

Global Hypertension 2000 to 2020

Trends, Disparities, and Progress in Awareness, Treatment, and Control

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ABSTRACT

BACKGROUND Hypertension is the leading preventable risk factor for premature death worldwide. Accurate estimates of prevalence and control are critical for developing public health priorities.

OBJECTIVE This study sought to examine global variations in hypertension prevalence, awareness, treatment, and control by world economic region and compare secular changes from 2000 to 2020.

METHODS A systematic search of MEDLINE from January 1995 to November 2024 was supplemented with manual searches of article references. Population-based cross-sectional surveys reporting age- and sex-specific hypertension prevalence and using standardized blood pressure measurement methods were included. Sex- and age-specific prevalence by country was applied to population counts to calculate the number with hypertension regionally and worldwide. Country-specific percentages of awareness, treatment, and control were applied to numbers of adults with hypertension to obtain regional and global estimates. Hypertension was defined as mean systolic blood pressure ≥ 140 mm Hg, diastolic blood pressure ≥ 90 mm Hg, or use of antihypertensive medication.

RESULTS We included 287 studies conducted in 6,060,567 adults from 119 countries. In 2020, 33.0% (95% CI: 32.5%-33.5%), or 1.71 (95% CI: 1.65-1.77) billion, of the world's adults had hypertension: 30.1% (95% CI: 29.4%-30.9%), or 395 (95% CI: 394-396) million, in high-income countries and 33.4% (95% CI: 32.8%-33.9%), or 1.32 (95% CI: 1.26-1.38) billion, in low- and middle-income countries. From 2000 to 2020, age-standardized prevalence decreased by 2.7% and absolute burden increased by 76 million in high-income countries compared with increases of 5.8% in prevalence and 651 million in absolute burden in low- and middle-income countries. From 2000 to 2020 in high-income countries, awareness increased from 57.7% to 69.2%, treatment from 42.9% to 66.3%, and control from 16.4% to 40.2%. More modest increases were observed in low- and middle-income countries: awareness from 29.1% to 46.1%, treatment from 20.7% to 30.8%, and control from 6.4% to 13.6%.

CONCLUSIONS The burden of hypertension is increasing, as are disparities between high-income countries and low- and middle-income countries. Urgent efforts are needed to address hypertension worldwide, particularly in low- and middle-income countries. (JACC. 2026;■:■-■) © 2026 by the American College of Cardiology Foundation.

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**ABBREVIATIONS
AND ACRONYMS****BP** = blood pressure**DBP** = diastolic blood pressure**HICs** = high-income countries**LMICs** = low- and
middle-income countries**SBP** = systolic blood pressure**NCDs** = noncommunicable
diseases

High blood pressure (BP) is the leading preventable risk factor for premature death and disability globally, accounting for 10.8 million deaths in 2019.¹⁻⁴ Understanding the burden of hypertension worldwide is critical for prevention and treatment efforts.

Our previous analysis found that from 2000 to 2010 hypertension prevalence decreased and awareness, treatment, and control increased in high-income countries (HICs), whereas in low- and middle-income countries (LMICs), prevalence increased and minimal improvement was made in awareness, treatment, and control.⁵ Further, in 2010, more than 3 times as many people had hypertension in LMICs compared with HICs, and hypertension control rates were low worldwide, particularly in LMICs.⁵

A report on hypertension from 1990 to 2019 is consistent with our previous findings of continued increases in the absolute burden of hypertension globally and some improvement in control of hypertension.⁶ However, this analysis included estimates with nonstandardized BP measurements and from cohort studies with repeated assessments, potentially leading to overestimation of awareness, treatment, and control compared with findings from general population estimates. Given the importance of hypertension prevention and control for reducing morbidity and mortality worldwide, an updated population-based analysis is needed to estimate the global burden of hypertension and trends over time using rigorous inclusion criteria for accurate estimates. The goal of this study was to examine global variations of hypertension prevalence, awareness, treatment, and control by economic region in 2020 and compare secular trends from 2000 to 2020.

METHODS**LITERATURE SEARCH AND STUDY SELECTION.**

MEDLINE was searched via PubMed from January 1, 2015, to November 12, 2024, with additional studies identified by manual review of references cited in reviews, meta-analyses, and original studies.⁵⁻⁸ Search terms included “hypertension” or “blood pressure” or “hypertension awareness” or “hypertension treatment” or “hypertension control” and “prevalence” or “cross-sectional studies.” The search was limited to studies conducted in humans, and no language restrictions were applied. The following eligibility criteria were applied for peer-reviewed studies: population-based cross-sectional survey in

adults aged ≥ 20 years that reported sex-specific hypertension prevalence; use of standardized BP measurement methods; and hypertension defined as average systolic blood pressure (SBP) ≥ 140 mm Hg, average diastolic blood pressure (DBP) ≥ 90 mm Hg, or currently taking antihypertensive medication. All eligible nationally representative samples were used. If no nationally representative study was available, data from multisite or regional studies were included. If no peer-reviewed studies were available for a country, unpublished reports meeting our inclusion criteria were used if they met the following BP measurement requirements: patients rest at least 5 minutes before BP measurements; at least 2 BP measurements were taken; and BP was measured using a device that met the International Organization for Standardization (ISO) standard for clinical validation. Studies were included in the 2000, 2010, and 2020 analyses if data were collected between 1995 and 2004, 2005 and 2014, and 2015 or later, respectively. Study selection and data abstraction were conducted independently by 2 reviewers with standardized protocol and data collection forms. Discrepancies were resolved by a third reviewer.

Percentages of hypertension awareness, treatment, and control were abstracted from all studies that reported them. Hypertension awareness was defined as self-reported diagnosis of hypertension among those with hypertension, treatment as self-reported use of antihypertensive medication among those with hypertension, and control as SBP < 140 mm Hg and DBP < 90 mm Hg among those with hypertension and among those treated for hypertension.

COUNTRY-SPECIFIC PREVALENCE ESTIMATES.

Countries were grouped into regions using the World Bank classification system, which groups the high-income countries into 1 region and the low- and middle-income countries into 6 geographic regions: high-income economies, East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and sub-Saharan Africa.⁹ Prevalence data were obtained in 10-year age groups (20-29, 30-39, etc). If studies did not report prevalence data in the age groups of interest, age-specific prevalence was imputed using logistic regression models for each sex in each region separately. Predictive models of the relationship between age and prevalence were generated from studies with age-specific data within each region-sex subgroup. Mean age and sex-specific

prevalence from each study with missing age-specific prevalence were used to calibrate age-specific prevalence estimates for each country. Age was incorporated as a continuous variable, and the relationship between age and prevalence was assumed to be linear on the log-odds scale.¹⁰ To account for uncertainty in the estimation of age-specific prevalence data, Monte Carlo methods with 40 simulations per estimate were used.^{11,12} The 2.5th and 97.5th percentiles were used to form 95% CIs.¹³ Predictive models were generated separately for 2020, 2010, and 2000.

COUNTRY-SPECIFIC AWARENESS, TREATMENT, AND CONTROL ESTIMATES. Sex-specific percentages of awareness, treatment, and control were used in our analyses. For studies that did not include participants in the full adult age range, the proportion of awareness, treatment, and control was estimated for the entire age range using sex-specific predictive models with median age and awareness, treatment, and control within each age and sex group from studies reporting them. Models were created for 2020, 2010, and 2000 HICs and LMICs, separately.

STATISTICAL ANALYSIS. For countries with multiple nationally representative studies within the same calendar period, random-effects meta-analysis was conducted to obtain pooled estimates for age- and sex-specific prevalence and sex-specific awareness, treatment, and control. Multiple imputation by chained equations with random forests was used to obtain estimates for countries without available data.¹⁴ This method is robust for imputing missing data in complex data sets.¹⁵ Country-specific data from the World Bank, including current health expenditure, life expectancy, adult mortality rate, undernourishment, rural residence, unemployment, gross domestic product, gross national income per capita, and education were used for multiple imputation. Indicators were selected based on data availability and their likely association with prevalence of hypertension.

To estimate prevalence and absolute burden in 2000, 2010, and 2020 by world region, sex- and age-specific prevalences of hypertension for each country were applied to United Nations population counts for the corresponding years to estimate the number of adults with hypertension in each country by sex and age group.¹⁶ The number of adults with hypertension in each country was summed to calculate the number in each region, and the regional numbers were added to obtain the worldwide count. Sex- and age-specific regional prevalences of hypertension

KEY POINTS

Question: How large are global disparities in hypertension prevalence and control trends from 2000 to 2020?

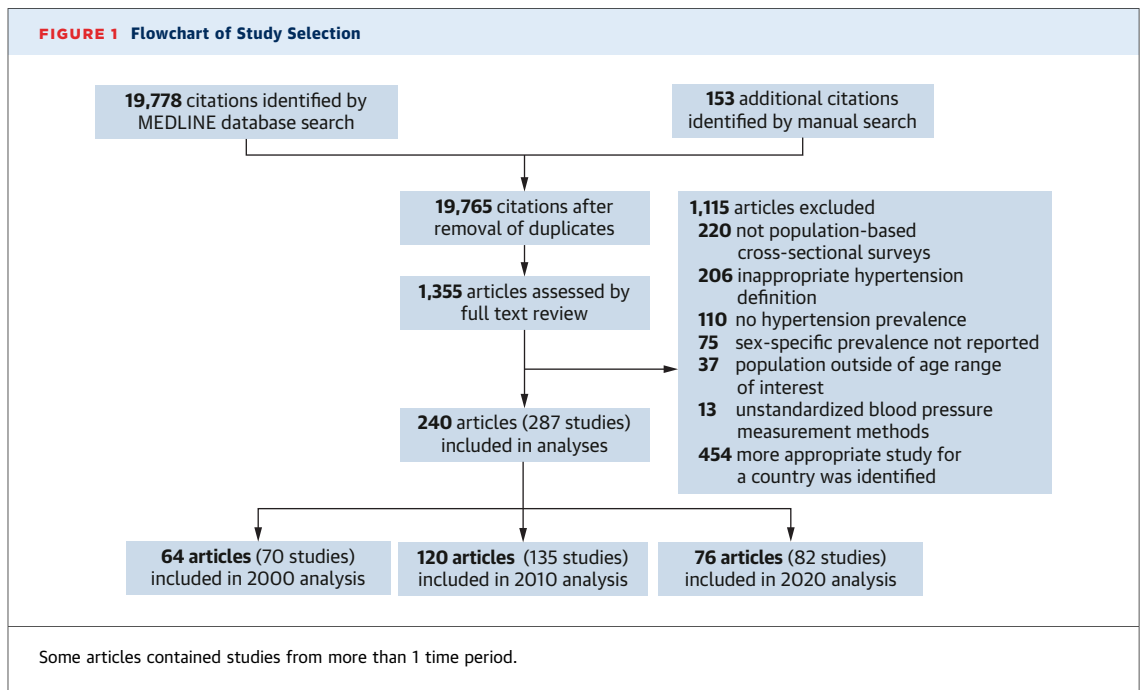
Findings: In this systematic analysis of 287 population-based studies with 6,060,567 adults from 119 countries representing trends from 2000 to 2020, hypertension prevalence decreased slightly in high-income countries (HICs) (-2.7%) while increasing in low- and middle-income countries (LMICs) (+5.8%), and control rates are increasing much faster in HICs (+23.8%) than LMICs (+7.2%). As a result, disparities between HICs and LMICs are increasing, with 83% of those with uncontrolled hypertension living in LMICs in 2020 (increased from 70% in 2000).

Meaning: Disparities in hypertension burden and control are large and increasing between HICs and LMICs. Urgent efforts are needed to address hypertension, worldwide, particularly in LMICs.

were calculated by dividing the total number of adults with hypertension in each region by the number of people living in that region from each sex and age group. Worldwide prevalence was estimated by dividing the total number of adults with hypertension by the total adult population. Prevalence of hypertension within each region and worldwide were age-standardized to the 2020 world population, using the direct method.¹⁷

Regional and global proportions of hypertension awareness, treatment, and control in 2000, 2010, and 2020 were estimated by applying proportions of hypertension awareness, treatment, and control to the number of adults with hypertension in each country in 2000, 2010, and 2020 by sex. These numbers were summed within regions and globally and then divided by the total number of adults with hypertension in each region and worldwide. The number of adults with controlled hypertension was also divided by the number of adults with treated hypertension.

Standard errors for all estimates were abstracted from those studies that report them. Standard errors for prevalence estimates obtained by logistic regression were estimated using Monte Carlo simulations.¹⁸ For the remaining estimates, standard errors were obtained through multiple imputation. The standard errors for the numbers of persons with hypertension within a region and worldwide were then estimated with Taylor series approximation methods and used to calculate 95% CIs.¹⁹ Nonlinear relationships between the proportion of hypertension control and time were assessed using cubic splines. Analyses were conducted using SAS version 9.4 and R statistical software packages "micranger" and "splines."



RESULTS

Of the 19,765 articles identified by database and manual searching, 1,355 underwent full-text review, and 240 articles (287 studies) from 119 countries with a combined sample size of 6,060,567 adults were included in analyses (Figure 1). Hypertension prevalence analyses included 82 studies with 3,079,337 participants in 2020, 135 studies with 2,580,899 participants in 2010, and 70 studies with 400,331 participants in 2000. In the 2020 analysis, 37.8% of studies were from HICs, 62.2% from LMICs, and 80.5% were nationally representative (Supplemental Table 1). In the 2010 analysis, 34.8% were from HICs, 65.2% were from LMICs, and 77.8% were nationally representative (Supplemental Table 2). In the 2000 analysis, 34.3% of studies were from HICs, 65.7% from LMICs, and 48.6% were nationally representative (Supplemental Table 3). Hypertension awareness, treatment, and control were reported for 24 countries (10 HICs and 14 LMICs) in 2020, 57 countries (22 HICs and 35 LMICs) in 2010, and 26 countries (13 HICs and 13 LMICs) in 2000.

Table 1 and the Central Illustration provide a summary of hypertension prevalence, awareness, treatment, and control globally and in HICs and LMICs for 2000, 2010, and 2020.

DISPARITIES IN HYPERTENSION PREVALENCE AND ABSOLUTE BURDEN IN 2020. The age-standardized global prevalence of hypertension in 2020 was

33.0% (95% CI: 32.5%-33.5%) overall, 33.5% (95% CI: 32.9%-34.1%) in men and 32.3% (95% CI: 31.7%-32.9%) in women (Table 2). The age-standardized prevalence was 30.1% (95% CI: 29.4%-30.9%) in HICs compared with 33.4% (95% CI: 32.8%-33.9%) in LMICs. The highest age-standardized prevalence of hypertension in 2020 was in Latin America and the Caribbean (38.1% in men and 37.5% in women) and sub-Saharan Africa (37.6% in men and 40.6% in women) (Figure 2A).

An estimated 1.71 billion (95% CI: 1.65-1.77 billion) adults had hypertension worldwide in 2020. More than 3 times as many adults with hypertension lived in LMICs (1.32 billion [95% CI: 1.26-1.38 billion]) compared with HICs (395 million [95% CI: 394-396 million]). Prevalence increased with age in all regions; however, although in HICs the greatest absolute burden is in those ≥ 70 years of age, in LMICs the greatest absolute burden is in those ages 40 to 59 years (Supplemental Table 4). The highest absolute burden of hypertension in 2020 was in East Asia and Pacific (265 million men and 245 million women) (Figure 3A).

TRENDS AND DISPARITIES IN HYPERTENSION PREVALENCE AND ABSOLUTE BURDEN CHANGES: 2000 TO 2020. Globally, the age-standardized prevalence of hypertension increased from 29.2% (95% CI: 28.7%-29.7%) in 2000 to 33.0% (95% CI: 32.5%-33.5%) in 2020, representing a net increase of 3.8%. During the same period, the prevalence of

hypertension in HICs slightly decreased from 32.8% (95% CI: 32.0%-33.6%) in 2000 to 30.1% (95% CI: 29.4%-30.9%) in 2020. In contrast, the prevalence of hypertension in LMICs substantially increased from 27.6% (95% CI: 27.0%-28.2%) in 2000 to 33.4% (95% CI: 32.8%-33.9%) in 2020 (Table 2, Figure 4A).

The global absolute burden of hypertension increased by 727 million from 2000 to 2020 (Table 2). Close to 90% of this increase is in LMICs, in which the absolute burden increased by 651 million compared with an increase of only 76 million in HICs. Prevalence estimates and absolute burden in 2010 and 2000 by world region are presented in Supplemental Tables 5 and 6 and Supplemental Figures 2 and 3. Prevalence estimates for individual countries in 2020, 2010, and 2000 are available in Supplemental Tables 7 to 9, respectively.

DISPARITIES IN HYPERTENSION AWARENESS, TREATMENT, AND CONTROL, 2000 TO 2020. In 2020, just more than one-half of all adults with hypertension worldwide were aware of their conditions (51.5% [95% CI: 50.7%-52.2%]) (Table 1, Supplemental Table 10). Awareness of hypertension is higher in HICs (69.2% [95% CI: 68.6%-69.8%]) compared with LMICs (46.1% [95% CI: 45.2%-47.1%]). From 2000 to 2020, awareness increased moderately in both HICs (+11.5%) and LMICs (+17%). The proportion of awareness remained consistently higher in HICs compared with LMICs over time (Figure 4B).

In 2020, the global proportion of those with hypertension who were treated was 39.0% (38.3%-39.7%) (Table 1, Supplemental Table 10). The percentage being treated was twice as high in HICs (66.3% [65.3%-67.3%]) compared with LMICs (30.8% [30.0%-31.6%]). From 2000 to 2020, the percentage of treatment in HICs was consistently double that of LMICs (Figure 4C).

In 2020, the percentage of adults with hypertension who had their BP controlled was only 19.7% (95% CI: 19.2%-20.3%) (Table 1, Supplemental Table 10). The percentage was nearly 3 times higher in HICs (40.2% [95% CI: 39.1%-41.3%]) compared with LMICs (13.6% [95% CI: 13.0%-14.2%]) (Figures 4D and 5). Over the 20-year period of 2000 to 2020, disparities in hypertension control widened, as hypertension control improved steadily in HICs, whereas improvements in LMICs were minimal (Figure 6). In 2000, 891 million adults had uncontrolled hypertension worldwide: 266 million (29.9%) in HICs and 625 million (70.1%) in LMICs. By 2020, the absolute burden of uncontrolled hypertension had grown to 1,375 million worldwide: 236 million (17.2%) in HICs and 1,139 million (82.8%) in LMICs.

TABLE 1 Hypertension Prevalence, Awareness, Treatment, and Control by Economy and Year, 2000-2020

	2000	2010	2020
	Prevalence		
Global	29.2 (28.7-29.7)	31.2 (30.7-31.7)	33.0 (32.5-33.5)
High-income	32.8 (32.0-33.6)	31.3 (30.6-32.1)	30.1 (29.4-30.9)
Low and middle income	27.6 (27.0-28.2)	30.9 (30.4-31.5)	33.4 (32.8-33.9)
	Awareness		
Global	38.3 (37.4-39.2)	45.6 (44.7-46.5)	51.5 (50.7-52.2)
High income	57.7 (57-58.4)	67.2 (65.8-68.6)	69.2 (68.6-69.8)
Low and middle income	29.1 (27.7-30.4)	37.9 (36.8-39.0)	46.1 (45.2-47.1)
	Treatment		
Global	27.9 (27.0-28.7)	36.3 (35.5-37.2)	39.0 (38.3-39.7)
High income	42.9 (42.2-43.6)	56.4 (55.0-57.8)	66.3 (65.3-67.3)
Low and middle income	20.7 (19.5-21.9)	29.1 (28.0-30.2)	30.8 (30.0-31.6)
	Control ^a		
Global	33.3 (32.5-34.2)	39.3 (38.2-40.3)	45.1 (44.5-45.6)
High income	37.8 (36.8-38.7)	49 (47.6-50.3)	57.9 (57.0-58.8)
Low and middle income	28.9 (27.5-30.3)	32.5 (31.0-34.0)	36.8 (36.2-37.4)
	Control ^b		
Global	9.6 (9.2-10.0)	14.4 (13.8-15.0)	19.7 (19.2-20.3)
High income	16.4 (15.9-17.0)	28.5 (27.8-29.3)	40.2 (39.1-41.3)
Low and middle income	6.4 (5.9-6.8)	9.4 (8.6-10.1)	13.6 (13.0-14.2)


Values are percentages (95% CIs). Hypertension is defined as average systolic blood pressure \geq 140 mm Hg, average diastolic blood pressure \geq 90 mm Hg, or use of antihypertensive medication. Awareness is defined as self-reported previous diagnosis of hypertension among those with hypertension. Treatment is defined as self-reported antihypertensive medication use among those with hypertension. Control is defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg among those self-reporting treatment^a and among all participants with hypertension.^b

Trends in hypertension control over time were consistent for men and women (Figure 6). In 2020, women had higher percentages of awareness, treatment, and control compared with men (Figure 7).

DISCUSSION

Prevalence of hypertension is decreasing slightly in HICs whereas it is increasing in LMICs, and control rates are increasing much faster in HICs than LMICs. As a result, disparities between HICs and LMICs are increasing, with 83% of those with uncontrolled hypertension living in LMICs (increased from 70% in 2000). Between 2000 and 2020, prevalence of hypertension increased by 3.8% globally, driven by a 5.8% increase in LMICs. Globally, hypertension control to BP <140/90 mm Hg remains low but has improved progressively. Awareness and treatment of hypertension are increasing globally but remain consistently lower in LMICs compared with HICs. These findings are consistent with the results of previous work and document a persistent disparity that has become even more striking in recent years.⁵⁻⁷ Building on previous research, these results underscore the increasing burden of

CENTRAL ILLUSTRATION Global Hypertension 2000 to 2020: Trends, Disparities, and Progress in Awareness, Treatment, and Control



Global hypertension prevalence, defined as systolic BP ≥ 140 , diastolic BP ≥ 90 , or use of antihypertensive medications, increased from 29.2% in 2000 to 33.0% in 2020, with widening disparities in control—83% of uncontrolled cases now occur in low- and middle-income countries (LMICs).

One of the most comprehensive analyses of global hypertension trends using standardized blood pressure measurements across 119 countries, highlighting persistent and growing inequities between high-income countries (HICs) and LMICs over two decades.

STUDY DESIGN & POPULATION



Systematic review and pooled analysis of 287 population-based, cross-sectional surveys



6,060,567 adults aged ≥ 20 years



119 countries



Data grouped by World Bank income classification:

- (1) High-income countries (HICs)
- (2) LMIC regions:
 - East Asia and Pacific
 - Europe and Central Asia
 - Latin America and the Caribbean
 - Middle East and North Africa
 - South Asia
 - Sub-Saharan Africa

RESULTS



33% or 1.71 billion of the world's adults had hypertension in 2020.



LMICs account for nearly all increases in cases

Trends in hypertension, 2000-2020

	HICs	Prevalence	LMICs
2000	33%		28%
2010	31%		31%
2020	30%		33%

Awareness

2000	58%	29%
2010	67%	38%
2020	69%	46%

Treatment

2000	43%	21%
2010	56%	29%
2020	66%	31%

Control

2000	16%	6%
2010	29%	9%
2020	40%	14%

TABLE 2 Global Age-Standardized Prevalence Estimates and Absolute Numbers of Those With Hypertension by Sex and National Income Level, 2000-2020

	Prevalence, % (95% CI)			Absolute Numbers in Millions (95% CI)		
	2000	2010	2020	2000	2010	2020
Global						
Overall	29.2 (28.7-29.7)	31.2 (30.7-31.7)	33.0 (32.5-33.5)	986 (971-1000)	1,324 (1,310-1,338)	1,713 (1,652-1,774)
Men	29.4 (28.8-30.0)	31.7 (31.2-32.3)	33.5 (32.9-34.1)	484 (473-495)	656 (646-666)	846 (815-878)
Women	28.8 (28.2-29.4)	30.6 (30.0-31.1)	32.3 (31.7-32.9)	502 (493-511)	668 (659-677)	866 (815-918)
High-Income Countries						
Overall	32.8 (32.0-33.6)	31.3 (30.6-32.1)	30.1 (29.4-30.9)	319 (317-320)	351 (348-354)	395 (394-396)
Men	33.9 (33.0-34.8)	33.3 (32.4-34.2)	32.8 (31.9-33.7)	150 (149-151)	171 (169-173)	197 (196-197)
Women	31.4 (30.5-32.3)	29.0 (28.1-29.9)	27.2 (26.3-28.0)	168 (168-169)	180 (178-182)	198 (198-199)
Low- and Middle-Income Countries						
Overall	27.6 (27.0-28.2)	30.9 (30.4-31.5)	33.4 (32.8-33.9)	667 (652-681)	973 (960-987)	1,318 (1,257-1,379)
Men	27.7 (27.0-28.3)	31.0 (30.4-31.7)	33.5 (32.8-34.1)	334 (322-345)	485 (475-495)	650 (645-655)
Women	27.4 (26.7-27.7)	30.6 (30.0-31.3)	33.2 (32.5-33.8)	333 (324-342)	488 (479-497)	668 (617-720)

Hypertension is defined as average systolic blood pressure ≥ 140 mm Hg, average diastolic blood pressure ≥ 90 mm Hg, or use of antihypertensive medication, National income level is defined according to the World Bank classification system.

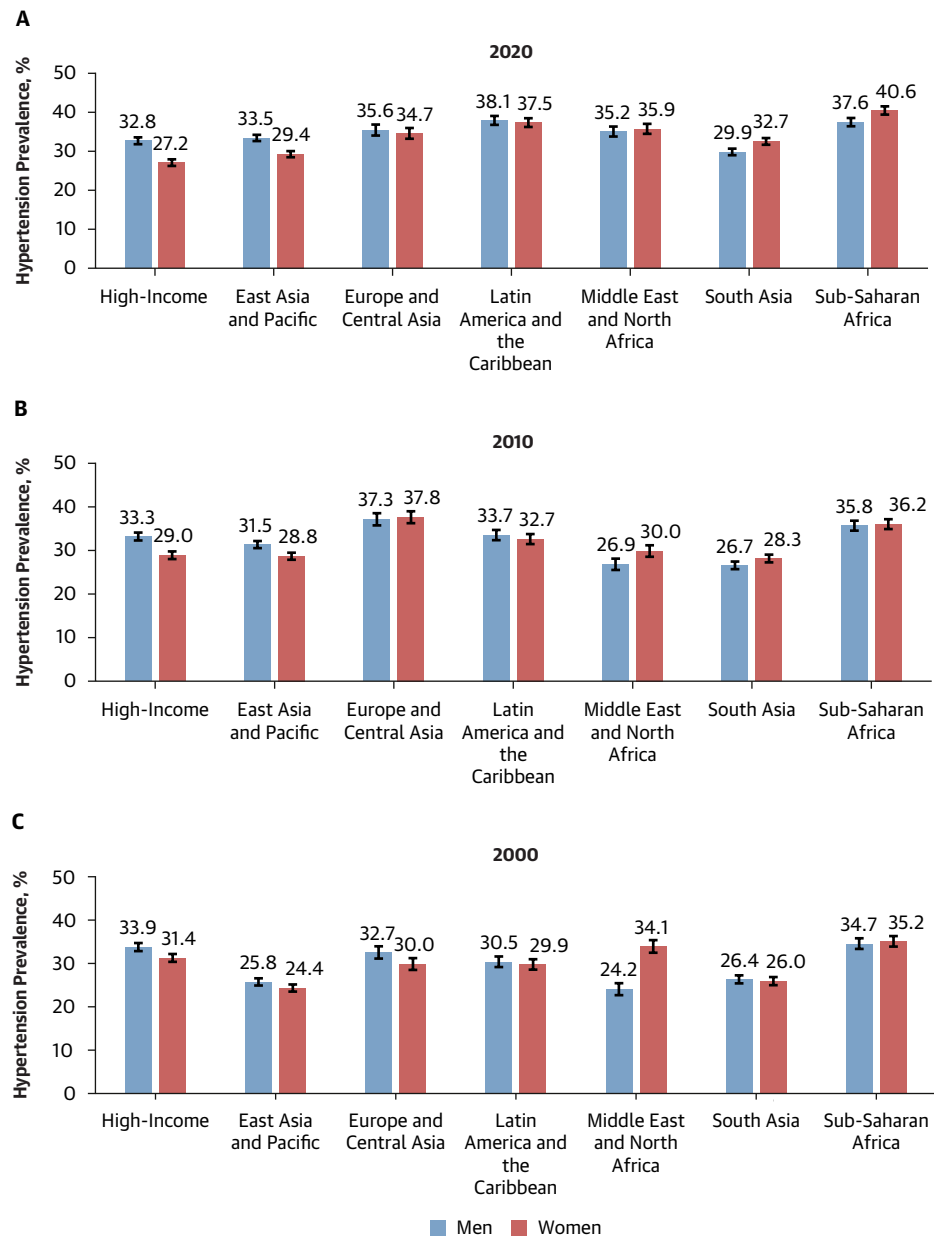
uncontrolled hypertension and its disproportionate impact on LMICs, in which disparities compared with HICs continue to widen. Following current trends, the number of people with hypertension will continue to increase, and, unless urgent action is taken, particularly in LMICs, the vast majority will be of working age and at risk for preventable heart attacks, strokes, and dementia.

Although hypertension prevalence decreased moderately in HICs (-2.7%), it increased substantially in LMICs (+5.8%) over the 20-year period. Further, the absolute burden of hypertension has risen steadily, with close to 90% of the increase in LMICs, driven both by increasing prevalence and accelerated population growth compared with HICs. Aging and population growth, environmental changes, increasing prevalence of obesity, and related dietary factors are likely major contributors to these trends.²⁰⁻²⁵

Control of hypertension has improved over time but remains low worldwide. Further, control has improved more quickly in HICs than in LMICs, resulting in widening disparities. Despite improvements since 2000, control rates in HICs appear to have plateaued in recent years, highlighting the need for intensified efforts to improve management of hypertension in both HICs and LMICs. Barriers to BP control exist at the health care system, provider, and patient levels, including under-resourced health care systems that lack a patient-centered approach to life-long management of hypertension, insufficient access to affordable antihypertensive medications including single-pill combination therapies, lack of adherence to antihypertensive guidelines and simple

treatment protocols, use of BP measurement devices not validated for accuracy, lack of information systems, patient lifestyle factors, and low adherence to medication.²⁶⁻²⁹ Many countries, particularly LMICs, face additional barriers to improved management of hypertension such as fragmented health systems, large patient out-of-pocket expenditures, long facility waiting times, low-quality or inconvenient models of care, health information systems that are difficult to use, low health literacy, transportation and communication barriers, and inadequate health budgets.^{23,30} Many LMIC health care systems face a double burden of noncommunicable diseases (NCDs) and infectious diseases and have health care systems designed primarily for maternal, infant, and episodic care, resulting in inadequate capacity for management of NCDs.³¹ Because of limited resources and competing demands, many patients are lost at each stage of the hypertension care cascade, including measurement of BP, diagnosis, treatment, and achieving control.⁸ LMICs also have disproportionately lower access to antihypertensive medications compared with HICs. An estimated 97% of HIC communities have availability of 3 or more recommended antihypertensive classes compared with 61% in LMICs.³² Nonadherence to medication is also a major global challenge that is more prevalent in LMICs compared with HICs.³³

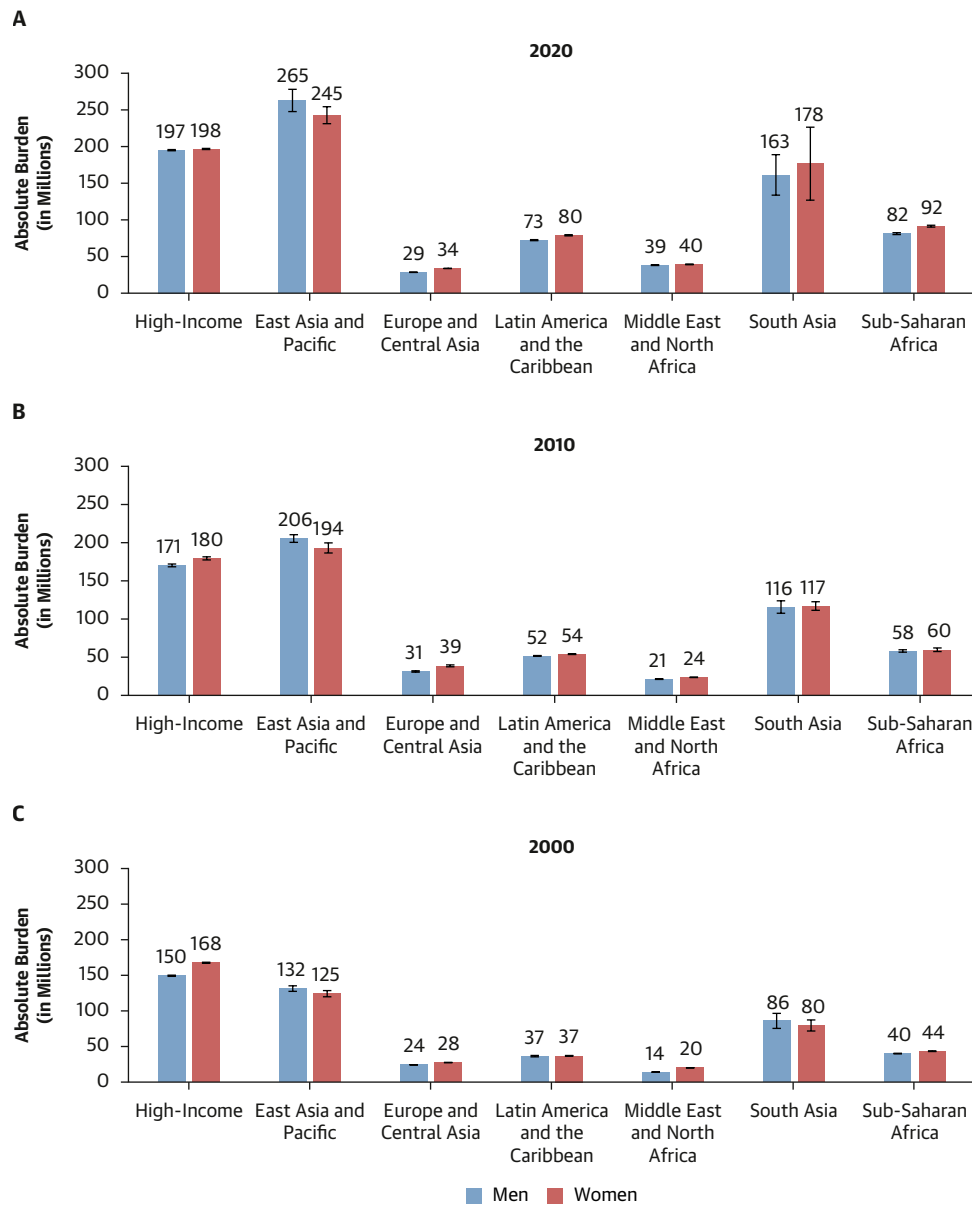
To prevent and control hypertension, there is a need to implement evidence-based interventions adapted to local contexts.^{29,30} Multilevel, multicomponent strategies for implementing BP control interventions, such as team-based care, are most effective for BP control.³⁴ Several LMIC studies

FIGURE 2 Age-Standardized Prevalence of Hypertension by Region in 2020, 2010, and 2000

(A) 2020, (B) 2010, (C) 2000. Prevalence of hypertension is defined as average systolic blood pressure ≥ 140 mm Hg, average diastolic blood pressure ≥ 90 mm Hg, or use of antihypertensive medication. In 2020, hypertension prevalence among women is higher in each LMIC region compared with women in HICs and higher in LMIC men in almost every region compared with HICs. This highlights the need for interventions for hypertension prevention in LMIC contexts. HICs = high-income countries; LMIC = low- and middle-income country.

showed that team-based care with tasks shifted from physicians to lower-cost, trained, dedicated personnel, such as nurses and community health workers, could result in significant improvements in control of BP.^{35,36} The World Health Organization

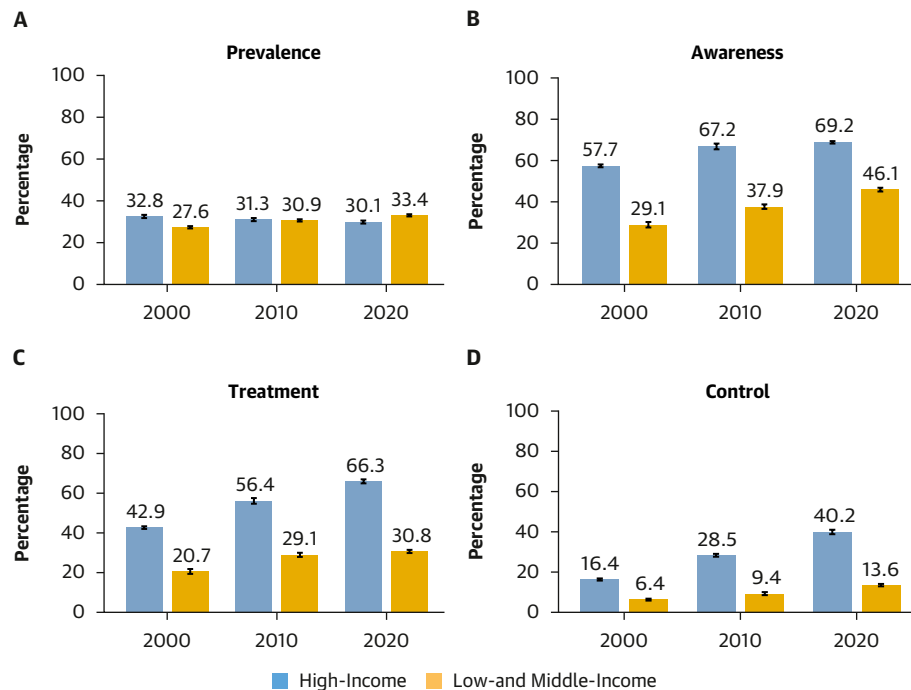
developed the HEARTS program, including lifestyle counseling, simple treatment protocols, consistent medication access, team-based care, patient-centered care, and robust health information systems to improve hypertension control in primary-

FIGURE 3 Absolute Burden of Hypertension (in Millions) by Region

(A) 2020, (B) 2010, (C) 2000. Hypertension is defined as average systolic blood pressure ≥ 140 mm Hg, average diastolic blood pressure ≥ 90 mm Hg, or use of antihypertensive medication. The numbers of people with hypertension in East Asia and Pacific and South Asia are high and increasing rapidly because of increasing hypertension prevalence and population trends. This large and increasing burden of hypertension is likely to strain resource-limited health care systems in these regions with needs for management of chronic disease and clinical disease resulting from inadequately controlled hypertension.

care settings.³⁷ A clear focus on increasing those with hypertension who are treated and controlled can help accelerate progress and focus attention on the single most important indicator of program effectiveness.³⁸

Policy interventions could also play a critical role in addressing barriers such as air pollution, the food environment, and lack of availability and affordability of antihypertensive medications, including fixed-dose combinations. Policy interventions to

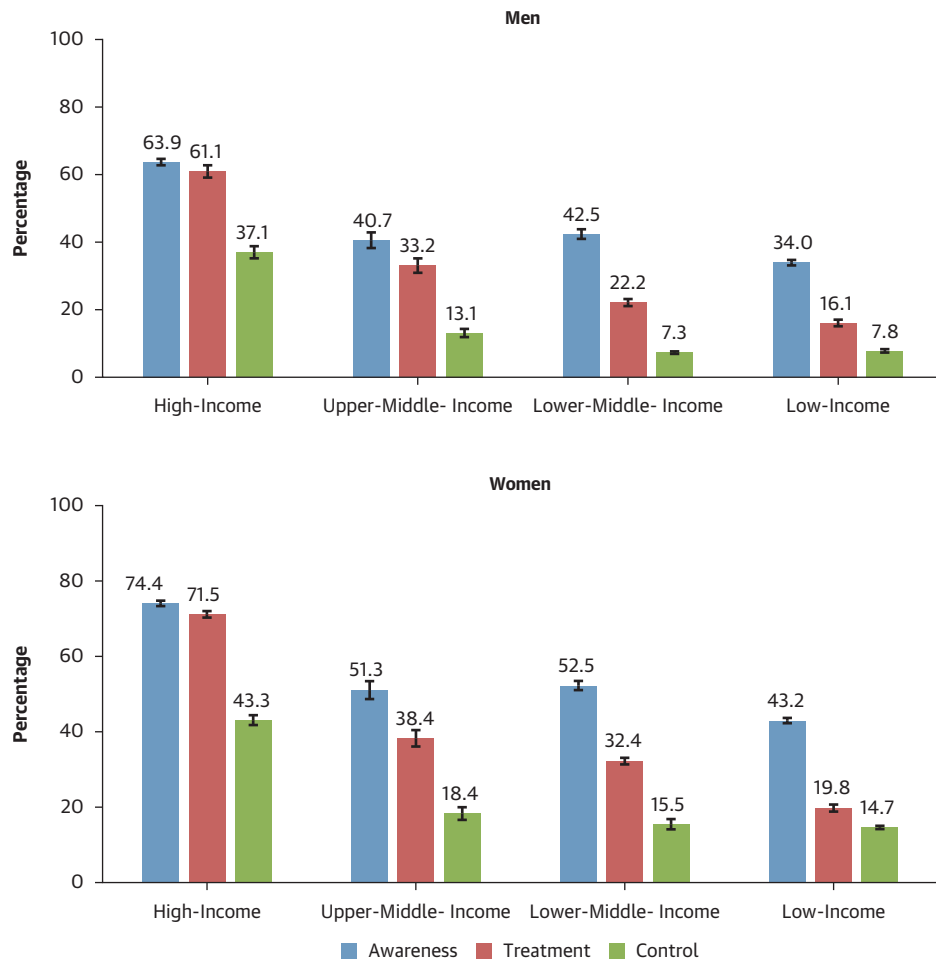
FIGURE 4 Trends in Hypertension Prevalence, Awareness, Treatment, and Control in High-Income and Low- and Middle-Income Countries, 2000 to 2020

(A) Prevalence of hypertension is defined as average systolic blood pressure ≥ 140 mm Hg, average diastolic blood pressure ≥ 90 mm Hg, or use of antihypertensive medication. (B) Awareness is defined as self-reported previous diagnosis of hypertension among those with hypertension. (C) Treatment is defined as self-reported antihypertensive medication use among those with hypertension. (D) Control is defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg among all participants with hypertension. Hypertension awareness, treatment, and control are higher in HICs compared with LMICs but remain inadequate in both groups. Implementation of evidence-based interventions is needed to improve blood pressure control, particularly in LMICs. Abbreviations as in [Figure 2](#).

improve the food environment could include lowering the sodium content of packaged and prepared foods and promoting use of potassium-enriched, low-sodium salts.^{29,30,39,40} Policy interventions to improve medication access and affordability include more efficient procurement, more rigorous and accurate inventory and supply chain functions, increased access to fixed-dose combination medications, and longer prescription durations.⁴¹⁻⁴³

STUDY STRENGTHS AND LIMITATIONS. Among the strengths of this study is that this extensive pooling analysis includes 240 population-based surveys conducted in 6,060,567 adults from 119 countries. Further, the inclusion criteria requiring standardized BP measurement techniques, and not including repeated measurements from follow-up visits of cohort studies, reduces measurement error in pooled estimates.

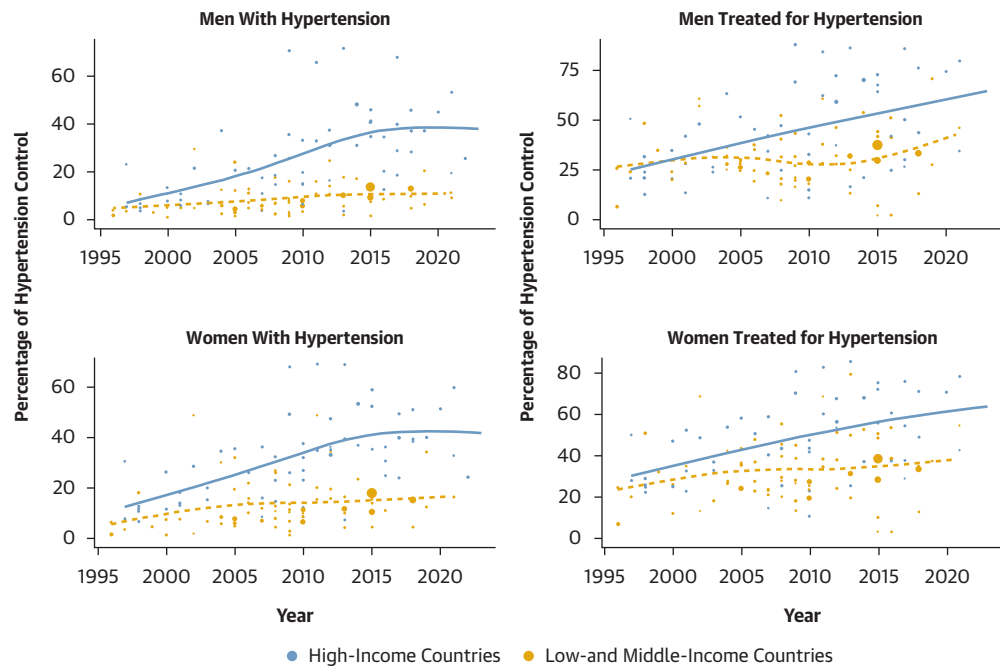
Several limitations are inherent to this study. First, the quality of our analysis is contingent on the quality and availability of original studies. Although many countries have data, many do not, and there may be inherent differences among countries that collect data on hypertension prevalence vs those that do not. Second, because the nature of most population-based surveys, BP was measured multiple times on a single day to determine hypertension status and was not confirmed outside survey data collection. Third, awareness, treatment, and control are only available from a subset of studies, and more country-specific estimates are needed to calculate awareness, treatment, and control prevalence by geographic region. Fourth, these estimates largely reflect pre-COVID-19 data. The pandemic likely exacerbated global disparities in hypertension awareness, treatment, and control through disruptions in health care delivery and access to

FIGURE 5 Percentage of Hypertension Awareness, Treatment, and Control by Income Group in 2020 in Men and Women

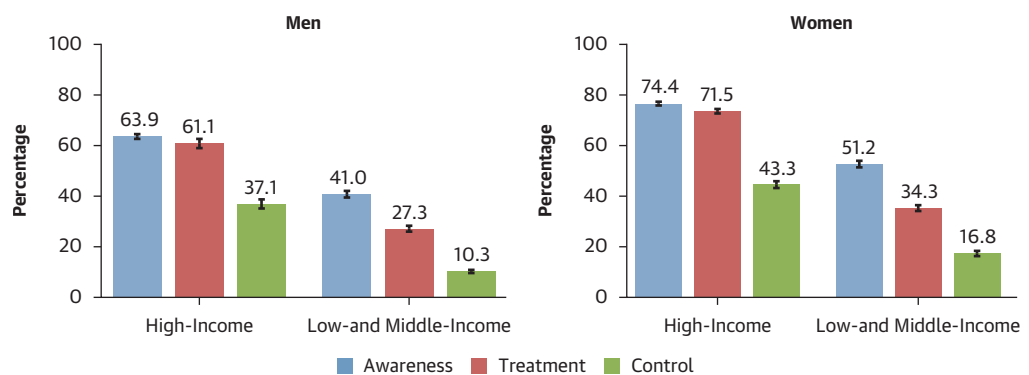
Awareness is defined as self-reported previous diagnosis of hypertension among those with hypertension. Treatment is defined as self-reported antihypertensive medication use among those with hypertension. Control is defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg among all participants with hypertension. HICs have substantially better awareness, treatment, and control than the 3 LMIC income categories. The lowest income countries have the lowest proportions of awareness, treatment, and control compared to the other economy groups. This suggests the health care systems in the lowest income countries are not currently equipped to manage hypertension. Policy interventions and other innovative solutions are needed in these contexts to improve management of blood pressure. Abbreviations as in [Figure 2](#).

medication, particularly in low- and middle-income settings. COVID-19 also suspended population-based health surveys in some countries affecting data availability in 2020 and 2021. Fifth, due to data availability, we were only able to assess hypertension prevalence and control defined using the cutpoints of SBP ≥ 140 mm Hg and DBP ≥ 90 mm Hg, despite some guidelines now defining hypertension prevalence and control at

lower cutpoints. Future population-based surveys should include prevalence of hypertension and control estimates using guideline-based lower cutpoints, which will result in even higher prevalence and lower control estimates than those reported here. Further, all studies did not report information on risk factors for hypertension, such as body mass index, so their impact on hypertension prevalence or control could not be assessed.

FIGURE 6 Trends in Hypertension Control in High-Income and Low- and Middle-Income Countries Among Men With Hypertension, Women With Hypertension, Men Treated for Hypertension, and Women Treated for Hypertension

Control is defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg. Over the last 25 years, hypertension control has improved in HICs and then plateaued over the last 10 years among men and women with hypertension. In LMICs, hypertension control has improved very slowly over the 25-year period and has remained very low in both men and women.

FIGURE 7 Percentage of Hypertension Awareness, Treatment, and Control in High-Income and Low- and Middle-Income Countries in 2020 in Men and Women

Awareness is defined as self-reported previous diagnosis of hypertension among those with hypertension. Treatment is defined as self-reported antihypertensive medication use among those with hypertension. Control is defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg among all participants with hypertension. Men have lower hypertension awareness, treatment, and control than women. Urgent action is needed to engage individuals in the hypertension care cascade and implement evidence-based interventions to improve management and control.

CONCLUSIONS

These findings provide important implications for future global hypertension control efforts. The global burden of hypertension continues to rise, and the proportion of hypertension that is controlled is low worldwide. Global disparities in hypertension prevalence, awareness, treatment, and control are large and increasing. Urgent action is needed to accelerate adoption of hypertension-control strategies and overcome barriers to sustained hypertension control in LMICs and worldwide. The most important target to accelerate progress will be to get the number of people with hypertension treated and controlled. Based on mean BP in adults with untreated hypertension from national surveys (eg, National Health and Nutrition Survey [NHANES] 2017-2020 SBP mean in untreated hypertension was approximately 146 mm Hg),⁴⁴ in order to achieve control to SBP <130 or <140 mm Hg in 70% to 80% of those treated, the mean SBP would have to be approximately 120 or 130 mm Hg, requiring an average reduction of SBP of >25 or >15 mm Hg. To accomplish this magnitude of SBP reduction, initial

therapy should be dual or triple antihypertensive drug therapy, with monotherapy being the exception in those whose BP is only slightly above the cutpoint for hypertension. To do this, urgent action is needed to adapt and implement evidence-based interventions that overcome barriers to blood pressure control in local contexts. In parallel, policy interventions to improve medication access and affordability are critical to accelerating progress.

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KEY WORDS epidemiology, global health, hypertension, prevention & control

APPENDIX For supplemental tables, please see the online version of this paper.