years of education, systolic BPs were 3.79 mmHg ($P < 0.001$) lower among those with 1-6 years of education and

Table 1 Total participants and percentages with hypertension, awareness, on medication and with controlled blood pressure, stratified by sex

	Total	Number with hypertension	Percentage of all participants with hypertension	Percentage of hypertensives aware	Percentage of hypertensives on medication	Percentage of those on medication with controlled BP	Percentage of all hypertensives controlled
Female	27 050	15 664	57.9	84.8	83.1	58.8	48.8
Male	19 588	12 474	63.7	79.2	76.5	51.8	39.6
Total	46 732	28 188	60.3	82.3	80.2	55.8	44.7

5.56 mmHg ($P < 0.001$) lower among those with 7–12 years of education. Years of education showed no significant association with diastolic BP. Reported physical activity of at least 150 min of moderate exercise or 75 min of vigorous exercise per week was associated with lower systolic and diastolic BP: $-1.81/-0.75$ mmHg ($P < 0.001/P < 0.001$).

In women, current pregnancy was associated with lower systolic and diastolic BPs (3.91/4.01 mmHg, $P < 0.001/P < 0.001$), but the use of hormonal replacement therapy or contraceptive medications did not significantly affect BP levels. Women with hypertension in a previous pregnancy had significantly higher systolic and diastolic BPs: 3.81/2.69 mmHg ($P < 0.001/P < 0.001$) than those with no such history.

A previous positive COVID-19 test was reported in 5203 subjects (11.1%) and one or more previous COVID-19 vaccinations in 10 613 participants (22.7%). Of those on antihypertensive medication, 78.8% reported the treatment was not affected by COVID-19, while 0.1% reported that the usual drugs were not available, in 0.1% their usual drug was changed, and in 0.5% a new drug was added.

After adjustment for age, sex, and antihypertensive medication use, those with a previous positive COVID-19 test had significantly lower systolic BP than those without (0.76 mmHg lower, $P = 0.011$) as did those with a previous COVID-19 vaccination (1.39 mmHg lower, $P < 0.001$), but with no significant impact on diastolic BP was apparent.

Discussion

In MMM21 in Venezuela, the percentage of participants with hypertension was 60.3%, which is higher than in previous MMM studies for Venezuela.^{5–7} For example, in 2019, 48.9% were classified as hypertensive,⁶ which may be due in small part to an older average age of 2021 screenees (56.4 vs. 54.7 years). On the other hand, sampling of MMM campaigns is opportunistic and not randomized, and it is possible that hypertensive patients participated in higher numbers than in previous years after the restrictions from the COVID-19.

In this study, 17.7% of hypertensives were unaware (compared with 14.3% in the previous year⁹). The proportion of participants on hypertension drug therapy with controlled hypertension was 55.8% compared with 53.3% in 2019.

The strongest factors linked with high mean systolic/diastolic BP were known hypertension, the use of antihypertensive medication, and lower years of formal education, as previously reported.^{6,7} By contrast, physical activity was associated with lower mean BPs. In women, pregnancy was associated with lower BPs, and in women who presented with hypertension in a previous pregnancy, both systolic and diastolic BPs were significantly higher. The use of hormonal replacement therapy or contraceptive medication had no impact on BP levels.

Most of the participants with a positive COVID-19 test or who had been vaccinated reported that treatment of hypertension was not affected, and those who had received the COVID-19 vaccine or had a previous positive COVID-19 test had a small but statistically significant lower systolic BP. The small changes in BP observed among those vaccinated or with a positive COVID-19 test may reflect

confounding but are compatible with other data¹⁰ in showing no significant long-term adverse changes in BP levels because of vaccination. On the other hand, by September 2021, COVID-19 vaccination was reported in 11.7% of the Venezuelan population,⁷ but in this screening, 22.7% of the participants reported receiving one or more doses of the vaccine, indicating this screening was carried out in cities where vaccination was more concentrated.

Acknowledgements

The authors would like to acknowledge all individuals who made it possible to successfully deliver the MMM21 screening in Venezuela. Our special thanks to the staff of FARMATODO, who fully collaborated with us, to make this study possible, and OMRON Healthcare for providing most of the automated devices.

Funding

None declared.

Conflict of interest: none declared.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

References

1. Pan American Health Organization/World Health Organization, Evidence and Intelligence for Action in Health Department/Health Analysis, Metrics and Evidence Unit. PLISA Database. Core indicators 2019: health trends in the Americas. Washington, D.C., United States of America, 2019. <https://iris.paho.org/handle/10665.2/51542> (December 2022).
2. Top 10 causes of death and disability, Venezuela 2019. WHO global health estimates 2019. World Health Organization, 2020. www.paho.org/en/enlace (August 2023).
3. Hernández-Hernández R, Silva H, Velasco M, Pellegrini F, Macchia A, Escobedo J *et al.* Hypertension in seven Latin American cities: the cardiovascular risk factor multiple evaluation in Latin America (CARMELA) study. *J Hypertens* 2010;**28**:24–34.
4. González J, Mechanick J, Duran M, Ugel E, Marulanda M, Nieto R. Re-classifying hypertension in the Venezuelan EVESCAM database using 2017 AHA/ACC criteria: high prevalence, poor control, and urgent call for action. *Ann Global Health* 2019;**85**:1–8.
5. Hernández-Hernández R, Octavio-Seijas JA, Morr I, López-Rivera J, Gúzman-Franolic ML, Costantini-Olmos AP *et al.* Results of the May Measurement Month 2017: blood pressure campaign in Venezuela-Americas. *Eur Heart J Suppl* 2019;**21**:D124–D126.
6. Hernández-Hernández R, Duin A, Octavio-Seijas JA, López-Rivera J, Morr I, Silva E *et al.* Results of May Measurement Month 2018 campaign in Venezuela. *Eur Heart J suppl* 2020;**22**:H135–H138.
7. Hernández-Hernández R, Poulter NR, Gúzman-Franolic ML, Rawik Y, Octavio-Seijas JA, López-Rivera JA *et al.* May Measurement Month 2019: an analysis of blood pressure screening results from Venezuela, Latin America. *Eur Heart J Suppl* 2021;**23**:B151–B153.
8. Beaney T, Wang W, Schlaich MP, Schutte AE, Stergiou GS, Alcocer L *et al.* Global blood pressure screening during the COVID-19 pandemic: results from the May Measurement Month 2021 campaign. *J Hypertens* 2023;**41**:1446–1455.
9. Venezuela Crisis de Covid-19. www.datosmacro.expansion.com/otros/coronavirus-vacuna/venezuela (Dec 2022).
10. Angeli F, Reboldi G, Trapasso M, Santilli G, Zappa M, Verdecchia P. Blood pressure increase following COVID-19 vaccination: a systematic overview and meta-analysis. *J Cardiovasc Dev Dis* 2022;**9**: 150. Published 2022 May 9.