Clinical and treatment profiles of arterial hypertension in Mexico during the COVID-19 pandemic: A cross-sectional survey endorsed by the "Mexican Group of Experts on Arterial Hypertension"

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ABSTRACT (250 WORDS)

BACKGROUND: Arterial hypertension is a highly prevalent disease in Mexico; nevertheless, there are limited insights regarding its management during the context of the COVID-19 pandemic. Here, we estimate the prevalence of clinical and treatment profiles of arterial hypertension and explore associated factors for undiagnosed and uncontrolled hypertension using a cross-sectional survey endorsed by the Mexican Group of Experts on Arterial Hypertension.

METHODS: Our survey was conducted from May to November 2021 using the May-Measurement Month 2021 protocols of the International Society of Hypertension. Arterial hypertension (blood pressure [BP] ≥140/90 mmHg, previous diagnosis, or taking antihypertensives) and its clinical and treatment profiles were classified according to the World Hypertension League Expert Committee. Mixed-effects logistic regression models were used to explore associated factors for undiagnosed and uncontrolled hypertension.

FINDINGS: Among 77,239 screened individuals (women: 62.4%; median age: 46 [IQR: 32-59] years), the prevalence of arterial hypertension was 35.7% (95% CI: 35.3-36.0, n=27,731). Among participants with arterial hypertension, 30.9% (95% CI: 30.4-31.5, n=8,533) were undiagnosed, 6.6% (95% CI: 6.3%-6.9%, n=1,806) were diagnosed but untreated, 43.4% (95% CI: 42.3-44.0, n=11,965) had uncontrolled hypertension, and only 19% (95% CI: 18.6% to 19.5%, n=5,236) achieved hypertension control (BP <130/80 mmHg). Explored associated factors for undiagnosed and uncontrolled hypertension include being men, living in the central and southern regions, lower educational attainments, higher use of pharmacological agents, and previous COVID-19 infection.

INTERPRETATION: Our findings suggest that adverse arterial hypertension profiles, mainly undiagnosed and uncontrolled hypertension, were highly prevalent during the context of the COVID-19 pandemic in Mexico.

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Keywords: *Arterial hypertension, blood pressure, prevalence, epidemiology, Mexico*

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ABBREVIATIONS

AHA: American Heart Association

BIC: Bayesian Information Criteria

CVD: Cardiovascular Disease

ENSANUT: National Health and Nutrition Survey

IMSS: Instituto Mexicano del Seguro Social

IQR: Interquartile Range

ISH: International Society of Hypertension

LMICs: Low-and Middle-Income Countries

MMM: May-Meassurment-Month

VIF: Variance Inflation Factor

WHLEC: World Hypertension League Expert Committee

INTRODUCTION

Arterial hypertension is a central contributor to the burden of chronic health diseases worldwide [1]. The high prevalence of arterial hypertension reported within low- and middle-income countries (LMICs) has brought substantial consequences, as it has been linked directly responsible for over 1.6 million deaths annually within Latin America, mainly related to cardiovascular diseases (CVD) [2–4]. The management of arterial hypertension represents a challenging situation for healthcare systems in LMICs, as there is a high proportion of unawareness and uncontrolled hypertension in the general population [5]. Moreover, the Latin American population has historically suffered from underfunded healthcare systems that limit the coverage and access to adequate screening and sufficient antihypertensive treatment, particularly in primary-care sectors [6].

Mexico has experienced a steep increase in arterial hypertension prevalence and mortality within the last two decades [7]. Furthermore, the Mexican population coexists with a high prevalence of cardiometabolic diseases that have been demonstrated to impact the management of blood pressure [8]. These structural conditions created a challenging scenario for managing arterial hypertension within the context of the COVID-19 pandemic. It has been reported that the Mexican healthcare system modified its care policies to prioritize the attention of critically ill COVID-19 patients, triggering structural deficiencies in care in different healthcare sectors [9]. Consequently, these changes brought a deficiency in care for other chronic health diseases, such as diabetes and cardiovascular diseases [10,11]. We hypothesize that arterial hypertension was not the exception, as modification in healthcare policies could have led to an increase in the burden of undiagnosed and uncontrolled hypertension. Though several reports have estimated the impact of the COVID-19 pandemic on other chronic health conditions and its related complications, there are limited insights regarding the clinical and treatment management of arterial hypertension during the COVID-19 pandemic in Mexico. Hence, there is a need to assess the epidemiological situation of arterial hypertension profiles to strengthen healthcare policies and mitigate the burden of hypertension in our country.

Hence, this study aimed to 1) estimate the prevalence of clinical and treatment profiles of arterial hypertension and 2) explore associated factors for undiagnosed and uncontrolled hypertension during the COVID-19 pandemic using a cross-sectional survey using a cross-sectional survey endorsed by the Mexican Group of Experts on Arterial Hypertension.

METHODS

Study design

We performed a cross-sectional survey among adults ≥20 years living in Mexico between May to November 2021 following the international protocol established by the May-Measurement Month (MMM) 2021 consortium by the International Society of Hypertension (ISH) [12]. In Mexico, reports of the MMM protocols have been published elsewhere [13,14]. Briefly, this survey consisted of an open invitation of adults to assist with modules disposed by our group of study in public healthcare clinics across Mexico. The participation consisted of a standardized arterial pressure measurement followed by a standardized questionnaire to ask for sociodemographic, clinical, and lifestyle habits and arterial hypertension treatment-related variables. This survey followed the recommendations of the 2021 version of MMM, including a section to interrogate COVID-19-related variables. All the modules involved trained healthcare personnel previously certified by qualified physicians to measure clinical and arterial blood pressure according to standardized guidelines. The Investigation Review Board of the Mexican Institute of Social Security (Acronym in Spanish – IMSS: Instituto Mexicano del Seguro Social) approved this study by protocol number R-2021-1406-016 (**Supplementary Figure 1**). All the participants gave verbal informed consent before being assessed in the study and were given an internal identification number to anonymize their personal information. This study adhered to the STROBE guidelines for reporting cross-sectional studies (**Supplementary Table 1**)

Variables and definitions

Outcome variable

Our main analysis focused on assessing the clinical and treatment profiles of people with arterial hypertension. This classification is based on the definition of arterial hypertension adopted by the World Hypertension League Expert Committee (WHLEC) for epidemiological studies [15].

I. *Arterial hypertension* - According to the WHLEC, a person is considered to have arterial hypertension if they meet any of the following criteria: 1) systolic and/or diastolic blood pressure readings greater than 140/90 mmHg, 2) have previously been diagnosed with arterial hypertension, or 3) was taking any antihypertensive medication of drug to regulate their high blood pressure.

II. *Clinical and treatment profiles* - Undiagnosed arterial hypertension was considered when someone had systolic and/or diastolic blood pressure readings greater than 140 and 90 mmHg and was not aware of having any arterial hypertension diagnosis, or neither had any antihypertensive treatment. Untreated arterial hypertension was classified as participants with previous arterial hypertension diagnoses but without receiving any antihypertensive treatment. Treated arterial hypertension was considered when a participant had a previous arterial hypertension diagnosis and self-reported to be receiving antihypertensive treatment. Uncontrolled arterial hypertension was defined as a participant who had been diagnosed with arterial hypertension and was treated with any antihypertensive treatment but whose blood pressure was greater or equal to 130 or 80 mmHg. Controlled arterial hypertension was considered when a diagnosed and treated individual had blood pressure lower than 130 or 80 mmHg.

Arterial blood pressure assessment

Arterial blood pressure was measured using a brand-name digital sphygmomanometer (*OMRON HEM-9200T*) available and provided for all medical facilities. Three measurements of blood pressure were taken, each with a one-minute break in between. The results of the final two readings were then averaged and used in all the analyses to determine the individual arterial blood pressure.

Standardized questionnaire assessment

A) *Sociodemographic variables* - We included age, sex, state of residency, years of education (categorized as 0-6, 7-12, and ≥13 years), and whether the participant self-identified as Mexican-Mestizo, Caucasian, or Afro-descendant as our sociodemographic variables. For convenience, participants were grouped as living in four regions in Mexico: north, central, metropolitan area, and south region based on the classification of the Mexican National Institute of Geography (INEGI) [16].

B) *Clinical and lifestyle habits evaluation* - Clinical variables asked in the questionnaire were time categorized in 12 months since the last clinical visit to a healthcare professional, smoking and alcohol consumption, aspirin and statin use, and prior clinical diagnosis of diabetes, ischemic heart disease (IHD), or stroke. For the anthropometric evaluation, weight was measured in kilograms using calibrated scales. Self-reported weight was captured in subjects when this measurement could not be assessed. All participants received standardized dietary and lifestyle recommendations in an informative card (**Supplementary Figure 1**), and routine medical follow-up was advised.

C) *Hypertension-related variables* - A direct questionnaire was applied to all participants, asking whether a medical professional had previously informed them if they had been diagnosed with arterial hypertension by asking, "*Have you ever been informed by a doctor or other health professional that you had arterial hypertension, also known as high blood pressure?*". The following query was also used to determine whether a person was taking antihypertensives: "*Are you now taking any drugs, tablets, or pills for high blood pressure?*". If the answer to the previous question was affirmative, we asked the total number of medications using the following query: "*How many drugs, tablets, or pills are you currently taking for managing your hypertension?*". For convenience, we classified the antihypertensive treatment as monotherapy, dual therapy, and triple therapy. Adherence

to antihypertensives was asked using the following question: "*Do you fully take your hypertensive treatment? and if not, please explain the reason.*"

D) *COVID-19-related variables* - Participants were asked whether they had previous COVID-19 infection as the response to the following question: "*Have you had any positive test for COVID-19 (Coronavirus) disease?*". Additionally, it was asked whether their hypertension treatment was affected by COVID-19 using the question: "*Was your arterial hypertension treatment affected due to the COVID-19 pandemic?*". Finally, COVID-19 vaccination was asked through the query: "*Have you already received any COVID-19 vaccine?*".

Statistical analysis

According to the distribution of the continuous data, variables are displayed as means (standard deviation) or medians (interquartile range) determined by the Anderson-Darling normality test. Categorical variables are displayed as frequency and in absolute proportion. All statistical analyses were performed in R Studio (Version 4.1.2). A value of $p<0.05$ was considered as our statistically significance threshold.

Missing variables assessment

To calculate the missing values from the second and third blood pressure measurements, we used a multiple imputation algorithm based on the fully conditional specification technique as proposed by Van Buuren and Groothuis-Oudshoorn under the assumption that data was missed completely at random. We multiply 5 imputed datasets for a maximum of 5 iterations combined using Rubin's rules using the *mice* package (Version 3.14.0) [17]. Detailed results of imputed variables are presented in **Supplementary Figure 2**.

Prevalence estimation of clinical and treatment profiles of arterial hypertension

The Clopper-Pearson approach was used to estimate the overall prevalence of arterial hypertension, along with clinical and treatment hypertension profiles. We further stratify these prevalences across sex, region of residency, ethnicity, and educational attainments. We used the *epiR* package to estimate the prevalence with a 95% confidence interval (Version 2.0.3) [18]. The

networkD3 (Version 0.4) package was used to create Sankey-Diagrams and bar plots to visualize the clinical and treatment profiles related to arterial hypertension stratified by sociodemographic variables [19].

Factors related to undiagnosed and uncontrolled arterial hypertension.

To investigate the potential factors associated with undiagnosed and uncontrolled arterial hypertension, we fitted random-effects binomial logistic regression models to examine the roles of sociodemographic, clinical, lifestyle habits, arterial hypertension treatment, and COVID-19-related variables. The final models were chosen according to the lowest Bayesian Information Criteria (BIC). A model with multicollinearity in its estimation was judged to have a Variance Inflation Factor (VIF) >5. The *jtools* package (Version 2.1.4) was used to build odds-ratio charts [20].

Sensitivity Analyses

The estimated prevalence of arterial hypertension depends on the definition criteria proposed by different societies. As a sensitivity analysis to evaluate whether a lower arterial blood pressure threshold may modify the prevalence of clinical and treatment profiles of arterial hypertension, we tested the American Heart Association (AHA) definition [21]. The AHA considers arterial hypertension when an individual has systolic and/or diastolic blood pressure readings greater than 130 and 80 mmHg, respectively. The use of antihypertensives and previous medical diagnosis of hypertension were also considered for this definition.

RESULTS

Study population

Throughout the study period, 77,239 participants were screened across 13 states in Mexico. The number of participants contributed by each state is displayed in **Supplementary Table 2**, and the complete descriptive characteristics of the overall study population are presented in **Supplementary Table 3**. Briefly, our sample predominantly consisted of women (62.4%), with a median age of 46 years (IQR: 32-59). A significant portion of the participants, 51.2%, had 7 to 12 years of educational attainment, and most lived in the northern region of Mexico (49.6%). As of October 2022, 20% of the sample had previously self-reported COVID-19 disease and 63.4% had received vaccinations against the SARS-CoV-2 virus.

Prevalence of arterial hypertension in Mexico during the COVID-19 pandemic

We identified 27,540 participants with arterial hypertension during the studied period, resulting in an estimated prevalence of 35.7% (95% CI: 35.3% to 36.0%). The characteristics of these participants, stratified by clinical and treatment profiles, are detailed in **Table 1**. Sociodemographic stratification of arterial hypertension indicated a higher prevalence among male participants (37.8%, 95% CI: 37.2% to 38.3%), individuals living in the southern region (61.3%, 95% CI: 59.6% to 62.9%), those of Mexican-Mestizo ethnicity (35.9%, 95% CI: 35.5% to 36.2%), and particularly among those with 0 to 6 years of educational attainment (54.1%, 95% CI: 53.4% to 54.9%) **(Figure 1)**.

Clinical and treatment profiles of arterial hypertension

Among all participants living with arterial hypertension (n=27,731), we classified 30.9% (95% CI: 30.4% to 31.5%, n=8,533) with undiagnosed hypertension and 6.6% (95% CI: 6.3% to 6.9%, n=1,806) as previously diagnosed but currently untreated. The diagnosis and treatment of arterial hypertension were achieved in only 62.4% (95% CI: 61.9% to 63.0%, n=17,201), of whom 43.4% (95% CI: 42.3% to 44.0%, n=11,965) did not achieve arterial pressure goals and only 19% (95% CI: 18.6% to 19.5%, n=5,236) were currently controlled (BP <130/80 mmHg) (**Figure 2**).

Prevalence of hypertension profile stratified by key-demographic variables.

The stratification of clinical and treatment profiles by sociodemographic variables revealed that younger participants tended to have higher rates of undiagnosed and untreated arterial hypertension, while older participants were more likely to be on treatment but also exhibited a high prevalence of uncontrolled blood pressure. Notably, participants living in central states of Mexico, those identifying as Afro-descendant, and participants with higher educational levels yielded the highest prevalence of undiagnosed hypertension. Untreated hypertension was most prevalent among women, residents of the central region, Caucasian individuals, and those with over 12 years of education. Additionally, the greatest prevalence of uncontrolled hypertension was observed in participants from the southern region with 0 to 6 years of educational attainment (**Supplementary Table 4**).

Associated conditions for undiagnosed and uncontrolled arterial hypertension

The unadjusted regression model revealed several associated factors for undiagnosed and uncontrolled arterial hypertension (**Supplementary Table 5**). In the adjusted logistic regression analysis, we identify that being male, increased age, residing in the northern or southern regions, having lower educational levels, lack of self-reported physical activity, a history of COVID-19 infection, and usage of statins and aspirin emerged as significant associated factors of undiagnosed arterial hypertension compared to those with a known diagnosis. Additionally, for uncontrolled hypertension, being male, higher age, having 7-12 years of educational attainments, residing in the metropolitan, northern, or southern regions, frequent or daily alcohol consumption, not engaging in self-reported physical activity, previous stroke, reporting treatment disruption due to the COVID-19 pandemic and being on dual or triple antihypertensive therapy were identified as key contributing factors (**Table 2**).

Sensitivity Analyses

Some reports in Mexico used the AHA definition for the classification of arterial hypertension. ($\leq$130/80 mmHg). Hence, we performed a sensitivity analysis to evaluate the prevalence of arterial

hypertension using a blood pressure threshold <130/80 mmHg. We observed that the prevalence of arterial hypertension increased to 57.5% (95% CI: 57.1 to 57.8) in the overall sample. The evaluation of the clinical and treatment profiles of arterial hypertension revealed that lowering the arterial blood pressure threshold increases the proportion of undiagnosed (57.1%, 95% CI: 56.6 to 57.6) hypertension, but decreases the proportion of diagnosed (42.9%, 95% CI: 42.4 to 43.4) and treated (38.8%, 95% CI: 38.4 to 39.3) arterial hypertension. Hence, a lower proportion of uncontrolled (26.9%, 95% CI: 26.6 to 27.4) and controlled (11.8%, 95% CI: 11.5 to 12.1) blood pressure was observed.

DISCUSSION

In this study, we aimed to determine the prevalence of clinical and treatment profiles of arterial hypertension as well as the associated factors for undiagnosed and uncontrolled hypertension, during the context of the COVID-19 pandemic in Mexico. We performed a cross-sectional survey of 77,239 participants and found that more than one-third of our sample was living with arterial hypertension, with nearly one-third of these cases undiagnosed, two-fifths uncontrolled, and only a fifth effectively managed to achieve blood pressure goals. Sociodemographic stratification underscored variability in clinical and treatment profiles across different age groups and sociodemographic factors. Notably, being male, residing in the southern regions of Mexico, having lower educational levels, not performing physical activity, extensive use of pharmacological agents, and a history of COVID-19 infection were significantly associated with increased odds of both undiagnosed and uncontrolled hypertension. These findings underscore the magnitude of arterial hypertension as a critical public health concern during the COVID-19 pandemic, adding to the national burden of chronic diseases among adults in Mexico and bearing considerable implications for individual and public healthcare systems.

These results demonstrate a higher prevalence compared with previous studies performed by the MMM in Mexico [13,14]. Furthermore, a study performed by our group in the eastern zone

of Mexico revealed a prevalence of 32.4% (95% CI: 31.2%-33.6%) within the studied sample, which suggests a higher prevalence at a national-wide level compared with previous estimations [22]. While these figures denote an upward trend in prevalence over the past five years, it is important to note the absence of a national consensus on reporting uncontrolled hypertension, which may influence the higher prevalence observed in our study. This discrepancy underscores the necessity for standardized reporting criteria to ensure accurate prevalence assessments. Other studies have employed a lower threshold for arterial hypertension classification. According to the latest National Health and Nutrition Survey (ENSANUT) performed in 2020, it was reported that 49.4% of the Mexican population was living with arterial hypertension using the AHA hypertension definition (>130/80 mmHG) [23]. Our sensitivity analyses revealed a higher prevalence compared to ENSANUT-2020 and our previous research, indicating an elevated prevalence of arterial hypertension in 2021 during the COVID-19 pandemic when applying the WHO and AHA definitions.

The potential explanations for the high prevalence of arterial hypertension in Mexico are linked with individual and sociodemographic components. Although arterial hypertension has been classified as a multifactorial disease, it has been identified that nutritional, behavioral, and environmental causes were combined with adverse sociodemographic conditions that directly impact the clinical and treatment presentations of arterial hypertension [24]. A possible explanation is that in LMICs in Latin America, it has been reported that a high toll of socially disadvantaged populations experienced worse access to hypertension care during the last two decades, which led to an extensive challenge for managing chronic health diseases at primary care levels [25]. Here, we demonstrated that participants within the central and southern regions experienced the highest prevalence of arterial hypertension compared with the rest of the country, driven by a high proportion of uncontrolled hypertensive disease. Similar results have been previously reported by a longitudinal study, which demonstrated that rural dwellers, uninsured subjects, and the least wealthy are at risk for persistent untreated and uncontrolled hypertension

[26]. In our results, factors that also contributed to both undiagnosed and uncontrolled disease include unhealthy lifestyle habits such as alcohol intake and lack of physical activity, which overall demonstrate that there is a need for targeting both individual and sociodemographic conditions to diminish the burden of arterial hypertension in Mexico.

During the context of the COVID-19 pandemic, Mexico experienced an interruption of primary healthcare services that mainly affected patients living with chronic health conditions. A time-series analysis performed in Mexico reported that over one-third of hypertensive care visits were delayed or postponed, and the proportion of controlled hypertensive disease declined by 17% [9]. Though the disruptions were mainly driven by the hospital reconversion policy that sought to prioritize critically ill COVID-19 patients, the Mexican healthcare system was strained prior to the arrival of the pandemic. The structural deficiencies have been widely reported to be mainly characterized by a lack of healthcare personnel, inequalities in coverage and insufficient supplies for the primary care sector [27,28]. The COVID-19 pandemic exacerbated these deficiencies, leading to a proportion of the population living with chronic health conditions being exposed to acute complications and excess deaths due to diabetes and CVD, particularly within vulnerable groups [10,11]. In our results, we observed that people who experienced a disruption in hypertensive treatment had increased odds of uncontrolled hypertension. Overall, the combination of both structural and the high burden of cardiometabolic conditions within people living with arterial hypertension caused an exacerbated increase in uncontrolled arterial hypertension in Mexico, leading as a consequence to a high toll of deaths related to arterial hypertension reported during the COVID-19 pandemic.

Our results derived one of the first epidemiological estimations of the prevalence of clinical and treatment profiles of arterial hypertension in Mexico during the COVID-19 pandemic. We confirm that arterial hypertension continues to be a highly prevalent condition and a public health care concern in Mexico. There are big challenges for diminishing the burden of the disease in the future, which overall require actions to promote healthier lifestyle habits, guarantee primary care

access within vulnerable populations, and promote adequate access to pharmacological treatment across the country to diminish the high proportion of uncontrolled arterial hypertension.

Strengths and Limitations

Our study has strengths and limitations to be acknowledged. Among the strengths, we highlight the participation of 77,239 individuals, deriving in one of the largest samples performed in Mexico to estimate the prevalence of arterial hypertension. This estimation allowed us to study the prevalence of clinical and treatment profiles by regional, educational, and ethnic groups. Furthermore, we offer insights regarding associated factors for undiagnosed and uncontrolled arterial hypertension, which could be used to identify vulnerable groups within clinical practice. Nevertheless, some limitations need to be acknowledged. First, this survey was intended to be an open invitation to the general population to assist with provisional modules located in public clinics across Mexico. This could lead to a sampling bias towards capturing people who assisted with healthcare services for various reasons. Furthermore, due to COVID-19 mobility restrictions, we could only install modules in 13 of the 32 states of Mexico, leading to a potential underrepresentation compared with other national-wide probabilistic household surveys such as the ENSANUT. Second, we identify missing values regarding our arterial blood pressure assessment, a frequent issue reported by other studies worldwide. However, we used a multiple imputation algorithm approach to complete missing blood pressure values, which have demonstrated to derive unbiased estimations in previous studies and within our results. Third, although we explored and found associated factors for undiagnosed and untreated arterial hypertension, this survey is a cross-sectional design that does not prove any risk association for the studied outcomes. Hence, future prospective studies should evaluate the impact of our observed associated factors in the development of acute and chronic complications related to undiagnosed and untreated arterial hypertension. Fourth, we were unable to assess height as a standardized measurement due to methodological and structural issues. Hence, we were unable to estimate body mass indexes in our study. Finally, we were unable to assess biochemical

measurements and specific pharmacological treatments, which limited our capacity to provide details regarding therapeutic profiles, leading to future areas of opportunity and research.

CONCLUSION

In conclusion, over one-third of our studied sample had arterial hypertension, in which one-third were classified with undiagnosed disease, two-fifths with uncontrolled blood pressure, and only one-fifth achieved controlled blood pressure. Key factors associated with these conditions included male gender, residing in the northern, southern, or central regions, lower educational attainment, inactivity, alcohol use, and COVID-19 infection and related antihypertensive treatment disruptions due to the pandemic. These findings yield an urgent call to action to improve healthcare screening in primary care settings and guarantee sufficient arterial hypertension treatment to reduce the burden of the disease in Mexico during the ongoing COVID-19 pandemic and beyond.

AUTHOR CONTRIBUTIONS

Research Idea and Study Design: SPP, LA; Data Acquisition: RARZ, MGBL, JMMS, LRGC, OMR, MLLV, RSGD, VJGC, JRPS; Data Analysis/Interpretation: SPP, NEAV; Statistical Analysis: NEAV; Manuscript Drafting: SPP, NEAV; Supervision and Mentorship: SPP, LA. Each author contributed important intellectual content during manuscript drafting or revision and accepted accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work were appropriately investigated and resolved.

DATA AVAILABILITY: The R code for reproduction is available in the following URL: https://github.com/neftalivilla/MMM_2021

DECLARATION OF INTERESTS: Nothing to disclose.

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FIGURE LEGENDS

Figure 1: Prevalence of arterial hypertension stratified by sex, regions in Mexico, ethnicity, and educational attainments.

Figure 2: Proportion of undiagnosed, diagnosed but treated, treated but no controlled and controlled arterial hypertension.

TABLES

Table 1: Descriptive characteristics of the population living with arterial hypertension identified in Mexico.

Characteristic	Participants with Hypertension (n = 27,540)	Undiagnosed (n = 8,533)	Untreated (n = 1,806)	Uncontrolled (n = 11,965)	Controlled (n = 5,236)
Sex, (%)					
Women	60.3%	54.1%	64.8%	60.5%	68.1%
Men	39.7%	45.9%	35.2%	39.5%	31.9%
Age, (Years) [median, IQR]	56 (45, 66)	51 (39, 62)	46 (35, 58)	59 (50, 67)	59 (49, 67)
Education Years, (%)					
0-6	35.1%	27.8%	25.1%	39.5%	40.5%
7-12	46.2%	49.5%	49.4%	45.0%	42.6%
>13	18.7%	22.8%	25.4%	15.5%	16.8%
Region of Recruitment, (%)					
North	48.8%	54.1%	34.3%	49.9%	42.9%
Central	10.9%	17.3%	15.7%	7.8%	5.9%
Metropolitan Area	32.7%	22.4%	45.2%	33.8%	42.8%
South	7.6%	6.2%	4.8%	8.6%	8.4%
Self-Reported Ethnicity, (%)					
Caucasian	0.1%	0.1%	0.3%	0.1%	0.2%
Mexican−Mestizo	99.3%	98.7%	99.0%	99.7%	99.6%
Afro−Descendant	0.5%	1.2%	0.7%	0.2%	0.2%
Performing Physical Activity, (%)	30.4%	32.3%	32.3%	28.4%	31.3%
Smoking Status, (%)					
Never-Smoking	60.4%	63.6%	57.2%	58.1%	61.4%
Quit-Smoking	25.5%	19.6%	24.5%	29.4%	26.7%
Active-Smoking	14.1%	16.8%	18.3%	12.5%	11.9%
Alcohol Intake, (%)					
Never-Drink	77.3%	72.6%	71.0%	78.7%	83.9%
Frequent Intake	17.8%	21.3%	22.8%	16.7%	12.9%
Daily Intake	4.9%	6.1%	6.2%	4.7%	3.2%
High Arterial Blood Pressure During Pregnancy, (%) *	11.5%	6.3%	27.7%	12.1%	11.7%
Current Pregnancy, (%) *	2.3%	2.9%	7.9%	1.5%	1.5%
Diabetes, (%)	26.8%	11.1%	19.5%	35.8%	34.5%
Previous CVD, (%)	6.0%	2.8%	4.5%	7.9%	7.3%
Previous Hearth Attack, (%)	4.6%	2.1%	2.7%	6.1%	5.8%
Previous Stroke, (%)	1.8%	0.9%	2.0%	2.5%	1.8%
Statin Use, (%)	15.6%	6.2%	7.0%	21.1%	21.2%
Aspirin Use, (%)	19.3%	7.7%	15.2%	25.6%	25.6%
Previous COVID-19 Infection, (%)	20.1%	22.9%	23.9%	18.5%	18.0%

Antihypertensive Treatment Affected by COVID-19, (Years)	8.3%	5.6%	5.8%	11.0%	7.3%
COVID-19 Vaccine, (%)	75.5%	67.6%	63.7%	80.3%	81.7%
Time Since Clinical Visit, (%)					
<12 Months	83.7%	71.6%	71.8%	90.5%	92.0%
≥12 Months	12.9%	22.7%	23.1%	7.3%	5.9%
Never	3.4%	5.7%	5.1%	2.2%	2.1%
Antihypertensive Treatment, (%)					
No-Therapy	37.5%	100.0%	100.0%	0.0%	0.0%
Monotherapy	33.8%	0.0%	0.0%	52.7%	57.6%
Dual-Therapy	21.5%	0.0%	0.0%	35.4%	32.4%
Triple-Therapy	7.1%	0.0%	0.0%	12.0%	10.0%
Weight, (kg) [median, IQR]	75 (66, 86)	76 (67, 87)	73 (64, 85)	76 (67, 87)	72 (63, 81)
SBP, (mmHg) [median, IQR]	133 (121, 144)	141 (130, 149)	122 (112, 133)	137 (130, 147)	116 (109, 123)
DBP, (mmHg) [median, IQR]	83 (76, 91)	91 (82, 94)	79 (72, 85)	85 (81, 91)	72 (68, 76)
HR, (bpm) [median, IQR]	76 (70, 84)	78 (71, 85)	77 (70, 84)	77 (70, 84)	74 (67, 81)

Abbreviations: CVD= cardiovascular disease; mmHg= millimeters of mercury; bpm= beats per minute.

Annotations:

* = Variables applicable only to women.

Table 2: Adjusted binomial logistic regression model to evaluate the factors associated with undiagnosed and uncontrolled arterial hypertension in Mexico.

Outcome	Variables	aOR	95% CI	p-value
Undiagnosed Hypertension (Vs. No-Hypertension) $\chi^2(14) = 4290.11$, $p < 0.01$ Pseudo-R^2 (McFadden) = 0.09 BIC: 44369.42	**Sex, (%)**			<0.001
	Women	Ref	—	
	Men	1.47	1.40, 1.54	
	Age Categories, (%)			<0.001
	18-35	Ref	—	
	36-49	1.54	1.39, 1.71	
	50-64	1.72	1.47, 2.02	
	>65	1.53	1.20, 1.94	
	Education Years, (%)			<0.001
	>13	Ref	—	
	7-12	1.01	0.96, 1.08	
	0-6	1.23	1.15, 1.33	
	Region of Recruitment, (%)			<0.001
	Central	Ref	—	
	Metropolitan Area	2.08	1.96, 2.21	
	North	2.74	2.53, 2.96	
	South	3.89	3.45, 4.38	
	Performing Physical Activity, (%)			<0.001
	Yes	Ref	—	
	No	1.12	1.07, 1.18	
	Previous COVID-19 Infection, (%)			<0.001
	No	Ref	—	
	Yes	1.22	1.15, 1.29	
	Statin Use, (%)			<0.001
	No	Ref	—	
	Yes	1.69	1.50, 1.90	
	Aspirin Use, (%)			<0.001
	No	Ref	—	
	Yes	1.90	1.71, 2.11	
Uncontrolled Hypertension (Vs. Controlled) $\chi^2(16) = 405.10$, $p < 0.01$ Pseudo-R^2 (McFadden) = 0.02	**Sex, (%)**			**<0.001**
	Women	—	—	
	Men	1.34	1.25, 1.44	
	Age Categories, (%)			**<0.001**
	18-35	Ref	—	
	36-49	1.46	1.24, 1.72	

BIC = 20902.35	50-64	1.61	1.37, 1.88	
	>65	1.38	1.17, 1.62	
	Education Years, (%)			**0.014**
	>13	Ref	—	
	7-12	1.15	1.05, 1.27	
	0-6	1.09	0.99, 1.21	
	Region of Recruitment, (%)			**<0.001**
	Central	Ref	—	
	Metropolitan Area	1.50	1.39, 1.61	
	North	1.40	1.21, 1.63	
	South	1.21	1.07, 1.38	
	Alcohol Intake, (%)			**<0.001**
	Never-Drink	Ref	—	
	Frequent Intake	1.24	1.12, 1.37	
	Daily Intake	1.32	1.10, 1.58	
	Performing Physical Activity, (%)			**<0.001**
	Yes	Ref	—	
	No	1.19	1.11, 1.28	
	Previous Stroke, (%)			**0.047**
	No	Ref	—	
	Yes	1.27	1.00, 1.61	
	Antihypertensive Treatment Affected by COVID-19, (%)			**<0.001**
	No	Ref	—	
	Yes	1.52	1.34, 1.73	
	Antihypertensive Treatment, (%)			**<0.001**
	Monotherapy	Ref	—	
	Dual-Therapy	1.15	1.07, 1.24	
	Triple-Therapy	1.23	1.11, 1.38	

539 Abbreviations: aOR= Adjusted odds ratio; BIC= Bayesian information criteria.