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Prevalence of hypertension in a clinical population of primarily rural and Indigenous Guatemalan women

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Abstract

Objective Our objective was to determine the prevalence of hypertension, overall and by sociodemographic factors, in a large clinical population of 13,873 primarily rural and Indigenous Guatemalan women. The purpose of the research is to present epidemiological findings that can be useful for public health planning and resource allocation.

Results Overall prevalence of hypertension was 16.3% (95% CI 15.7–17.0%) and age-adjusted prevalence was 16.0% (95% CI 15.3–16.8%) using American Heart Association thresholds of 130 mmHg for systolic blood pressure and 80 mmHg for diastolic blood pressure for classification. Seventy-nine percent of those classified as hypertensive were previously undiagnosed. Hypertension prevalence increased with age and body mass index. Indigenous women and women who spoke Mayan languages both had approximately 20% lower prevalence of hypertension than non-Indigenous and Spanish-speaking women, respectively. In general, hypertension prevalence increased as likelihood of poverty decreased. Among those classified as hypertensive who had a second blood pressure reading available, 53% had elevated blood pressure on the second reading. When thresholds of 140 mmHg and 90 mmHg were used for systolic and diastolic blood pressure, respectively, overall hypertension prevalence was 5.4% (95% CI 5.0-5.8%) and age-adjusted prevalence was 6.0% (95% CI 5.4–6.6%).

Introduction

Guatemala is a middle-income Central American nation of 18.3 million people with a majority-rural population, approximately half of whom are Indigenous [1]. In recent years, Guatemala has seen rising prevalence of obesity and cardiometabolic disease. According to the Global Burden of Disease, hypertension is the third most important risk factor for morbidity and mortality in Central America [2]. Hypertension is linked to lifestyle patterns, including dietary and physical activity patterns, and increases the risk of other chronic conditions including heart disease, kidney disease and stroke [3]. The prevalence of hypertension in low- and middle-income countries has been estimated to be 31.5% [4]. In Guatemala, prevalence estimates have varied widely from 16.9% to 41.1% [5–7]. The accuracy of reported prevalence estimates has been questioned due to limited public health surveillance capacity in Guatemala [8]. Accurate prevalence estimates from distinct regions and subgroups help to paint a more complete picture of hypertension burden in Guatemala, where statistics on hypertension prevalence among Indigenous people are limited. The present study set out to determine the prevalence of hypertension, overall and by sociodemographic factors, in a large

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clinical population of 13,873 primarily rural and Indigenous Guatemalan women. Data were collected from electronic health records.

Methods

Overview

We conducted a retrospective chart review using data from a non-governmental, community-based primary care program serving adult women from a microfinance program that operates in nine Central and Western departments in Guatemala. Ethics approval was obtained from the Wuqu' Kawoq (WK) Institutional Review Board (WK-2022-004). Informed consent was waived as it was determined that the study posed minimal risk and could not be practically carried out without the waiver. Study size was limited by the number of available medical records for which hypertension data was available. Patients had systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements taken upon enrollment in the program, and at subsequent health visits as needed.

Inclusion and exclusion criteria

Patients from the clinical program were included in the study if they had at least one medical record entry between July 1, 2015 and December 31, 2022 for which a hypertension reading was available or a blood pressure lowering medication was recorded and at which time the patient was at least 18 years of age. There were no exclusion criteria.

Data extraction

We extracted electronic health record and administrative data from within the given timeframe. Electronic health record data were extracted using automated Structured Query Language (SQL) search routines with assistance from Wuqu' Kawoq information technology staff.

Arrival at analytical N

Automated SQL search yielded 14,056 patient observations (1 observation per patient). Twenty-six invalid patient observations were dropped (e.g. due to invalid medical record number or duplicate record). One hundred and fifty-seven observations were dropped due to missing SBP, missing DBP and no blood pressure lowering medications recorded. The final analytical dataset contained 13,873 observations.

Definition of hypertension

We defined hypertension to align with American Heart Association (AHA) guidance [9] as 1) current use of a blood pressure lowering medication, or 2) a systolic blood pressure of 130 mmHg or higher, or a diastolic blood pressure of 80 mmHg or higher using the most recently recorded value in the medical record. We also included a modified definition of this main definition in which thresholds of 140 mmHg systolic blood pressure and 90 mmHg diastolic blood pressure were used to allow for comparison with studies that used those thresholds.

Variables

The outcome variable of interest was hypertension, as defined above. Patient characteristic variables included age group, body mass index (BMI) category, preferred language (Spanish or Mayan language), residence (rural or urban) and economic status. Body mass index was calculated by dividing weight (kg) by squared height (m) using anthropometric measurements. Body mass index category was defined using standard cutoffs for underweight (< 18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2) and obesity (30+ kg/m^2). Economic status was assessed using the Poverty Probability Index (PPI) for Guatemala, which uses asset ownership to predict the probability of poverty [10].

Statistical analysis

We calculated crude and age-adjusted hypertension prevalence overall and by patient characteristics using the main definition of hypertension given above as well as for the modified definition. We age-standardized prevalence estimates to the World Health Organization (WHO) reference population [11]. Absolute differences and relative differences (as risk ratios) in hypertension prevalence were computed within levels of each characteristic. We used multiple imputation with chained equations to impute missing data on patient characteristics (50 iterations). Results were reported with 95% confidence intervals [12]. We used StataNow/SE 18.5.

Results

The final dataset for analysis included 13,873 patient observations. As shown in Table 1, the clinical population studied was largely Indigenous (90.2%), rural (85.2%) and Mayan language speaking (59.1%) with a median age of 40 (IQR, 31–51) and a median BMI of 27.3 (IQR, 24.1–30.9). Approximately 30% of the women were classified as obese and 1% underweight. A high percentage of data were missing for language (20.4%), setting (44.0%) and economic status (42.5%). Based on the threshold of $3.65 2017 purchasing power parity (PPP), poverty likelihood for each quantile was as follows: quantile 1 (43.6% or greater), quantile 2 (30.0% to 42.2%), quantile 3 (15.1% to 28.8%) and quantile 4 (14.3% or less).

As shown in Fig. 1, overall prevalence of hypertension was 16.3% (95% CI 15.7–17.0%) and age-adjusted prevalence was 16.0% (95% CI 15.3–16.8%). 79% of those classified as hypertensive were previously undiagnosed. Hypertension prevalence increased with age and BMI.

Table 1 Demographic characteristics of a clinical population of 13,873 primarily rural and Indigenous women in Guatemala

Age, median (IQR)	Total (*n* = 13,873) median (interquartile range) *n* (%)	Hypertension (*n* = 2,268)	No hypertension (*n* = 11,605)	Missing *n* (%)
	40 (31–51)	**50 (39–59)**	**38 (30–48)**	**0 (0.0)**
Number of children, median (IQR)	3 (2–5)	4 (2–6)	3 (2–5)	601 (4.3)
BMI, median (IQR)	27.3 (24.1–30.9)	29.3 (26.1–33.0)	26.9 (23.9–30.3)	208 (1.5)
BMI Class				208 (1.5)
Underweight (BMI < 18.5)	143 (1.1)	7 (0.3)	136 (1.2)	
Normal weight (BMI 18.5–24.9)	4,116 (30.1)	416 (18.6)	3,700 (32.4)	
Overweight (BMI 25–29.9.9)	5,279 (38.6)	816 (36.6)	4,463 (39.0)	
Obese (BMI > = 30)	4,127 (30.2)	993 (44.5)	3,134 (27.4)	
Ethnicity				2 (0.0)
Indigenous	12,515 (90.2)	1,951 (86.1)	10,564 (91.0)	
Not indigenous	1,356 (9.8)	316 (13.9)	1,040 (9.0)	
Language				2,833 (20.4)
Mayan language	6,522 (59.1)	935 (53.3)	5,587 (60.2)	
Spanish	4,518 (40.9)	820 (46.7)	3,698 (39.8)	
Setting				6,108 (44.0)
Rural	6,617 (85.2)	1,029 (80.5)	5,588 (86.2)	
Urban	1,148 (14.8)	250 (19.6)	898 (13.9)	
Economic Status[1] (Quartiles)				5,899 (42.5)
1 (Most likely in poverty)	2,127 (26.7)	274 (19.8)	1,853 (28.1)	
2	1,889 (23.7)	294 (21.3)	1,595 (24.2)	
3	2,502 (31.4)	445 (32.2)	2,057 (31.2)	
4 (Least likely in poverty)	1,456 (18.3)	368 (26.7)	1,088 (16.5)	

[1]As assessed by Poverty Probability Index (PPI)

Indigenous women and women who spoke Mayan languages both had approximately 20% lower prevalence of hypertension than non-Indigenous and Spanish-speaking women, respectively. In general, hypertension prevalence increased as likelihood of poverty decreased. Among those classified as hypertensive who had a second blood pressure reading available, 53% had elevated blood pressure on the second reading. When thresholds of 140 mmHg and 90 mmHg were used for systolic and diastolic blood pressure, respectively, rather than the American Heart Association thresholds of 130 mmHg and 90 mmHg, overall hypertension prevalence was 5.4% (95% CI 5.0–5.8.0.8%) and age-adjusted prevalence was 6.0% (95% CI 5.4–6.6%).

Discussion

Estimated crude hypertension prevalence of 16.3% among women in this analysis was lower than recent hypertension prevalence estimates in Guatemala. A representative survey of adults from two rural Indigenous municipalities, which used a diagnostic threshold of 140/90 mmHg, estimated crude hypertension prevalence of 23.8% (95% CI 17.1% – 23.95%) in women and 16.9% (95% CI 11.4% – 22.4%) in men [6]. The Pan American Health Association Organization (PAHO) reported hypertension prevalence of 22.0% in men and 20.4% in women in Guatemala [7]. Methodological details were not reported. Finally, data from a representative, cross-sectional survey in Guatemala estimated prevalence of hypertension among women at 41.1% (95% CI, 37.7% – 44.4%) using AHA guidelines [5].

We discuss possible explanations for the lower hypertension prevalence observed in this clinical population compared with previous estimates in Guatemala. First, methodological details, including hypertension definitions and measurement procedures, differed among studies. Second, the clinical population in our analysis is not representative of the broader population, consisting of only women, the majority of whom are rural and Indigenous, and all of whom had to meet eligibility criteria for a microfinance program that recruits in some of the most remote areas of Central and Western Guatemala.

Lifestyle and environmental factors specific to these areas, such as decreased reliance on automobiles, may partly explain the lower hypertension prevalence observed. In Guatemala, migration from rural areas to urban areas has been associated with worsened cardiometabolic health markers, as well as with more sedentary lifestyles and less healthful dietary patterns [13]. If such factors do partly explain the lower prevalence of hypertension in this clinical population, it is unlikely that they are mediated by reductions in BMI given that 69% of the women were categorically overweight or obese by BMI.

Additionally, our findings indicate that hypertension prevalence is lower among women who are Indigenous, women who speak Mayan languages and women who are more likely to be poor. It is possible that these factors may offer some protective effect, but definitive conclusions cannot be drawn given the cross-sectional study design and high percentages of missing data. Contrary to our findings, a nationally representative analysis found similar hypertension prevalence among Indigenous and

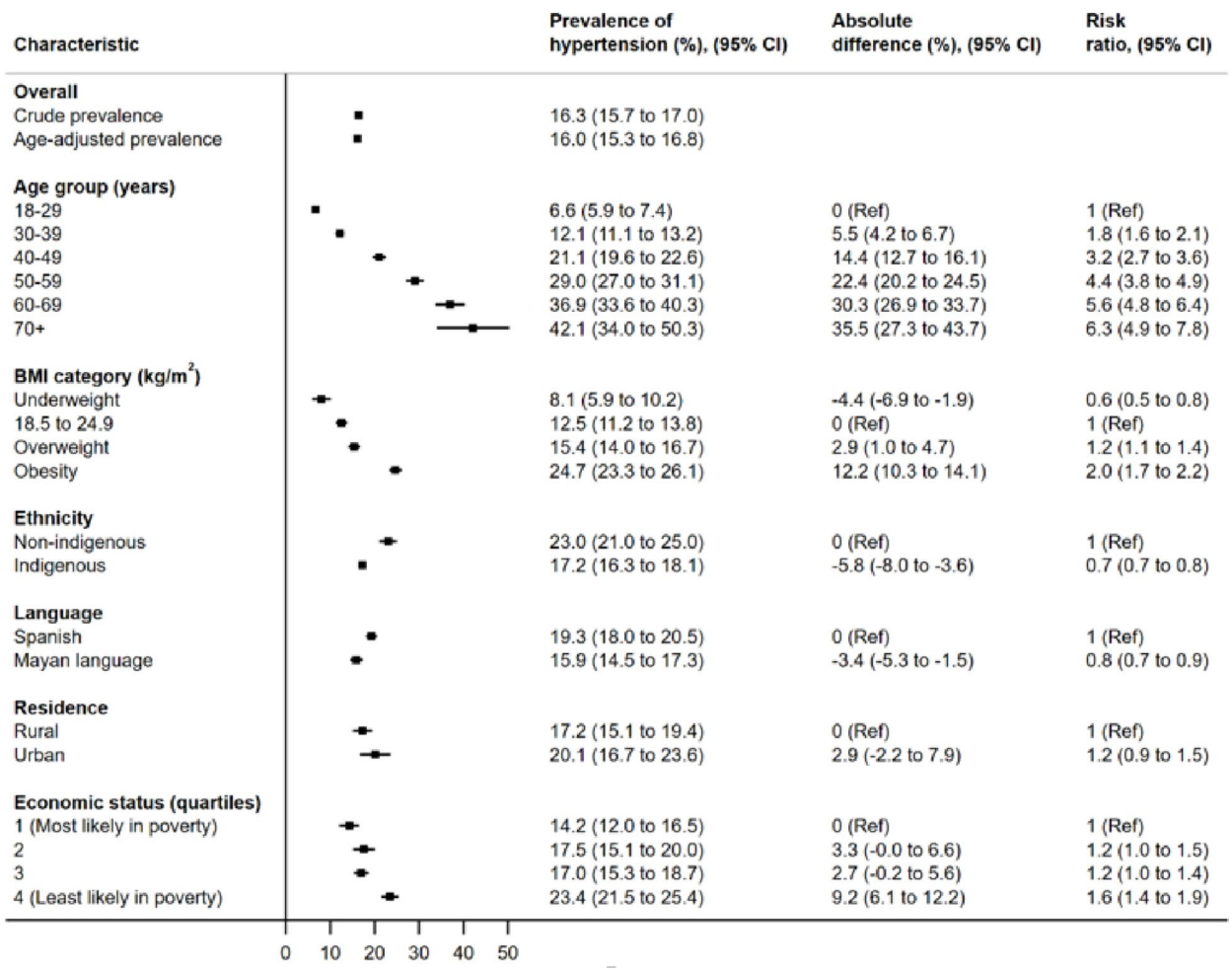

Fig. 1 Prevalence of hypertension in a clinical population of primarily rural and Indigenous women in Guatemala, overall and by demographic characteristic

non-Indigenous women and decreasing prevalence with increasing socioeconomic status [5].

In conclusion, we determined that the prevalence of hypertension in a large clinical population of primarily rural and Indigenous Guatemalan women was 16.3%, and age-adjusted prevalence was 16.0%. Characteristics associated with higher prevalence of hypertension included more advanced age, higher body mass index, non-Indigenous ethnicity, Spanish language preference and lower likelihood of poverty. Public health planning efforts should consider these findings.

Limitations

A major limitation of this study is that the clinical population was not drawn from a representative sampling frame, limiting generalizability to broader populations. Another significant limitation is the use of a single blood pressure reading to define hypertension, resulting in higher prevalence estimates than would have resulted had multiple readings been used. We attempted to address this by reporting the percentage of women who had an elevated blood pressure on a second reading, when available. Another limitation was the high degree of missing data for certain variables, most notably poverty, language and setting which limit interpretation of hypertension prevalence in these subgroups. While this study has significant limitations, the large number of available observations for the analysis is a major strength, allowing for narrower confidence intervals and providing sufficient power to meaningfully assess differences in prevalence across subgroups.

Abbreviations

CI	Confidence Interval
mmHg	Millimeter(s) of mercury
WK	Wuqu'Kawoq
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
SQL	Structured Query Language
MRN	Medical record number
AHA	American Heart Association
BMI	Body mass index
PPI	Poverty Probability Index

WHO World Health Organization
IQR Interquartile range
PAHO Pan American Health Organization

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Author contributions
PR conceptualized the work, extracted the data from the medical record and performed initial data cleaning. YJM and CS made substantial contributions to the acquisition of the data. SA cleaned and analyzed the data and drafted the manuscript. All authors critically reviewed the work for important intellectual content.

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Data availability
The datasets generated and analyzed during the current study are not publicly available due to privacy concerns. Data requests should be directed to the corresponding author. Statistical code is available at the Harvard Dataverse ([https://doi.org/10.7910/DVN/SNVDEF] (https:/doi.org/10.7910/DVN/SNVDEF)).

Declarations

Ethics approval and consent to participate
Ethics approval was obtained from the Wuqu' Kawoq Institutional Review Board (WK-2022-004), and informed consent was waived.

Consent for publication
Not applicable.

Competing interests
Stephen Alajajian and Peter Rohloff have received financial support from the National Institutes of Health.

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