Potential U.S. Population Impact of the 2017 American College of Cardiology/American Heart Association High Blood Pressure Guideline

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Abstract

BACKGROUND—The 2017 American College of Cardiology/American Heart Association (ACC/AHA) Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults provides recommendations for the definition of hypertension, systolic and diastolic blood pressure (BP) thresholds for initiation of antihypertensive medication and BP target goals.

The objective of this study was to determine the prevalence of hypertension, implications of recommendations for antihypertensive medication and prevalence of BP above the treatment goal among US adults using criteria from the 2017 ACC/AHA and the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC7) guidelines.

METHODS—We analyzed data from the 2011–2014 National Health and Nutrition Examination Survey (N=9,623). NHANES (National Health and Nutrition Examination Survey) participants completed study interviews and an examination. For each participant, blood pressure was measured three times following a standardized protocol and averaged. Results were weighted to produce US population estimates.

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RESULTS—According to the 2017 ACC/AHA and JNC7 guidelines, the overall crude prevalence of hypertension among US adults was 45.6% (95% confidence interval [CI] 43.6%,47.6%) and 31.9% (95%CI 30.1%, 33.7%), respectively, and antihypertensive medication was recommended for 36.2% (95%CI 34.2%, 38.2%) and 34.3% (32.5%, 36.2%) of US adults, respectively. Compared to US adults recommended antihypertensive medication by JNC7, those recommended treatment by the 2017 ACC/AHA guideline but not JNC7 had higher cardiovascular disease (CVD) risk. Non-pharmacological intervention is advised for the 9.4% of US adults with hypertension according to the 2017 ACC/AHA guideline who are not recommended antihypertensive medication. Among US adults taking antihypertensive medication, 53.4% (95%CI 49.9%, 56.8%) and 39.0% (95%CI 36.4%, 41.6%) had BP above the treatment goal according to the 2017 ACC/AHA and JNC7 guidelines, respectively. Overall, 103.3 (95%CI 92.7, 114.0) million US adults had hypertension according to the 2017 ACC/AHA guideline of whom 81.9 (95%CI 73.8, 90.1) million were recommended antihypertensive medication.

CONCLUSIONS—Compared with the JNC 7 guideline, the 2017 ACC/AHA guideline results in a substantial increase in the prevalence of hypertension but a small increase in the percentage of U.S. adults recommended antihypertensive medication. A substantial proportion of US adults taking antihypertensive medication is recommended more intensive BP lowering under the 2017 ACC/AHA guideline.

Keywords

hypertension; guideline; prevalence; treatment

The American College of Cardiology/American Heart Association (ACC/AHA) Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults provides comprehensive information on the prevention and treatment of hypertension (1). This guideline updated the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC7), which was published in 2003 (2). Compared to the JNC7 guideline, the 2017 ACC/AHA guideline recommends using lower systolic blood pressure (SBP) and diastolic blood pressure (DBP) levels to define hypertension (Table 1). All adults recommended antihypertensive medication by JNC7 are also recommended antihypertensive medication by the 2017 ACC/AHA guideline. Additionally, adults with high cardiovascular disease (CVD) risk with SBP of 130–139 mm Hg or DBP of 80–89 mm Hg and adults 65 years of age with SBP of 130–139 mm Hg are recommended antihypertensive medication by the 2017 ACC/AHA guideline. The 2017 ACC/AHA guideline recommends treating SBP/DBP to less than 130/80 mm Hg for all adults taking antihypertensive medication. This is lower than the goal recommended by JNC7, with the exception of adults with diabetes or chronic kidney disease (CKD) where the treatment goal has not changed. Each of the recommendations in the 2017 ACC/AHA guideline was based on systematic evaluations by an evidence review team and/or members of the Guideline Writing Committee (1).

The purpose of the current analysis was to estimate the percentage and number of US adults with hypertension and recommended for pharmacological antihypertensive treatment according to the 2017 ACC/AHA guideline as compared with the JNC7 guideline. Additionally, we estimated the percentage and number of US adults taking antihypertensive

medication with BP above goal using targets from each guideline. US adults taking antihypertensive medication with BP above goal according to the 2017 ACC/AHA guideline are recommended more intensive antihypertensive treatment. To accomplish these goals, we analyzed data from the US National Health and Nutrition Examination Survey (NHANES). As a secondary goal, we contrasted prevalence estimates from the 2017 ACC/AHA guideline with those obtained using the 2014 Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC8 panel member report).(3).

Methods

NHANES is conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention with the goal of monitoring the health status of the US general population.(4) Since 1999, NHANES has been conducted in two-year cycles. For each cycle, potential participants are identified through stratified, multistage probability sampling of the non-institutionalized US population. Using sampling weights, nationally representative estimates for the non-institutionalized US population can be generated and NHANES cycles can be combined to provide more stable prevalence estimates when needed. For the current analysis, we pooled data from the 2011–2012 and 2013–2014 NHANES cycles. The current analysis was restricted to adult participants, 20 years of age and older (n=10,907). Participants who did not have three SBP and DBP measurements obtained during their study visit (n=704) or were missing data on self-reported antihypertensive medication (n=13) were excluded. Also, participants missing data on variables (age, gender, race, smoking, total and HDL-cholesterol, and diabetes) used to calculate 10-year predicted CVD risk according to the Pooled Cohort risk equations (n=567) were excluded. After these exclusions were applied, data from 9,623 participants were available for the current analyses. The protocols for NHANES 2011–2012 and 2013–2014 were approved by the National Center for Health Statistics of the Centers for Disease Control and Prevention Institutional Review Board. Written informed consent was obtained from each participant.

Data collection

NHANES data were collected through the administration of standardized questionnaires and a medical evaluation at a mobile examination clinic. Covariates included in this analysis and their method of ascertainment are described in Online Table 1.

Blood pressure measurement and antihypertensive medication use

BP was measured by a trained physician using a mercury sphygmomanometer and an appropriately sized cuff. Cuff sizes were selected after measurement of each participant's mid-right arm circumference. Readings were obtained after 5 minutes of seated rest. Three blood pressure measurements were obtained at 30 second intervals. The mean of the three measurements was used to define SBP and DBP. Quality control included quarterly re-certification with retraining as needed, and annual retraining of all physicians. Certification required video test recognition of Korotkoff sounds and performing measurements on volunteers. Participants who responded affirmatively to both of the questions "Have you ever been told by a doctor or other healthcare professional that you had hypertension, also called

high blood pressure?" and "Are you now taking prescribed medication for high blood pressure?" were considered to be taking antihypertensive medication.

Cardiovascular disease (CVD) risk

History of CVD was defined by self-report of a prior diagnosis of myocardial infarction, coronary heart disease, stroke or heart failure. Among those without a history of CVD, 10-year predicted CVD risk was calculated using the Pooled Cohort risk equations.(5) Participants were categorized into one of five mutually exclusive groups including history of CVD and no history of CVD with 10-year predicted CVD risk <5%, 5% to <10%, 10% to <20% and ≥ 20%. High CVD risk was defined as having a history of CVD or a 10-year predicted CVD risk ≥ 10%.

Definitions of hypertension, recommendations for antihypertensive medication, and blood pressure treatment goals

The 2017 ACC/AHA and JNC7 guideline and JNC8 panel member report definitions of hypertension, criteria for recommending antihypertensive medication, and recommended BP goals for adults taking antihypertensive medication are provided in Table 1.

Statistical Analysis

We calculated the distribution of the population across five groups including those not taking antihypertensive medication with SBP/DBP < 120/<80, 120–129/<80, 130–139/80–89, and ≥ 140/90 mm Hg and those taking antihypertensive medication. These levels represent the BP stages in the 2017 ACC/AHA guideline (Online Table 2). Participants with SBP and DBP in two categories (e.g., SBP< 120 mm Hg and DBP between 80 and 89 mm Hg) were designated into the higher category. We calculated the demographic and clinical characteristics of US adults in each of these groups. Next, we calculated the percentage and number of US adults with hypertension and recommended antihypertensive medication according to the 2017 ACC/AHA guideline, the JNC7 guideline, and the 2017 ACC/AHA guideline but not the JNC7 guideline. Also, we calculated the percentage and number of US adults taking antihypertensive medication with BP above goal according to the 2017 ACC/AHA guideline, JNC7 guideline, and the 2017 ACC/AHA but not the JNC7 guideline. These calculations were done for the overall population and within sub-groups defined by age, gender, race-ethnicity and CVD risk categories. Demographic and clinical characteristics of US adults with hypertension and, separately, taking antihypertensive medication with BP above goal according to the 2017 ACC/AHA guideline, JNC7 guideline, and the 2017 ACC/AHA but not the JNC7 guideline were calculated. In a secondary analysis, we calculated the percentage of US adults with hypertension, recommended antihypertensive medication and with BP above goal according to the JNC 8 panel member report published in 2014.

NHANES sampling weights were used in all calculations to obtain US nationally representative prevalence estimates. These weights were recalibrated based on the proportion of participants missing data by age, gender, and race-ethnicity within each NHANES cycle. Recalibration of the sampling weights corrects for differences in missing data across age, gender and race-ethnicity strata and assumes that data within strata are

missing at random.(6) Data management was conducted in SAS version 9.4 (SAS Institute, Cary, NC) and data analysis was conducted in Stata V14 (Stata Corporation, College Station, TX).

Results

In 2011–2014, 42.3%, 12.1%, 13.7% and 7.7% of US adults not taking antihypertensive medication had SBP/DBP levels of <120/80, 120–129/<80, 130–139/80–89, and ≥140/90 mm Hg, respectively (Table 2). Additionally, 24.1% of US adults were taking antihypertensive medication. US adults with higher BP were older, more likely to be non-Hispanic black, taking a statin, and have diabetes, reduced eGFR, albuminuria and a history of CVD. Total cholesterol levels and mean 10-year predicted CVD risk were higher at higher BP levels.

The prevalence of hypertension was 45.6% and 31.9% according to the 2017 ACC/AHA and JNC7 guideline definitions, respectively (Table 3). The prevalence of hypertension was higher when defined by the 2017 ACC/AHA guideline compared to the JNC7 guideline within all age, gender, race-ethnicity, and CVD risk category sub-groups. Antihypertensive medication was recommended for 36.2% of US adults according to the 2017 ACC/AHA guideline compared to 34.3% of adults with hypertension recommended antihypertensive medication according to the JNC7 guideline. An increase in the percentage of the population recommended antihypertensive medication by the 2017 ACC/AHA guideline compared to JNC 7 report was present for all age, sex, race-ethnicity and CVD risk sub-groups investigated. Among US adults with SBP/DBP of 130–139/80–89 mm Hg, 31.3% were recommended antihypertensive medication according to the 2017 ACC/AHA guideline because they had diabetes, CKD, high CVD risk or they had SBP of 130–139 mm Hg and were ≥65 years of age (Figure 1).

In 2011–2014, 103.3 million US adults met the definition for hypertension according to the 2017 ACC/AHA guideline compared with 72.2 million US adults according to the JNC7 guideline (Table 4). Based on use of the 2017 ACC/AHA guideline, 81.9 million US adults met criteria for treatment with antihypertensive medication in addition to nonpharmacological interventions whereas 21.4 million met criteria for treatment with nonpharmacological therapy on its own. An additional 4.2 million US adults were recommended antihypertensive medication according to the 2017 ACC/AHA guideline compared with the JNC7 guideline.

Compared with US adults defined as having hypertension according to the JNC7 guideline, those with hypertension defined by the 2017 ACC/AHA guideline but not the JNC7 guideline were younger, had lower total cholesterol, SBP, DBP and 10-year predicted CVD risk levels, and were less likely to have diabetes, reduced eGFR, albuminuria and a history of CVD (Online Table 3). Those recommended antihypertensive medication by the 2017 ACC/AHA guideline but not the JNC7 guideline had lower mean SBP and DBP levels but a higher mean 10-year CVD risk than their counterparts recommended antihypertensive medication by the JNC7 guideline. Also, US adults in this group were older, more likely to be male, non-Hispanic white, cigarette smokers, and have a history of CVD.

Among US adults taking antihypertensive medication, 53.4% had above goal BP according to the 2017 ACC/AHA guideline compared to 39.0% with above goal BP according to the JNC7 guideline (Table 5). BP above goal, defined using thresholds from the 2017 ACC/AHA guideline instead of the JNC7 guideline, was more than 10 percentage points higher in each sub-group investigated except for those 75 years of age and taking 4 classes of antihypertensive medication, where the prevalence was 7.1 and 9.3 percentage points higher, respectively. In 2011–2014, 54.7 million US adults were taking antihypertensive medication of whom 29.2 and 21.3 million US adults had BP above goal according to the 2017 ACC/AHA and JNC7 guidelines, respectively (Online Table 4). Characteristics of US adults taking antihypertensive medication with BP above goal according to the 2017 ACC/AHA guideline, the JNC7 guideline, and the 2017 ACC/AHA but not the JNC7 guideline are presented in Online Table 5. Overall, 47.9% and 31.8% of US adults with BP above goal according to the 2017 ACC/AHA but not the JNC7 guideline were taking 1 and 2 classes of antihypertensive medication, respectively.

Comparison of the 2017 ACC/AHA guideline with JNC8 panel member report

Overall, 31.1% of US adults had hypertension according to the JNC8 panel member report (Online Table 6). Compared with the JNC8 panel member report, an additional 5.1% of US adults were recommended antihypertensive medication according to the 2017 ACC/AHA guideline. The percentage of US adults recommended antihypertensive treatment according to the 2017 ACC/AHA guideline but not the JNC8 panel member report was higher at older ages, among men compared with women, among non-Hispanic whites compared with other race/ethnic groups and was highest for US adults with 10-year predicted CVD risk of 10% to <20% and 20% compared with the their counterparts in the other risk categories. Overall, 28.7% of US adults had BP above goal according to the thresholds in the 2017 ACC/AHA guideline but met the BP goal according to the JNC8 panel member report (Online Table 7).

Discussion

The current study documents the potential impact of the 2017 ACC/AHA guideline definition of hypertension, recommendation for antihypertensive medication in addition to nonpharmacological interventions and BP goals with antihypertensive drug treatment for US adults (Figure 2 - Central Illustration). We estimate that the 2017 ACC/AHA hypertension guideline will result in a substantial increase in the proportion of US adults defined as having hypertension. However, by using a combination of BP levels and CVD risk to guide treatment with antihypertensive medication, there will be only a small increase (1.9%) in the percentage of US adults who are recommended antihypertensive medication according to the 2017 ACC/AHA guideline compared to the JNC7 guideline. Also, 14.4% of US adults taking antihypertensive medication had a BP above the goal defined by the 2017 ACC/AHA guideline whereas they would have met the BP goal according to the JNC7 guideline. More intensive antihypertensive treatment is recommended to achieve the 2017 ACC/AHA guideline BP goal for these individuals.

The lower SBP and DBP levels (130 and 80 mm Hg, respectively) used to define hypertension in the 2017 ACC/AHA guideline wase based on data from observational

studies and clinical trials. Large observational studies demonstrate a graded association between higher BP and increased risk for CVD, end-stage renal disease, subclinical atherosclerosis, and all-cause mortality.(7,8) While many studies have reported increased risk associated with SBP/DBP of 120–129/80–84 mm Hg versus <120/80 mm Hg, the association is substantially stronger for a SBP/DBP of 130–139/85–89 mm Hg versus <120/80 mm Hg.(9–12) Randomized controlled trials of lifestyle modification (13–15) and low dose antihypertensive medication(16–18) have demonstrated BP and CVD risk reduction benefits among adults with BP lower than those used to identify hypertension in the JNC7 guideline. In addition, intensive antihypertensive drug treatment in patients with hypertension to BP goals below those recommended in the JNC7 guideline have been associated with CVD and mortality risk reduction benefits.(19–26) Nonpharmacological therapy on its own is the recommended treatment for the majority of US adults with SBP/DBP of 130–139/80–89 mm Hg. The 2017 ACC/AHA guideline writing committee concluded there is insufficient evidence to support a recommendation for antihypertensive drug treatment in addition to nonpharmacological therapy for adults with SBP/DBP of 130–139/80–90 mm Hg and low CVD risk. However, the diagnosis of hypertension provides an opportunity for healthcare providers and patients to discuss the value of nonpharmacological therapy in lowering BP, to implement recommended lifestyle changes and to emphasize that BP is a risk factor that can be controlled.

CVD risk is used in conjunction with BP levels to guide the recommendation to initiate antihypertensive medication in the 2017 ACC/AHA guideline. This decision was based on a diverse set of data from randomized trials, observational studies and simulation analyses. (27) In a meta-analysis of 11 trials (n=51,917 participants), the absolute CVD risk reduction over 5 years of follow-up was −1.41, −1.95, −2.41, and −3.84 events per 1,000 participants with 5-year predicted risk <11%, 11%–15%, 15%–21%, and >21%, respectively.(28) Also, simulation analyses have showed that using CVD risk in conjunction with BP levels has the potential to prevent more CVD events than basing treatment on BP levels alone and using CVD risk in conjunction with BP levels to guide antihypertensive medication may be cost-effective.(29,30) In the current study, we estimated that the 2017 ACC/AHA and JNC7 guidelines would result in a small increase in the percentage of US adults being recommended antihypertensive medication. US adults recommended antihypertensive medication according to the 2017 ACC/AHA but not the JNC7 guideline had high CVD risk with 15.8% of this population having a history of CVD and a mean 10-year predicted CVD risk of 15.6% among those without a history of CVD. Based on the randomized trial evidence, this group should experience a large absolute reduction in CVD risk with antihypertensive medication (28).

A number of randomized controlled trials have evaluated the potential CVD risk reduction benefits of BP goals lower than those used in JNC7.(20–22) The best evidence supporting BP treatment targets is derived from meta-analyses of these trials.(19,23–26) In a meta-analysis of 42 trials (n=144,220 participants), the risk for CVD mortality was lowest with SBP levels between 120 and 124 mmHg.(23) Although some adults will benefit from treatment to lower BP levels, the 2017 ACC/AHA guideline writing committee selected SBP/DBP goals of 130/80 mm Hg to account for the specific inclusion and exclusion criteria

used in randomized trials and the more careful conduct of BP measurement performed in trials compared with clinical practice (20).

The current analysis has several strengths. NHANES provides nationally representative estimates for the non-institutionalized US population and the results of this analysis have broad generalizability. NHANES enrolled a large sample size and oversampled population groups that facilitated the conduct of sub-group analysis. Blood pressure was measured following a standardized protocol. The results should also be interpreted in the context of known and potential limitations. Blood pressure was measured at a single visit in NHANES. Also, the BP measurement protocol including the use of a mercury sphygmomanometer likely differs from the typical approach used in most settings. The 2017 ACC/AHA and JNC7 guidelines recommend the diagnosis of hypertension be based on the average of multiple blood pressure measurements obtained at two or more visits.

In conclusion, the current analysis suggests a substantial increase in the prevalence of hypertension using the 2017 ACC/AHA guideline. However, the percentage of US adults recommended antihypertensive medication increased modestly with nonpharmacological interventions alone being recommended for the majority of US adults with hypertension according to the 2017 ACC/AHA guideline but not the JNC7 guideline. Additionally, over 50% of US adults taking antihypertensive medication do not meet the SBP/DBP goal of < 130/80 mm Hg set forth in the 2017 ACC/AHA guideline. More intensive antihypertensive drug therapy is recommended for this group. Given the high predicted CVD risk in this group, a substantial CVD risk reduction benefit should occur with more intensive antihypertensive medication treatment. The 2017 ACC/AHA hypertension guideline has the potential to increase hypertension awareness, encourage lifestyle modification and focus antihypertensive medication initiation and intensification on US adults with high CVD risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Clinical Perspective

What is new?

- Using cardiovascular risk in conjunction with blood pressure levels is an efficient approach to direct pharmacological antihypertensive treatment to those who are likely to benefit most. Many US adults are recommended more intensive antihypertensive medication according to the 2017 ACC/AHA Hypertension Guideline.

What are the clinical implications?

- Implementation of the 2017 ACC/AHA Hypertension Guideline has the potential to increase the prevalence of hypertension and use of antihypertensive medication among US adults. This should translate into a reduction in cardiovascular disease events.
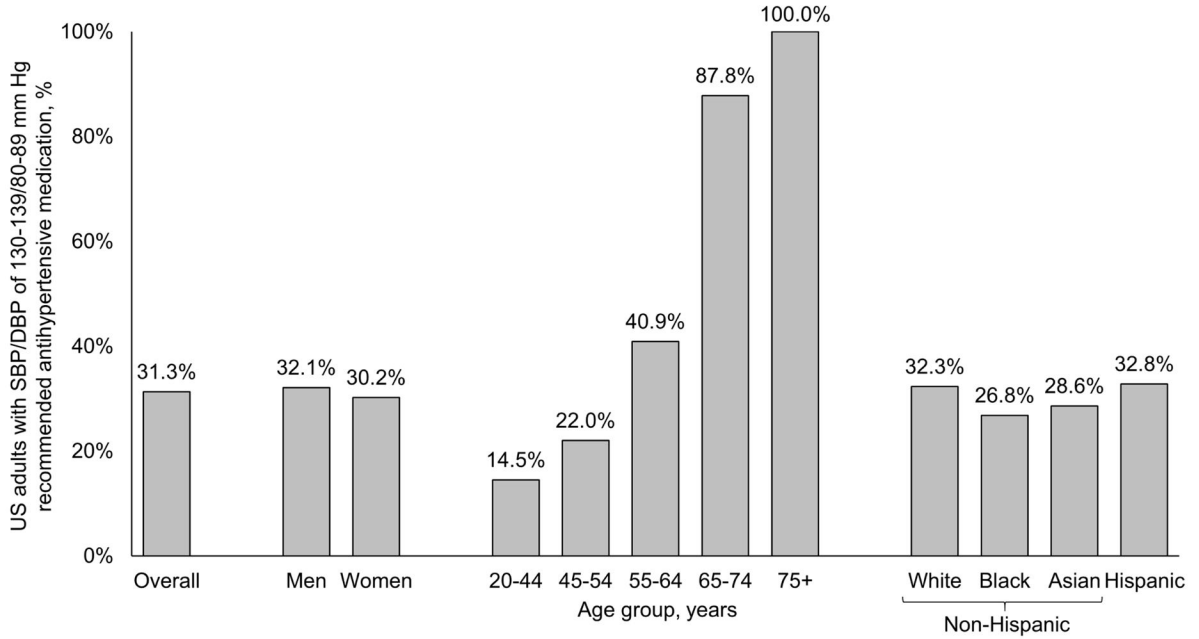
Figure 1. Percentage of US adults with a systolic blood pressure of 130 to 139 mm Hg or diastolic blood pressure 80 to 89 mm Hg recommended antihypertensive medication according to the 2017 ACC/AHA guideline

This figure shows the percentage of US adults not taking antihypertensive medication with systolic blood pressure of 130 to 139 mm Hg or diastolic blood pressure 80 to 89 mm Hg who are recommended antihypertensive medication. These individuals are recommended antihypertensive medication according to the 2017 ACC/AHA hypertension guideline because they have systolic blood pressure of 130 to 139 mm Hg or diastolic blood pressure 80 to 89 mm Hg and a history of cardiovascular disease or a 10-year predicted risk for cardiovascular disease ≥10%, diabetes or chronic kidney disease or they have systolic blood pressure of 130 to 139 mm Hg and are ≥65 years of age. Overall, 31.3% of US adults with systolic blood pressure of 130 to 139 mm Hg or diastolic blood pressure 80 to 89 mm Hg are recommended antihypertensive medication according to the 2017 ACC/AHA guideline. SBP – Systolic blood pressure; DBP – Diastolic blood pressure.

Prevalence of hypertension, recommendation for pharmacologic antihypertensive treatment, and blood pressure above goal among US adults according to the 2017 ACC/AHA guideline and the JNC7 guideline.
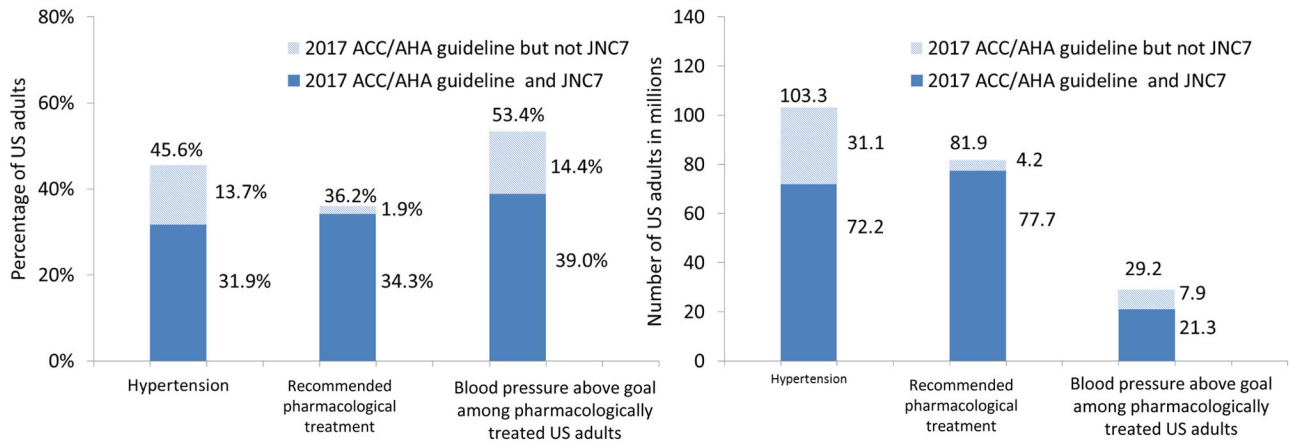
Figure 2 (Central Illustration). Prevalence of hypertension, recommendation for pharmacologic antihypertensive treatment, and blood pressure above goal among US adults according to the 2017 ACC/AHA guideline and the JNC7 guideline

This graph shows the percentage (left panel) and number (right panel) of US adults with hypertension, recommended pharmacological treatment and with blood pressure above goal among those receiving pharmacological treatment according to the 2017 ACC/AHA guideline (full bar height), the JNC7 guideline (dark blue bar), and the 2017 ACC/AHA guideline but not the JNC7 guideline (light blue bar).

Table 1

Blood pressure levels used to define hypertension, recommend antihypertensive medication, and treatment goal according to the 2017 ACC/AHA guideline, the JNC7 guideline and the JNC8 panel member report.

	Guideline – Definition of hypertension		
	2017 ACC/AHA	JNC7	JNC8 panel member report
Systolic blood pressure, mm Hg			
General population	130	140	140
≥60 years of age without diabetes or CKD			150
Diastolic blood pressure, mm Hg			
General population	80	90	90
Guideline – Recommended antihypertensive medication	2017 ACC/AHA	JNC7	JNC8 panel member report
Systolic blood pressure, mm Hg			
General population	140	140	140
Diabetes or CKD	130	130	140
High cardiovascular disease risk†	130		
Age ≥65 years	130		150
≥60 years of age without diabetes or CKD			
Diastolic blood pressure, mm Hg			
General population	90	90	90
Diabetes or CKD	80	80	
High cardiovascular disease risk†	80		
Guideline – Treatment goal among those taking antihypertensive medication			
Systolic blood pressure, mm Hg			
General population	<130	<140	<140
Age ≥65 years	<130		
Diabetes or CKD		<130	<140
≥60 years of age without diabetes or CKD			<150
Diastolic blood pressure, mm Hg			

Guideline – Definition of hypertension			
	2017 ACC/AHA	JNC7	JNC8 panel member report
General population	< 80	< 90	<90
Diabetes or CKD	< 80	< 80	

■ No specific blood pressure threshold is provided in the guideline for this population. The other thresholds listed from the guideline should be applied, as appropriate.

Systolic and diastolic blood pressure levels should be based on multiple measurements taken at two or more visits. In the National Health and Nutrition Examination Survey, blood pressure was measured three times at a single visit.

In the top and middle panels, adults with systolic blood pressure or diastolic blood pressure above the levels listed and those taking antihypertensive medication are considered to have hypertension and are recommended antihypertensive medication.

In the bottom panel, to achieve treatment goals, both the systolic and diastolic blood pressure goals have to be met.

[†]High cardiovascular risk is defined as a history of cardiovascular disease or 10-year predicted cardiovascular disease risk 10% using the Pooled Cohort risk equations.

2017 ACC/AHA guideline - 2017 American College of Cardiology/American Heart Association Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults.

JNC7 guideline - Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure

JNC8 panel member report - 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults: Report From the Panel Members Appointed to the Eighth Joint National Committee.

CKD – chronic kidney disease.

Table 2

Characteristics of US adults by blood pressure levels and antihypertensive medication use based on the 2011–2014 National Health and Nutrition Examination Survey.

	SBP/DBP categories in mm Hg among US adults not taking antihypertensive medication				Taking antihypertensive medication(n=2,587)
	<120/80(n=3,827)	120–129/<80(n=1,114)	130–139/80–89(n=1,276)	140/90 (n=819)	
Percentage (95% CI) of US population	42.3 (40.3, 44.3)	12.1(11.0, 13.3)	13.7(12.7, 14.9)	7.7(6.8, 8.7)	24.1(22.4, 26.0)
Population characteristics†					
Age, years	38.8 (0.4)	45.0 (0.7)	47.1 (0.7)	54.6 (0.6)	61.6 (0.3)
Male gender, %	41.1	60.4	58.0	58.1	45.0
Race/ethnicity, %					
Non-Hispanic white	63.5	66.2	66.7	63.7	71.2
Non-Hispanic black	9.1	10.8	11.6	14.5	14.8
Non-Hispanic Asian	6.5	4.9	4.7	6.0	3.4
Hispanic	18.2	14.9	14.0	12.4	8.7
Cigarette smoking, %	19.8	23.8	20.6	21.0	15.5
Total cholesterol, mg/dL	187.6 (1.0)	195.3 (1.1)	201.0 (1.8)	206.3 (2.1)	190.2 (1.3)
HDL cholesterol, mg/dL	54.2 (0.4)	51.9 (0.6)	52.8 (0.7)	54.0 (0.9)	51.6 (0.5)
Statin use, %	6.7	12.0	12.0	13.5	47.8
Diabetes, %	3.7	7.6	9.1	14.1	26.7
Reduced eGFR, %	2.3	2.3	3.4	8.7	20.8
Albuminuria, %	4.7	6.1	9.4	15.6	17.6
Systolic blood pressure, mm Hg	108.9 (0.2)	124.2 (0.1)	128.0 (0.3)	148.3 (0.9)	130.7 (0.6)
Diastolic blood pressure, mm Hg	66.5 (0.3)	70.4 (0.4)	78.6 (0.3)	82.5 (0.7)	71.1 (0.4)
Mean 10-year predicted CVD risk ††	2.4 (0.1)	5.0 (0.2)	5.9 (0.3)	13.1 (0.6)	17.8 (0.4)
High risk †††, %	7.5	15.1	19.8	46.1	61.8
10-year risk categories, %					
<5%	85.6	69.7	63.5	37.4	21.7
5% to <10%	6.9	15.2	16.7	16.4	16.6
10% to <20%	3.2	6.8	10.5	19.8	19.7

	SBP/DBP categories in mm Hg among US adults not taking antihypertensive medication				Taking antihypertensive medication(n=2,587)
	<120/80(n=3,827)	120–129/<80(n=1,114)	130–139/80–89(n=1,276)	140/90 (n=819)	
20%	1.5	4.7	5.1	20.4	20.1
History of CVD	2.9	3.6	4.2	6.0	21.9

[†]Population characteristics in the table are percentage or mean (standard error).

US adults were grouped into the higher category of systolic and diastolic blood pressure. For example, if a person had systolic blood pressure of 146 mm Hg and diastolic blood pressure of 82 mm Hg, they were grouped into the 140/90 mm Hg category.

Reduced estimated glomerular filtration rate was defined by levels < 60 ml/min/1.73 m^2.

Albuminuria was defined by an albumin-to-creatinine ratio 30 mg/g.

[††]10-year predicted risk was calculated using the Pooled Cohort risk equations. Mean risk was calculated among adults without a history of cardiovascular disease.

[†††]High risk defined as a 10-year predicted cardiovascular disease risk 10% or history of cardiovascular disease.

SBP – systolic blood pressure; DBP – diastolic blood pressure; eGFR - estimated glomerular filtration rate; CVD – cardiovascular disease.

Table 3

Percentage of US adults meeting the definition for hypertension and recommended antihypertensive medication according to the 2017 ACC/AHA guideline and the JNC7 guideline based on the 2011–2014 National Health and Nutrition Examination Survey.

	2017 ACC/AHA guideline		JNC7 guideline		Difference (2017 ACC/AHA but not JNC7)	
	Hypertension	Recommended antihypertensive medication	Hypertension	Recommended antihypertensive medication	Hypertension	Recommended antihypertensive medication
Overall	45.6(43.6, 47.6)	36.2(34.2, 38.2)	31.9(30.1, 33.7)	34.3(32.5, 36.2)	13.7(12.7, 14.9)	1.9(1.5, 2.3)
Age group						
20–44	24.0(21.8, 26.2)	12.5(11.2, 13.9)	10.5(9.4, 11.7)	12.2(10.9, 13.6)	13.4(12.0, 15.0)	0.3(0.1, 0.5)
45–54	47.1(44.4, 49.8)	33.4(30.8, 36.1)	29.5(27.0, 32.2)	32.7(30.1, 35.4)	17.6(15.1, 20.4)	0.7(0.4, 1.2)
55–64	66.6(63.6, 69.5)	58.2(54.9, 61.4)	52.4(49.1, 55.7)	55.0(62.0, 58.0)	14.2(12.1, 16.6)	3.2(2.1, 4.7)
65–74	75.6(73.4, 77.6)	74.1(71.4, 76.6)	63.6(60.2, 66.9)	66.9(63.7, 69.9)	12.0(9.4, 15.2)	7.2(5.2, 10.0)
75+	82.3(79.2, 85.0)	82.3(79.2, 85.0)	75.1(71.9, 78.1)	78.5(74.7, 81.8)	7.1(5.6, 9.0)	3.8(2.5, 5.6)
Men	48.6(45.9, 51.3)	37.3(34.9, 39.8)	32.0(29.8, 34.3)	34.8(32.4, 37.3)	16.6(15.0, 18.3)	2.5(2.0, 3.1)
Women	42.9(40.7, 45.1)	35.1(33.1, 37.3)	31.8(29.8, 33.8)	33.8(31.8, 35.9)	11.1(9.8, 12.5)	1.3(0.9, 1.9)
Race-ethnicity						
Non-Hispanic white	47.3(44.5, 50.0)	37.9(35.3, 40.6)	33.4(31.1, 35.8)	35.7(33.3, 38.2)	13.8(12.4, 15.4)	2.2(1.6, 2.8)
Non-Hispanic black	54.9(52.5, 57.3)	44.8(42.5, 47.0)	41.0(39.0, 43.1)	43.6(41.4, 45.8)	13.9(12.2, 15.7)	1.2(0.8, 1.8)
Non-Hispanic Asian	36.7(32.6, 40.9)	27.9(24.2, 32.0)	24.4(21.1, 28.2)	26.8(23.1, 30.8)	12.2(10.4, 14.3)	1.1(0.6, 2.0)
Hispanic	34.4(31.8, 37.1)	25.5(23.0, 28.1)	21.1(18.7, 23.8)	24.3(21.8, 26.9)	13.3(11.7, 15.1)	1.2(0.9, 1.6)
Risk categories						
<5%	27.4(25.6, 29.3)	14.6(13.3, 16.0)	13.2(12.0, 14.5)	14.6(13.3, 16.0)	14.2(13.1, 15.4)	0
5% to <10%	61.4(57.2, 65.3)	48.4(44.5, 52.3)	42.7(38.5, 47.1)	46.6(42.7, 50.5)	18.6(15.2, 22.6)	1.8(0.9, 3.6)
10% to <20%	78.2(74.7, 81.4)	78.2(74.7, 81.4)	63.6(58.4, 68.5)	68.3(63.5, 72.7)	14.6(11.5, 18.4)	9.9(7.7, 12.7)
20%	85.7(82.7, 88.2)	85.7(82.7, 88.2)	77.3(74.0, 80.3)	81.4(77.7, 84.6)	8.4(7.1, 9.8)	4.3(3.1, 5.8)
History of CVD	79.3(75.6, 82.6)	79.3(75.6, 82.6)	72.1(68.8, 75.3)	75.7(72.7, 78.4)	7.2(5.0, 10.3)	3.7(2.1, 6.2)

Numbers in table are percentage of US adults (95% confidence interval)

See Table 1 for the definitions of hypertension and antihypertensive medication treatment recommendations.

2017 ACC/AHA guideline - 2017 American College of Cardiology/American Heart Association Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults.

JNC7 guideline - Seventh Report of the Joint National Committee on Prevention, Detection, and Treatment of High Blood Pressure

CVD – cardiovascular disease

Table 4

Number of US adults, in millions, meeting the definition for hypertension and the definition for treatment with antihypertensive medication according to the 2017 ACC/AHA guideline and the JNC7 guideline based on the 2011–2014 National Health and Nutrition Examination Survey.

	2017 ACC/AHA guideline		JNC7 guideline		Difference (2017 ACC/AHA vs. JNC7)	
	Hypertension	Recommended antihypertensive medication	Hypertension	Recommended antihypertensive medication	Hypertension	Recommended antihypertensive medication
Overall	103.3 (92.7, 114.0)	81.9 (73.8, 90.1)	72.2 (65.3, 79.1)	77.7 (70.0, 85.5)	31.1 (26.6, 35.6)	4.2 (3.3, 5.1)
Age group						
20–44	24.7 (21.6, 27.9)	12.9 (11.3, 14.4)	10.9 (9.6, 12.2)	12.6 (11.1, 14.1)	13.9 (11.7, 16.0)	0.3 (0.1, 0.5)
45–54	20.1 (17.7, 22.6)	14.3 (12.6, 15.9)	12.6 (11.2, 14.0)	14.0 (12.4, 15.6)	7.5 (5.9, 9.1)	0.3 (0.1, 0.4)
55–64	26.2 (22.4, 30.0)	22.9 (19.6, 26.2)	20.6 (17.7, 23.5)	21.6 (18.5, 24.7)	5.6 (4.2, 6.9)	1.3 (0.7, 1.8)
65–74	18.5 (16.1, 20.9)	18.1 (15.9, 20.4)	15.6 (13.5, 17.6)	16.4 (14.3, 18.4)	2.9 (2.1, 3.8)	1.8 (1.1, 2.4)
75+	13.8 (11.7, 15.8)	13.8 (11.7, 15.8)	12.6 (10.9, 14.3)	13.1 (11.2, 15.1)	1.2 (0.8, 1.6)	0.6 (0.4, 0.9)
Men	52.8 (46.6, 59.1)	40.6 (35.7, 45.5)	34.8 (30.6, 39.0)	37.9 (33.2, 42.6)	18.1 (15.3, 20.8)	2.7 (2.0, 3.4)
Women	50.5 (45.4, 55.6)	41.4 (37.6, 45.1)	37.4 (34.1, 40.8)	39.9 (36.2, 43.5)	13.1 (10.8, 15.4)	1.5 (0.9, 2.1)
Race-ethnicity						
Non-Hispanic white	70.8 (58.3, 83.3)	56.8 (47.1, 66.4)	50.1 (41.7, 58.4)	53.5 (44.4, 62.7)	20.7 (16.0, 25.4)	3.2 (2.2, 4.2)
Non-Hispanic black	14.3 (11.3, 17.2)	11.6 (9.2, 14.1)	10.7 (8.4, 12.9)	11.3 (8.9, 13.7)	3.6 (2.8, 4.4)	0.3 (0.2, 0.5)
Non-Hispanic Asian	4.4 (3.5, 5.3)	3.3 (2.6, 4.1)	2.9 (2.3, 3.6)	3.2 (2.5, 3.9)	1.5 (1.1, 1.8)	0.1 (0.0, 0.2)
Hispanic	11.3 (8.4, 14.2)	8.4 (6.0, 10.8)	6.9 (4.8, 9.0)	8.0 (5.7, 10.3)	4.4 (3.4, 5.3)	0.4 (0.2, 0.5)
Risk categories						
<5%	38.2 (33.6, 42.7)	20.4 (18.0, 22.8)	18.4 (16.2, 20.6)	20.4 (18.0, 22.8)	19.8 (16.9, 22.6)	0
5% to <10%	17.1 (14.3, 19.9)	13.5 (11.3, 15.7)	11.9 (9.9, 14.0)	13.0 (11.0, 15.1)	5.2 (3.8, 6.6)	0.5 (0.1, 0.9)
10% to <20%	17.5 (15.3, 19.8)	17.5 (15.3, 19.8)	14.3 (12.4, 16.1)	15.3 (13.4, 17.3)	3.3 (2.3, 4.3)	2.2 (1.5, 2.9)
20%	16.1 (13.8, 18.5)	16.1 (13.8, 18.5)	14.6 (12.5, 16.7)	15.3 (13.0, 17.7)	1.6 (1.2, 1.9)	0.8 (0.6, 1.1)
History of CVD	14.3 (12.6, 16.1)	14.3 (12.6, 16.1)	13.0 (11.4, 14.7)	13.7 (12.0, 15.4)	1.3 (0.8, 1.8)	0.7 (0.3, 1.0)

Numbers in table are number of US adults in millions (95% confidence interval)

2017 ACC/AHA guideline - 2017 American College of Cardiology/American Heart Association Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults.

JNC7 guideline - Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure

SBP – systolic blood pressure; DBP – diastolic blood pressure; CVD – cardiovascular disease.

See Table 1 for the definitions of hypertension and antihypertensive medication treatment recommendations.

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Table 5

Percentage of US adults taking antihypertensive medication with blood pressure above the 2017 ACC/AHA guideline and the JNC7 guideline treatment goal based on the 2011–2014 National Health and Nutrition Examination Survey.

	Blood pressure above goal according to:		2017 ACC/AHA but not the JNC guideline
	2017 ACC/AHA guideline	JNC7 guideline	
Overall[†]	53.4 (49.9, 56.8)	39.0 (36.4, 41.6)	14.4 (12.4, 16.5)
Age group			
20–44	46.3 (38.6, 54.3)	23.2 (17.5, 30.0)	23.1 (17.7, 29.7)
45–54	46.0 (38.6, 53.5)	29.5 (24.2, 35.5)	16.4 (12.6, 21.2)
55–64	50.5 (44.9, 56.0)	33.1 (27.9, 38.6)	17.4 (13.2, 22.6)
65–74	54.4 (48.6, 60.1)	43.4 (38.5, 48.4)	11.0 (13.2, 22.6)
75+	67.2 (61.4, 72.4)	60.1 (54.1, 65.7)	7.1 (5.1, 9.8)
Men	51.8 (47.9, 55.7)	37.5 (34.5, 40.6)	14.3 (11.8, 17.2)
Women	54.7 (50.1, 59.2)	40.3 (36.6, 44.0)	14.4 (11.9, 17.3)
Race-ethnicity[†]			
Non-Hispanic white	50.6 (46.6, 54.6)	36.4 (33.3, 39.5)	14.2 (11.7, 17.2)
Non-Hispanic black	63.0 (58.4, 67.4)	48.6 (44.2, 53.1)	14.4 (12.2, 16.9)
Non-Hispanic Asian	62.9 (53.6, 71.3)	47.1 (39.0, 55.4)	15.8 (12.0, 20.5)
Hispanic	56.0 (50.7, 61.1)	41.7 (36.4, 47.1)	14.3 (11.6, 17.5)
Number of antihypertensive classes			
0	54.7 (38.3, 70.2)	44.3 (28.2, 61.7)	10.5 (3.0, 30.6)
1	57.5 (52.9, 61.9)	38.5 (35.0, 42.1)	19.0 (16.1, 22.3)
2	47.7 (41.4, 54.0)	35.3 (30.0, 41.0)	12.4 (9.6, 15.7)
3	56.1 (47.8, 64.0)	44.3 (37.3, 51.6)	11.8 (8.0, 17.0)
4	55.3 (47.8, 62.4)	45.9 (39.4, 52.6)	9.3 (5.6, 15.1)

Numbers in table are percentage of US adults (95% confidence interval)

2017 ACC/AHA guideline - 2017 American College of Cardiology/American Heart Association Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults.

JNC7 guideline - Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure

See Table 1 for the definition of blood pressure treatment goals in the JNC7 and 2017 ACC/AHA guidelines.

SBP – systolic blood pressure; DBP – diastolic blood pressure; CVD – cardiovascular disease.