Incident Cardiovascular Disease Among Adults With Blood Pressure <140/90 mm Hg

Editorial, see p 813

BACKGROUND: Data from before the 2000s indicate that the majority of incident cardiovascular disease (CVD) events occur among US adults with systolic and diastolic blood pressure (SBP/DBP) ≥140/90 mm Hg. Over the past several decades, BP has declined and hypertension control has improved.

METHODS: We estimated the percentage of incident CVD events that occur at SBP/DBP <140/90 mm Hg in a pooled analysis of 3 contemporary US cohorts: the REGARDS study (Reasons for Geographic and Racial Differences in Stroke), the MESA (Multi-Ethnic Study of Atherosclerosis), and the JHS (Jackson Heart Study) (n=31 856; REGARDS=21 208; MESA=6779; JHS=3869). Baseline study visits were conducted in 2003 to 2007 for REGARDS, 2000 to 2002 for MESA, and 2000 to 2004 for JHS. BP was measured by trained staff using standardized methods. Antihypertensive medication use was self-reported. The primary outcome was incident CVD, defined by the first occurrence of fatal or nonfatal stroke, nonfatal myocardial infarction, fatal coronary heart disease, or heart failure. Events were adjudicated in each study.

RESULTS: Over a mean follow-up of 7.7 years, 2584 participants had incident CVD events. Overall, 63.0% (95% confidence interval [CI], 54.9–71.1) of events occurred in participants with SBP/DBP <140/90 mm Hg; 58.4% (95% CI, 47.7–69.2) and 68.1% (95% CI, 60.1–76.0) among those taking and not taking antihypertensive medication, respectively. The majority of events occurred in participants with SBP/DBP <140/90 mm Hg among those <65 years of age (66.7%; 95% CI, 60.5–73.0) and ≥65 years of age (60.3%; 95% CI, 51.0–69.5), women (61.4%; 95% CI, 49.9–72.9) and men (63.8%; 95% CI, 58.4–69.1), and for whites (68.7%; 95% CI, 66.1–71.3), blacks (59.0%; 95% CI, 49.5–68.6), Hispanics (52.7%; 95% CI, 45.1–60.4), and Chinese-Americans (58.5%; 95% CI, 45.2–71.8). Among participants taking antihypertensive medication with SBP/DBP <140/90 mm Hg, 76.6% (95% CI, 75.8–77.5) were eligible for statin treatment, but only 33.2% (95% CI, 32.1–34.3) were taking one, and 19.5% (95% CI, 18.5–20.5) met the SPRINT (Systolic Blood Pressure Intervention Trial) eligibility criteria and may benefit from a SBP target goal of 120 mm Hg.

CONCLUSIONS: Although higher BP levels are associated with increased CVD risk, in the modern era, the majority of incident CVD events occur in US adults with SBP/DBP <140/90 mm Hg. While absolute risk and cost-effectiveness should be considered, additional CVD risk-reduction measures for adults with SBP/DBP <140/90 mm Hg at high risk for CVD may be warranted.

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Sources of Funding, see page 810

Key Words: cardiovascular disease ■ cardiovascular disease risk ■ cerebrovascular disease ■ epidemiology ■ heart failure ■ high blood pressure ■ hypertension ■ myocardial infarction ■ stroke

Clinical Perspective

What Is New?

- Studies conducted before the 2000s reported a majority of incident cardiovascular disease (CVD) events occurred among adults with systolic and diastolic blood pressure (SBP/DBP) ≥140/90 mm Hg. In 3 US cohorts enrolled after 2000, >60% of incident CVD events occurred among participants with SBP/DBP <140/90 mm Hg.
- In the 2001 to 2008 National Health and Nutritional Examination Survey mortality follow-up study, 58% of CVD deaths occurred in US adults with SBP/DBP <140/90 mm Hg.
- Among participants taking antihypertensive medication with SBP/DBP <140/90 mm Hg, only 33% of those who were eligible for statin treatment were taking one, and ≈20% met the SPRINT (Systolic Blood Pressure Intervention Trial) eligibility criteria.

What Are the Clinical Implications?

- Because the majority of CVD events are now occurring among adults with SBP/DBP <140/90 mm Hg, additional BP reduction and treatment of other major CVD risk factors should be considered for this population, particularly among those with high CVD risk.
- Findings from SPRINT indicate that treatment to a SBP target of 120 mm Hg versus 140 mm Hg prevents CVD and reduces the risk for mortality among adults with high CVD risk.
- Also, the HOPE-3 trial (Heart Outcomes Prevention Evaluation-3) provides evidence that statin therapy is well tolerated and lowers the risk of CVD.

Observational studies have demonstrated graded associations between higher systolic and diastolic blood pressure (SBP/DBP) and increased cardiovascular disease (CVD) risk.[1] Since 1993, Joint National Committee guidelines in the United States have categorized adults with SBP ≥140 mm Hg or DBP ≥90 mm Hg as having hypertension.[2–4] Although most US adults have SBP/DBP <140/90 mm Hg, data from before the 2000s indicate that a majority of incident stroke, coronary heart disease (CHD), and heart failure (HF) events occur among US adults with SBP/DBP ≥140/90 mm Hg (Table 1).[5–11] For example, data from the ARIC study (Atherosclerosis Risk in Communities), CHS (Cardiovascular Health Study), and FHS (Framingham Heart Study) indicate that 77% of incident strokes, 69% of incident myocardial infarctions (MIs), and 74% of HF events occurred among adults with SBP/DBP ≥140/90 mm Hg.[11] However, over the past several decades, the mean SBP and DBP have declined among US adults.[12] Also, between 1988–1991 and 2011–2012, the percentage of US adults who have SBP <140 mm Hg and DBP <90 mm Hg has increased from 24% to 52% among the overall population with hypertension and from 45% to 70% among those with hypertension taking antihypertensive medication.[13,14]

Given the shift in BP distribution and hypertension control among US adults, the majority of incident CVD events may now occur among people with SBP/DBP <140/90 mm Hg. This change would highlight the need to focus CVD prevention on further BP reduction and treatment of other major CVD risk factors among adults with SBP/DBP <140/90 mm Hg. Therefore, the purpose of the current study was to determine the percentage of incident CVD events occurring among adults with SBP/DBP <140/90 mm Hg. Additionally, to identify opportunities to further reduce CVD risk among adults with SBP/DBP <140/90 mm Hg, we examined the use of statins among participants with an indication for a statin. We also calculated the percentage of adults with SBP between 120 mm Hg and 139 mm Hg who meet eligibility criteria for the SPRINT (Systolic Blood Pressure Intervention Trial) because this large randomized trial showed a SBP target goal of 120 mm Hg versus 140 mm Hg substantially lowered risk for CVD and all-cause mortality.[15]

METHODS

Study Populations

We pooled data from 3 large contemporary US cohorts: the REGARDS study (Reasons for Geographic and Racial Differences in Stroke), the MESA (Multi-Ethnic Study of Atherosclerosis), and the JHS (Jackson Heart Study). The study design, recruitment, and data-collection procedures used in these studies have been described in detail previously.[16–19] A brief description of each cohort is presented in online-only Data Supplement Table I.

The current analyses were restricted to participants without a history of stroke, CHD, HF, or atherosclerotic CVD procedure to examine incident CVD events (Figure 1). Complete information on antihypertensive medication use and SBP and DBP measurements from the baseline visit for each study were required for inclusion in the current analyses. Additionally, 377 participants in the REGARDS study and 32 participants in the MESA study without follow-up for stroke, CHD, and HF events were excluded. After these criteria were applied, data were available for 31 856 participants (REGARDS, n=21 208; MESA, n=6779; JHS, n=3869). REGARDS, JHS, and MESA were each approved by the appropriate institutional review boards, and written informed consent was obtained from all participants.

Data Collection

For each cohort, we used interview and examination data collected at baseline and follow-up data for CVD events. Baseline study visits were conducted in 2003 to 2007 for REGARDS, 2000 to 2002 for MESA, and 2000 to 2004 for JHS. Detailed methods for the baseline data collection in the REGARDS study,[18] MESA,[17] and JHS[16,19] have been described previously.

Table 1. Percentage of Cardiovascular Disease Events Among Participants With Systolic and Diastolic Blood Pressure ≥140/90 mm Hg Occurring in Cohort Studies Recruited Before the Year 2000

First Author	Cohort	Enrollment Years	Outcomes	Percentage of CVD Events in Participants With Systolic or Diastolic Blood Pressure ≥140/90 mm Hg
Stamler[5]	Chicago Heart Association Detection Project in Industry	1967–1973	CHD mortality: men CHD mortality: women	80.1 73.6
Psaty[6]	Cardiovascular Health Study	1989–1993	Myocardial infarction Stroke	51.6 66.6
Miura[7]	Chicago Heart Association Detection Project in Industry	1967–1973	CHD mortality CVD mortality*	57.9 57.6
Kannel[8]	Framingham Heart Study: cohort and offspring	Cohort: 1948–1950 Offspring: 1971–1975	CVD events†	55.0
Masley[9]	William Hale Research Program	1975–2000	CVD events‡	57.2
Franklin[10]	Framingham Heart Study: cohort and offspring	Cohort (3rd examination): 1952–1956 Offspring: 1971–1975	CVD events§	53.6
Mozaffarian[11]	Atherosclerosis Risk in Communities study, Cardiovascular Health Study, Framingham Heart Study: cohort and offspring	Atherosclerosis Risk in Communities study: 1987–1989 Cardiovascular Health Study: 1989–1993 Framingham Heart Study: 1948–1950, 1971–1975	Incident myocardial infarction Stroke Heart failure	69 77 74

CHD indicates coronary heart disease; CVD, cardiovascular disease; DBP, diastolic blood pressure; and SBP, systolic blood pressure.
*ICD-8 codes 400.0 to 445.9, which included coronary heart disease, stroke or transient ischemic attacks, peripheral artery disease, and heart failure.
†Coronary heart disease, stroke or transient ischemic attacks, peripheral artery disease, and heart failure.
‡Myocardial infarction, stroke, and cardiovascular disease-related death.
§Myocardial infarction, stroke, heart failure, coronary insufficiency, and sudden cardiovascular disease-related death.

BP Measurement

BP was measured in REGARDS, MESA, and JHS by trained study staff using standardized methods.[17,19,20] In REGARDS, SBP and DBP were measured twice, 30 seconds apart, using an aneroid sphygmomanometer (American Diagnostic Corporation) after the participant had been seated for 5 minutes.[18,20,21] These measurements were averaged for analysis. In MESA, SBP and DBP were measured 3 times at 2-minute intervals using a Dinamap model Pro 100 automated oscillometric sphygmomanometer (GE Medical Systems Information Technologies, Inc.) after participants rested for 5 minutes in a seated position.[22] The second and third measurements were averaged.[17,22] In JHS, at the baseline assessment, SBP and DBP were measured twice, separated by 1 minute, with an appropriate cuff size using a Hawksley random-zero sphygmomanometer (Hawksley and Sons Ltd) after a participant had rested for ≥5 minutes. These measurements were averaged for analysis.[19] In subsequent JHS visits, an Omron HEM-907XL (Omron Healthcare Inc.) automatic oscillatory device was used to measure BP following the same measurement protocol as used for the random-zero sphygmomanometer. All BP readings taken in JHS with the random-zero sphygmomanometer device were calibrated to the automatic oscillatory device after a BP comparability study.[23] Participants were categorized as having SBP <140 mm Hg and DBP <90 mm Hg (SBP/DBP <140/90 mm Hg) or SBP ≥140 mm Hg or DBP ≥90 mm Hg (SBP/DBP ≥140/90 mm Hg) regardless of antihypertensive medication use. As described below, analyses were performed for participants overall and by antihypertensive medication use.

Study Variables

Age, race/ethnicity, sex, antihypertensive medication use, antihyperglycemic medication use (insulin or oral hypoglycemic medication), and current cigarette smoking status were self-reported. Obesity was defined as a body mass index ≥30.0 kg/m^2. Using data collected during visits for each study, body mass index was calculated as weight in kilograms divided by height in meters squared. Total and high-density lipoprotein-cholesterol and triglycerides were measured from fasting blood samples (online-only Data Supplement Table I). Low-density lipoprotein-cholesterol was calculated using the Friedewald equation.[24] The definitions of diabetes mellitus used in each cohort are provided in online-only Data Supplement Table I. We calculated 10-year predicted CVD risk using the Pooled Cohort Risk Equations.[25] Indications for statins included having diabetes mellitus, low-density lipoprotein-cholesterol ≥190 mg/dL, or a 10-year CVD risk ≥7.5%.[26] Statin use was determined by pill bottle review. Estimated glomerular filtration rate was calculated using the CKD-EPI equation (Chronic Kidney Disease Epidemiology Collaboration).[27]

CVD Outcomes

The primary outcome for the current study was incident CVD, defined by the first occurrence of a fatal or nonfatal stroke, nonfatal MI, fatal CHD, or nonfatal HF. Detailed descriptions of the adjudication process in REGARDS,[18,28,29] MESA,[17,30] and JHS[31] have been published previously. In brief, study participants or their proxies were contacted to identify hospitalizations and possible CVD events at 6-month intervals for

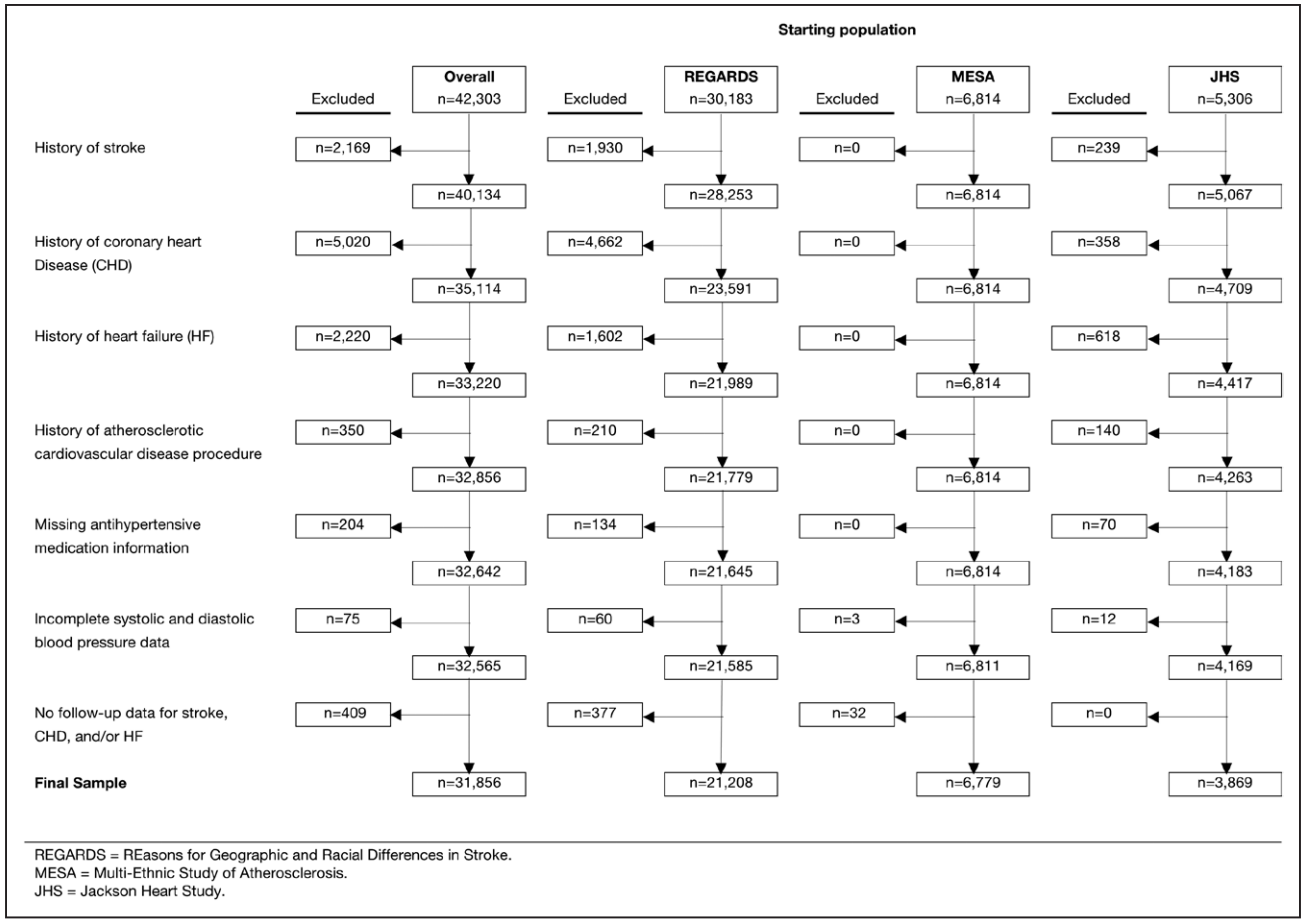

Figure 1. Study exclusions overall and by individual cohort.
JHS indicates Jackson Heart Study; MESA, Multi-Ethnic Study of Atherosclerosis; and REGARDS, Reasons for Geographic and Racial Differences in Stroke.

REGARDS, 9- to 12-months intervals for MESA, and annually for JHS. If a hospitalization for CVD was suspected, then the event was adjudicated by trained physicians. Deaths were detected by report from next of kin, the National Death Index, or through online sources (eg, Social Security Death Index). Interviews were conducted with proxies or next of kin regarding the circumstances surrounding death, including the presence of chest pain. Cause of death was adjudicated using information obtained from proxies, medical history, death certificates, and autopsy reports. Incident stroke events included the first occurrence of a definite nonfatal or fatal stroke.[31–33] Incident CHD events were defined as the first occurrence of a definite or probable nonfatal MI or definite or probable fatal CHD event.[28,31,32] Incident HF events were defined as a definite or probable HF hospitalization.[17,29,31] More details on the definitions for incident stroke, CHD, and HF are presented in online-only Data Supplement Table I. Adjudicated events for stroke, CHD, and HF for REGARDS were available from the baseline examination (2003–2007) through December 31, 2012, and for MESA from the baseline examination (2000–2002) through December 31, 2013. For JHS, stroke and CHD adjudication were available from the baseline examination (2000–2004) through December 31, 2012. However, HF adjudication did not begin until January 1, 2005. Therefore, for HF, we used JHS follow-up data from 2005 through 2012.

Statistical Analysis

All analyses were performed for participants overall and for those taking and not taking antihypertensive medication, separately. Participant characteristics were calculated with the statistical significance of differences between those with SBP/DBP <140/90 mm Hg versus SBP/DBP ≥140/90 mm Hg determined using *t* tests and χ^2 tests for continuous and categorical variables, respectively. *P* values <0.05 were considered statistically significant. The percentage of incident CVD, stroke, CHD, and HF events occurring among participants with SBP/DBP <140/90 mm Hg and SBP/DBP ≥140/90 mm Hg, separately, was calculated overall and in subgroups defined by age, sex, and race/ethnicity. Results from individual studies were pooled to obtain a weighted estimate using a random-effects model meta-analysis for proportions.[34] Next, incidence rates for CVD, stroke, CHD, and HF were calculated. These rates were calculated for the overall population and in subgroups defined by age, sex, race/ethnicity, current smoking, and diabetes mellitus status within each study, with pooled weighted estimates calculated using random-effects models.[35] The statistical significance of differences in percentages and incidence rates across subgroups and by antihypertensive medication use status was calculated using Poisson regression models within each study and using random-effects models for the pooled results. Robust

variance estimators were used in Poisson regression models when comparing percentages.[36]

To investigate potential opportunities to lower CVD risk among adults taking antihypertensive medication with SBP/DBP <140/90 mm Hg, we calculated the percentage of participants with an indication for statins who were taking a statin and the percentage with SBP ≥120 mm Hg and <140 mm Hg who were SPRINT eligible. SPRINT eligibility was defined as being ≥50 years of age, having SBP between 130 and 180 mm Hg (depending on the number of antihypertensive medications prescribed), having high CVD risk, being free of diabetes mellitus, end-stage renal disease, overt proteinuria, and not having a history of stroke.[15] High CVD risk criteria included the presence of an estimated glomerular filtration rate of 20 to 59 mL/min/1.73 m^2, a 10-year Framingham risk score for CVD ≥15%, or ≥75 years of age.

Several sensitivity analyses were conducted. First, we calculated the percentage of incident CVD, stroke, CHD, and HF events that occurred among participants with SBP/DBP <140/90 mm Hg in MESA and JHS, updating BP and antihypertensive medication use status to the nearest examination visit before their incident CVD event, rather than utilizing values from the baseline examination. We also calculated incidence rates updating BP and antihypertensive medication use status using data collected during follow-up visits. Second, to assess the percentage of CVD events that occurred at SBP/DBP <140/90 mm Hg in a nationally representative sample, we utilized NHANES (National Health and Nutrition Examination Survey) data from 2001 to 2008 with mortality follow-up through 2011. Using these data, we determined the percentage of CVD deaths occurring among US adults with SBP/DBP <140/90 mm Hg and CVD mortality rates per 1000 person years of observation. The analysis of NHANES data accounted for its complex survey design and were weighted to the noninstitutionalized US population.[37] Cause of death in NHANES was determined by linking the data to the National Death Index.[37] Third, we calculated the percentage of incident CVD, stroke, CHD, and HF events that occurred among participants with SBP/DBP <130/80 mm Hg and, separately, SBP/DBP <150/100 mm Hg. Fourth, we determined the percentage of incident CVD events among participants with SBP/DBP <140/90 mm Hg after excluding Hispanic and Chinese MESA participants because the REGARDS study and JHS enrolled only black and white adults. Fifth, the REGARDS study used an aneroid sphygmomanometer to measure BP in the home. Previous studies have reported only small differences in BP measured by aneroid and oscillometric methods.[38,39] However, BP measured in the home may be lower compared with BP measured in the clinic.[40] Therefore, we determined the proportion of incident events that occurred among REGARDS study participants with SBP <135 mm Hg and DBP <85 mm Hg. All analyses were conducted using SAS Version 9.4 (SAS Institute) and STATA Version 13 (StataCorp).

RESULTS

Baseline Characteristics

After pooling participants from REGARDS, MESA, and JHS, 78.3% of the sample had SBP/DBP <140/90 mm Hg (Table 2). Among the overall population and for participants taking and not taking antihypertensive medication, separately, those with SBP/DBP <140/90 mm Hg were younger, more likely to be white, less likely to be men, current smokers, and have diabetes mellitus compared with those with SBP/DBP ≥140/90 mm Hg. Among participants with SBP/DBP <140/90 mm Hg, 55.9% had a 10-year CVD risk ≥7.5% compared with 90.6% of participants with SBP/DBP ≥140/90 mm Hg. A lower percentage of participants with SBP/DBP <140/90 mm Hg were taking antihypertensive medication compared with participants with SBP/DBP ≥140/90 mm Hg. Participant characteristics are presented for each cohort (REGARDS, MESA, and JHS) separately in online-only Data Supplement Table II.

Percentage of Incident Events Occurring in Participants With SBP/DBP ≤140/90 mm Hg

Over a mean follow-up time of 7.7 years (maximum follow-up 13.5 years), 2584 participants had an incident CVD event. Overall, 63.0% (95% confidence interval [CI], 54.9–71.1) of incident CVD events occurred in participants with SBP/DBP <140/90 mm Hg (Figure 2, top; online-only Data Supplement Table III). Within every age, sex, and race/ethnicity subgroup, the majority of incident CVD events occurred in participants with SBP/DBP <140/90 mm Hg. The percentage of incident CVD events that occurred among participants with SBP/DBP <140/90 mm Hg was lower among those taking versus not taking antihypertensive medication. The majority of incident stroke, CHD, and HF events occurred in participants with SBP/DBP <140/90 mm Hg overall and also among participants taking and not taking antihypertensive medication (Figure 2, middle and lower; online-only Data Supplement Table III). Overall, 66.0% (95% CI, 63.6–68.3), 54.6% (95% CI, 51.0–58.2), and 68.6% (95% CI, 63.6–73.7) of incident CVD events in REGARDS, MESA, and JHS, respectively, occurred among participants with SBP/DBP <140/90 mm Hg (online-only Data Supplement Table IV).

Incidence Rates for CVD, Stroke, CHD, and HF Events

The incidence of CVD among participants with SBP/DBP <140/90 mm Hg and SBP/DBP ≥ 140/90 mm Hg was 8.0 (95% CI, 6.7–9.2) and 18.1 (95% CI, 16.7–19.6) per 1000 person-years, respectively (Table 3). Among participants taking antihypertensive medication with SBP/DBP <140/90 mm Hg and SBP/DBP ≥140/90 mm Hg, the incidence of CVD was 11.9 (95% CI, 11.1–12.7) and 19.9 (95% CI, 18.3–21.5) per 1000 person-years, respectively. Among participants who were not taking antihypertensive medication, the incidence of CVD was 5.7 (95% CI, 3.9–7.5) per 1000 person-years for those with SBP/DBP <140/90 mm Hg and 15.7 (95% CI, 13.2–18.2) per 1000 person-years for those with SBP/DBP ≥140/90 mm Hg.

Table 2. Baseline Characteristics of Participants With Systolic and Diastolic Blood Pressure <140/90 mm Hg and ≥140/90 mm Hg, Overall and Stratified by Antihypertensive Medication Use

	Overall			Taking Antihypertensive Medication			Not Taking Antihypertensive Medication		
	BP <140/90 mm Hg n=24 933 (78.3%)	BP ≥140/90 mm Hg n=6923 (21.7%)	*P* Value	BP <140/90 mm Hg n=9468 (70.0%)	BP ≥140/90 mm Hg n=4062 (30.0%)	*P* Value	BP <140/90 mm Hg n=15 465 (84.4%)	BP ≥140/90 mm Hg n=2861 (15.6%)	*P* Value
Age, y mean (SD)	61.3 (10.4)	65.3 (9.7)	<0.01	63.8 (9.5)	65.9 (9.3)	<0.01	59.8 (10.6)	64.4 (10.2)	<0.01
Race/ethnicity, %									
White	50.2	38.4	<0.01	41.3	33.3	<0.01	55.7	45.5	<0.01
Black	42.9	53.3		54.9	59.2		35.6	45.1	
Hispanic	4.4	5.6		2.5	5.0		5.6	6.4	
Chinese American	2.5	2.8		1.3	2.5		3.2	3.1	
Men, %	41.5	45.4	<0.01	36.6	41.6	<0.01	44.5	50.7	<0.01
Current smoker, %	13.3	14.9	<0.01	11.6	12.9	0.03	14.3	17.7	<0.01
Obesity, %	35.7	43.9	<0.01	47.3	48.4	0.21	28.6	37.4	<0.01
Diabetes mellitus, %	14.5	21.7	<0.01	24.2	27.8	<0.01	8.6	13.0	<0.01
LDL cholesterol, mg/dL mean (SD)	118.2 (33.7)	120 (34.7)	<0.01	113.5 (33.4)	117.0 (34.4)	<0.01	121.1 (33.6)	124.1 (34.7)	<0.01
HDL cholesterol, mg/dL mean (SD)	52.5 (15.8)	52.3 (16.1)	0.35	51.8 (15.7)	52.1 (15.7)	0.20	53.0 (15.8)	52.6 (16.5)	0.25
Statin medication, %	20.6	21.0	0.57	30.8	26.8	<0.01	14.2	12.4	0.02
10-year CVD risk ≥7.5%, %	55.9	90.6	<0.01	75.5	95.4	<0.01	44.0	83.9	<0.01
Antihypertensive medication, %	38.0	58.7	<0.01	100.0	100.0	-	0.0	0.0	-

BP indicates blood pressure; CVD, cardiovascular disease; HDL, high-density lipoprotein; and LDL, low-density lipoprotein. Numbers in the table are percentages or mean with standard deviation in parentheses. BP <140/90 mm Hg defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg. BP ≥140/90 mm Hg defined as systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg. Participant characteristics and blood pressure categories were calculated from the baseline exams in the following years: Raasons for Geographic and Racial Differences in Stroke study, 2003–2007; Multi-Ethnic Study of Atherosclerosis, 2000–2002; Jackson Heart Study, 2000–2004.

online-only Data Supplement Table V through VII provide incidence rates for CVD, stroke, CHD, and HF events for the REGARDS study, MESA and JHS, respectively.

Statin Use and SPRINT Eligibility

Among participants who were taking antihypertensive medication with SBP/DBP <140/90 mm Hg, 76.6% (95% CI, 75.8–77.5) had an indication for a statin of whom 33.2% (95% CI, 32.1–34.3) were taking a statin (Table 4). For participants with SBP ≥120 mm Hg and <140 mm Hg who were taking antihypertensive medication, 19.5% (95% CI, 18.5–20.5) met the SPRINT eligibility criteria.

Sensitivity Analyses

After updating BP and antihypertensive medication use status to the nearest examination visit before an incident CVD event, 59.9% (95% CI, 56.3–63.4) and 62.7% (57.5–68.0) of incident CVD events occurred among MESA and JHS participants with SBP/DBP <140/90 mm Hg, respectively (online-only Data Supplement Table VIII). Incidence rates calculated using updated BP and antihypertensive medication use status for MESA and JHS participants are presented in online-only Data Supplement Table IX and X, respectively. Using NHANES 2001 to 2008 data, 58.0% (95% CI, 52.0–63.7) of CVD deaths occurred among US adults with SBP/DBP <140/90 mm Hg (online-only Data Supplement Table XI). CVD mortality rates are presented in online-only Data Supplement Table XII. Overall, 35.5% (95% CI, 33.6–37.3) of incident CVD events occurred among participants with SBP/DBP <130/80 mm Hg, and 80.0% (95% CI, 78.5–81.6) of incident CVD events occurred among participants with SBP/DBP <150/100 mm Hg (online-only Data Supplement Table XIII and XIV, respectively). When restricting the analysis to whites and blacks, 64.0% (95% CI, 62.0–65.9) of incident CVD events occurred in participants with SBP/DBP <140/90 mm Hg (online-only Data Supplement Table XV). Finally, 54.0% (95% CI, 51.5–56.4) of incident CVD, 56.1% (95% CI, 52.1–60.0) of incident stroke, 53.4% (95% CI, 49.9–56.9) of incident CHD, and 48.1% (95% CI, 43.3–53.0) of incident HF events in the REGARDS study occurred among participants with SBP/DBP <135/85 mm Hg.

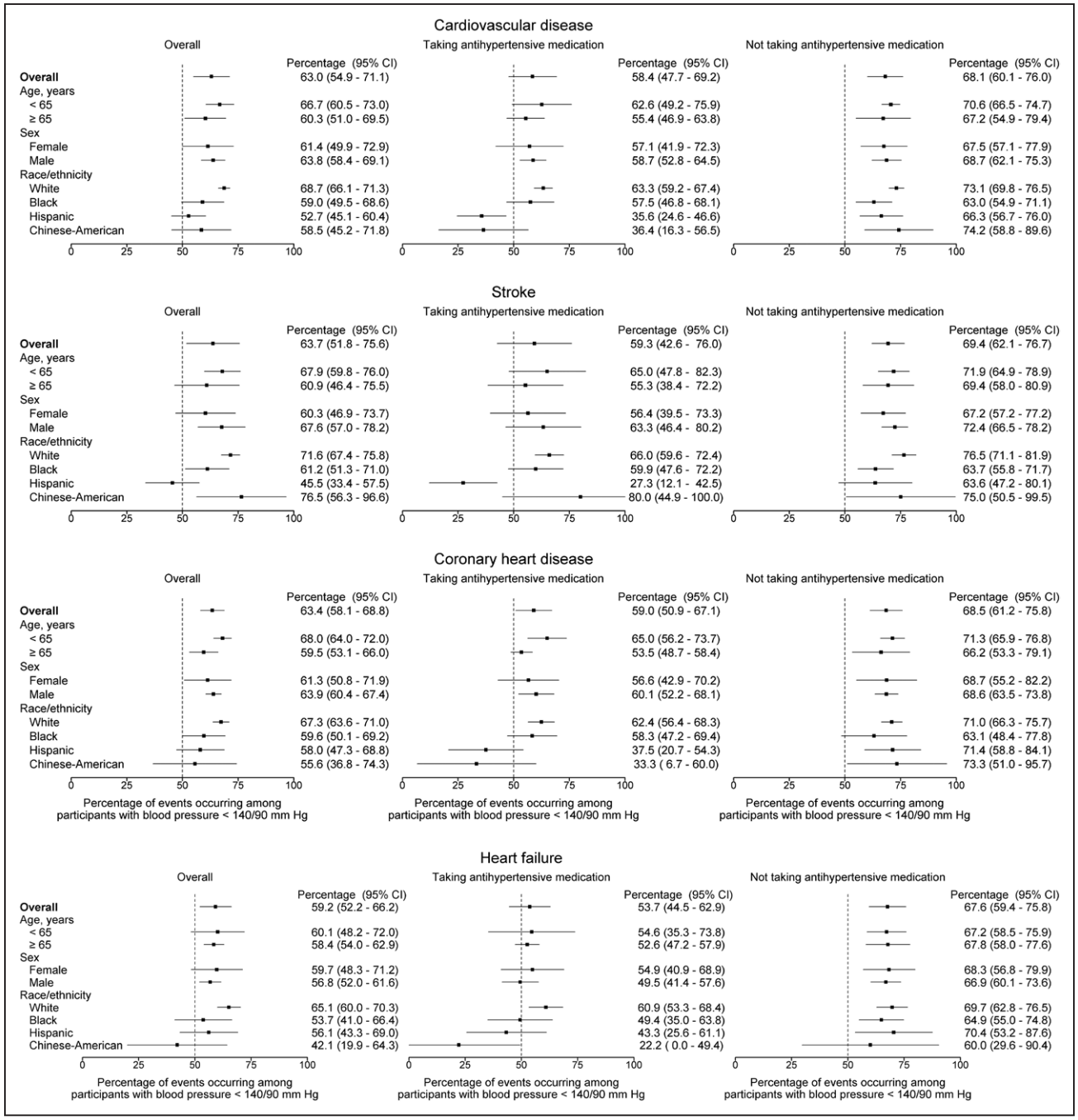

Figure 2. Percentage of cardiovascular disease, stroke, coronary heart disease, and heart failure events occurring among participants with blood pressure <140/90 mm Hg.

Blood pressure <140/90 mm Hg defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg. Statistical comparisons between groups are presented in online-only Data Supplement Table III. CI indicates confidence interval.

DISCUSSION

Several important findings are evident from the current pooled analysis of 3 contemporary US cohort studies. First, >60% of incident CVD events occurred in participants with SBP/DBP <140/90 mm Hg. This finding represents a fundamental shift from previous decades when the majority of incident CVD events occurred among US adults with SBP/DBP ≥140/90 mm Hg. Second, as expected from previous research, the incidence rate of CVD was higher among adults with SBP/DBP ≥140/90 mm Hg compared with participants with SBP/DBP <140/90 mm Hg. However, a majority of individuals with SBP/DBP <140/90 mm Hg had a 10-year predicted CVD risk ≥7.5%. Third, only 33.2% of participants taking antihypertensive medication with SBP/DBP <140/90 mm Hg and an indication for statins were taking one at the baseline examination of the 3 cohorts.

Table 3. Incidence Rates of Cardiovascular Disease, Stroke, Coronary Heart Disease, and Heart Failure, Overall and by Antihypertensive Medication Use

	Overall			Taking Antihypertensive Medication			Not Taking Antihypertensive Medication				
	BP <140/90 mm Hg n=24 933	BP ≥140/90 mm Hg n=6923	*P* Value	BP <140/90 mm Hg n=9468	BP ≥140/90 mm Hg n=4062	*P* Value	BP <140/90 mm Hg n=15 465	BP ≥140/90 mm Hg n=2861	*P* Value	*P* Value†	*P* Value‡
Cardiovascular Disease											
Overall	8.0 (6.7–9.2)	18.1 (16.7–19.6)	<0.01	11.9 (11.1–12.7)	19.9 (18.3–21.5)	<0.01	5.7 (3.9–7.5)	15.7 (13.2–18.2)	<0.01	<0.01	0.26
Age, y											
<65	4.9 (4.0–5.7)	12.3 (11.0–13.7)	<0.01	8.0 (7.2–8.9)	12.9 (11.1–14.7)	<0.01	3.5 (2.5–4.4)	11.6 (9.7–13.5)	<0.01	<0.01	0.36
≥65	15.8 (13.3–18.2)	24.6 (22.1–27.1)	<0.01	18.1 (15.4–20.7)	26.3 (22.8–29.9)	<0.01	13.3 (11.1–15.5)	21.8 (18.9–24.7)	<0.01	<0.01	0.73
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			
Sex											
Female	6.5 (5.3–7.6)	16.0 (14.5–17.5)	<0.01	9.9 (9.0–10.9)	18.1 (16.1–20.1)	<0.01	4.4 (3.4–5.3)	12.7 (10.6–14.8)	<0.01	<0.01	0.05
Male	9.9 (8.0–11.9)	20.3 (17.0–23.7)	<0.01	15.1 (13.6–16.7)	22.4 (19.8–25.1)	<0.01	7.4 (4.4–10.5)	17.6 (11.0–24.2)	<0.01	<0.01	0.97
P value	<0.01	<0.01		<0.01	0.01		<0.01	<0.01			
Race/ethnicity*											
White	8.4 (7.1–9.8)	19.6 (17.6–21.5)	<0.01	12.2 (10.9–13.6)	20.0 (17.2–22.8)	<0.01	7.0 (5.5–8.5)	19.1 (16.3–21.8)	<0.01	<0.01	0.97
Black	8.2 (7.1–9.4)	17.3 (15.3–19.4)	<0.01	11.9 (10.8–13.0)	19.6 (17.5–21.7)	<0.01	5.2 (3.6–6.8)	13.8 (11.5–16.2)	<0.01	<0.01	0.35
P value	0.73	0.05		0.70	0.31		0.22	0.06			
Hispanic	7.2 (5.7–8.7)	21.1 (16.4–25.8)	<0.01	10.3 (6.3–14.2)	24.3 (17.4–31.3)	<0.01	6.4 (4.8–8.0)	17.6 (11.4–23.8)	<0.01	0.04	0.16
P value	0.86	0.81		0.22	0.58		0.54	0.31			
Chinese American	4.5 (2.9–6.1)	11.0 (6.4–15.6)	<0.01	6.1 (1.9–10.3)	13.2 (6.3–20.1)	0.08	4.1 (2.4–5.8)	8.5 (2.6–14.4)	0.08	0.35	0.32
P value	0.01	<0.01		0.03	0.10		0.14	0.01			
Smoking											
Nonsmoker	7.5 (6.3–8.7)	17.4 (16.2–18.6)	<0.01	11.4 (10.6–12.3)	18.7 (17.1–20.4)	<0.01	5.2 (3.5–6.9)	15.1 (12.9–17.3)	<0.01	<0.01	0.16
Current	11.5 (9.9–13.2)	23.7 (19.0–28.4)	<0.01	15.6 (12.7–18.4)	26.6 (20.1–33.2)	<0.01	9.4 (7.2–11.7)	20.4 (15.6–25.3)	<0.01	<0.01	0.82
P value	<0.01	<0.01		<0.01	<0.01		<0.01	0.01			
Diabetes mellitus											
No	6.6 (5.3–8.0)	15.2 (12.5–17.9)	<0.01	10.4 (9.5–11.2)	16.6 (14.9–18.4)	<0.01	4.9 (3.0–6.9)	14.3 (11.3–17.4)	<0.01	<0.01	0.51
Yes	15.9 (14.3–17.4)	27.8 (24.6–31.1)	<0.01	16.7 (14.7–18.7)	29.0 (25.2–32.9)	<0.01	14.3 (11.9–16.6)	23.5 (17.5–29.5)	<0.01	0.07	0.56
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			
Stroke											
Overall	2.8 (1.9–3.7)	5.9 (4.8–7.0)	<0.01	4.2 (3.3–5.1)	6.5 (5.1–7.8)	<0.01	2.0 (1.2–2.8)	5.3 (4.3–6.2)	<0.01	<0.01	0.03
Age, y											
<65	1.6 (1.2–2.1)	3.9 (3.1–4.6)	<0.01	2.8 (2.2–3.3)	3.9 (2.9–4.9)	0.02	1.2 (0.8–1.5)	3.6 (2.6–4.7)	<0.01	0.04	0.37
≥65	5.5 (4.1–6.9)	8.3 (6.8–9.8)	<0.01	6.7 (5.6–7.7)	9.3 (7.8–10.8)	<0.01	4.8 (3.1–6.5)	6.8 (4.4–9.2)	<0.01	0.01	0.06

(*Continued*)

Table 3. Continued

	Overall			Taking Antihypertensive Medication			Not Taking Antihypertensive Medication				
	BP <140/90 mm Hg n=24 933	BP ≥140/90 mm Hg n=6923	*P* Value	BP <140/90 mm Hg n=9468	BP ≥140/90 mm Hg n=4062	*P* Value	BP <140/90 mm Hg n=15 465	BP ≥140/90 mm Hg n=2861	*P* Value	*P* Value†	*P* Value‡
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			
Sex											
Female	2.4 (1.7–3.1)	6.3 (5.2–7.4)	<0.01	3.8 (3.1–4.5)	6.9 (5.3–8.6)	<0.01	1.7 (1.1–2.3)	5.2 (3.9–6.6)	<0.01	<0.01	0.06
Male	3.2 (2.1–4.4)	5.6 (4.7–6.6)	<0.01	5.1 (3.7–6.5)	5.9 (4.5–7.2)	0.50	2.4 (1.4–3.5)	5.2 (3.9–6.6)	<0.01	0.01	0.23
P value	<0.01	0.19		<0.01	0.13		<0.01	0.95			
Race/ethnicity*											
White	2.8 (1.6–4.1)	6.3 (5.2–7.4)	<0.01	4.6 (3.7–5.5)	7.0 (5.3–8.6)	<0.01	2.3 (1.3–3.3)	5.6 (4.1–7.1)	<0.01	<0.01	0.24
Black	2.9 (2.0–3.9)	5.6 (4.1–7.1)	<0.01	4.3 (3.4–5.2)	6.1 (4.6–7.6)	<0.01	1.8 (1.0–2.6)	4.6 (2.7–6.5)	<0.01	<0.01	0.06
P value	0.32	0.29		0.56	0.45		0.67	0.14			
Hispanic	2.5 (1.6–3.3)	9.3 (6.3–12.3)	<0.01	3.5 (1.2–5.7)	11.7 (7.0–16.4)	<0.01	2.2 (1.3–3.1)	6.6 (2.9–10.3)	<0.01	0.25	0.10
P value	0.30	0.17		0.99	0.24		0.22	0.68			
Chinese American	1.9 (0.9–2.9)	2.0 (0.0–3.9)	0.93	3.0 (0.1–6.0)	0.9 (0.0–2.7)	0.29	1.6 (0.6–2.6)	3.2 (0.0–6.8)	0.30	0.29	0.28
P value	0.91	0.02		0.81	0.03		0.92	0.35			
Smoking status											
Nonsmoker	2.6 (1.7–3.5)	5.4 (4.1–6.6)	<0.01	3.9 (2.9–4.9)	5.9 (4.3–7.5)	0.02	1.9 (1.2–2.7)	4.8 (3.5–6.1)	<0.01	<0.01	0.01
Current	3.7 (2.7–4.8)	8.9 (6.7–11.1)	<0.01	6.0 (4.2–7.7)	10.2 (6.8–13.6)	<0.01	2.6 (1.4–3.7)	7.0 (4.2–9.7)	<0.01	0.01	0.71
P value	0.01	<0.01		0.04	<0.01		0.04	0.13			
Diabetes mellitus											
No	2.3 (1.4–3.3)	5.5 (4.4–6.6)	<0.01	3.7 (2.8–4.7)	6.1 (4.7–7.4)	<0.01	1.7 (0.8–2.6)	5.0 (4.0–6.0)	<0.01	<0.01	0.08
Yes	5.4 (4.5–6.3)	7.7 (6.0–9.3)	<0.01	5.6 (4.4–6.7)	7.9 (5.9–9.8)	0.04	4.9 (3.5–6.2)	7.0 (3.8–10.2)	0.14	0.60	0.58
P value	<0.01	0.01		<0.01	0.08		<0.01	0.17			
Coronary Heart Disease											
Overall	3.8 (3.1–4.5)	8.1 (6.4–9.8)	<0.01	5.4 (4.9–5.9)	8.7 (6.9–10.4)	<0.01	2.8 (1.6–4.0)	7.2 (4.8–9.6)	<0.01	<0.01	0.44
Age, y											
<65	2.5 (2.0–3.1)	5.9 (4.8–7.0)	<0.01	4.0 (3.4–4.6)	6.1 (4.8–7.3)	<0.01	1.8 (1.0–2.6)	5.5 (3.4–7.6)	<0.01	0.01	0.56
≥65	6.8 (6.1–7.4)	10.9 (8.9–12.9)	<0.01	7.2 (6.3–8.2)	11.3 (8.3–14.3)	0.06	6.3 (5.4–7.1)	10.2 (8.2–12.1)	<0.01	0.02	0.42
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			
Sex											
Female	2.7 (2.2–3.2)	6.5 (5.6–7.5)	<0.01	4.1 (3.5–4.7)	7.5 (6.2–8.7)	<0.01	1.8 (1.3–2.3)	4.9 (3.6–6.1)	<0.01	<0.01	0.39
Male	5.3 (4.2–6.4)	10.0 (6.8–13.1)	<0.01	7.6 (6.5–8.6)	10.6 (8.0–13.3)	0.12	4.0 (1.8–6.1)	8.9 (3.6–14.3)	<0.01	<0.01	0.13
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			

(*Continued*)

Table 3. Continued

	Overall			Taking Antihypertensive Medication			Not Taking Antihypertensive Medication				
	BP <140/90 mm Hg n=24 933	BP ≥140/90 mm Hg n=6923	*P* Value	BP <140/90 mm Hg n=9468	BP ≥140/90 mm Hg n=4062	*P* Value	BP <140/90 mm Hg n=15 465	BP ≥140/90 mm Hg n=2861	*P* Value	*P* Value†	*P* Value‡
Race/ethnicity*											
White	4.4 (4.0–4.8)	10.1 (8.7–11.5)	<0.01	5.7 (4.8–6.6)	9.4 (7.4–11.4)	0.03	3.8 (3.2–4.3)	10.7 (8.6–12.7)	<0.01	<0.01	0.21
Black	3.7 (2.9–4.4)	7.5 (6.0–8.9)	<0.01	5.3 (4.6–6.0)	8.3 (6.4–10.3)	<0.01	2.4 (1.2–3.5)	5.5 (4.0–7.1)	<0.01	<0.01	0.42
P value	0.43	0.28		0.41	0.77		0.09	0.45			
Hispanic	3.7 (3.4–4.0)	8.4 (7.5–9.2)	<0.01	4.6 (2.0–7.2)	9.8 (5.5–14.1)	0.04	3.6 (2.4–4.8)	7.6 (3.6–11.7)	0.02	0.47	0.48
P value	0.77	0.86		0.18	0.37		0.58	0.31			
Chinese American	6.2 (5.3–7.2)	10.8 (8.4–13.2)	<0.01	3.0 (0.1–5.9)	7.5 (2.3–12.6)	0.14	2.0 (0.8–3.1)	4.2 (0.1–8.3)	0.19	0.47	0.35
P value	0.02	0.18		0.09	0.97		0.12	0.08			
Smoking status											
Nonsmoker	3.5 (2.8–4.1)	8.2 (7.3–9.2)	<0.01	5.2 (4.6–5.7)	8.6 (7.2–9.9)	<0.01	2.4 (1.3–3.5)	7.3 (5.6–9.0)	<0.01	<0.01	0.39
Current	6.1 (5.1–7.1)	8.0 (2.6–13.5)	<0.01	7.3 (5.4–9.2)	8.7 (2.9–14.5)	0.27	5.1 (3.3–6.9)	7.2 (2.0–12.5)	<0.01	0.05	0.89
P value	<0.01	0.03		<0.01	0.06		<0.01	0.16			
Diabetes mellitus											
No	3.2 (2.5–3.9)	6.8 (4.6–8.9)	<0.01	4.7 (4.1–5.2)	7.2 (5.5–8.9)	<0.01	2.4 (1.2–3.6)	6.4 (3.8–9.1)	<0.01	<0.01	0.70
Yes	7.7 (6.6–8.8)	12.8 (10.7–15.0)	<0.01	7.8 (6.4–9.1)	12.4 (9.6–15.2)	<0.01	7.1 (5.1–9.1)	11.8 (7.7–16.0)	0.04	0.16	0.04
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			
Heart Failure											
Overall	3.0 (1.9–4.1)	7.5 (5.3–9.7)	<0.01	4.9 (2.8–7.0)	8.8 (6.2–11.5)	<0.01	1.8 (1.6–2.0)	5.1 (3.4–6.8)	<0.01	<0.01	0.15
Age, y											
<65	1.5 (0.8–2.2)	4.7 (3.3–6.1)	<0.01	2.6 (1.5–3.8)	5.5 (4.0–7.1)	<0.01	0.9 (0.6–1.2)	3.2 (1.6–4.7)	<0.01	<0.01	0.07
≥65	7.7 (2.8–12.5)	11.4 (5.6–17.1)	<0.01	8.8 (3.7–13.9)	13.0 (5.7–20.4)	<0.01	4.1 (3.3–5.0)	6.8 (5.2–8.4)	<0.01	<0.01	0.80
P value	<0.01	<0.01		<0.01	<0.01		0.02	0.11			
Sex											
Female	2.8 (1.3–4.4)	7.0 (3.8–10.1)	<0.01	4.3 (2.1–6.5)	8.0 (4.4–11.5)	<0.01	1.4 (1.1–1.7)	4.2 (2.4–6.0)	<0.01	<0.01	0.44
Male	3.0 (2.3–3.7)	7.7 (6.1–9.3)	<0.01	5.4 (2.9–7.9)	9.2 (7.5–10.8)	<0.01	2.2 (1.8–2.6)	5.5 (3.7–7.2)	<0.01	<0.01	0.14
P value	0.30	0.01		0.27	0.01		<0.01	<0.01			
Race/ethnicity*											
White	2.4 (1.9–2.8)	6.0 (4.1–7.9)	<0.01	4.2 (2.1–6.3)	6.2 (4.6–7.7)	<0.01	1.8 (1.4–2.1)	5.5 (3.0–7.9)	<0.01	<0.01	0.96
Black	3.2 (2.1–4.2)	7.9 (5.9–10.0)	<0.01	4.7 (2.5–6.9)	9.3 (6.9–11.7)	<0.01	1.9 (1.5–2.4)	4.8 (2.7–6.9)	<0.01	0.06	0.34
P value	0.83	0.99		0.10	0.71		0.94	0.53			
Hispanic	2.6 (1.7–3.5)	6.4 (3.9–9.0)	<0.01	5.0 (2.3–7.7)	8.3 (4.4–12.3)	0.16	2.0 (1.1–2.9)	4.3 (1.3–7.4)	0.06	0.01	0.13

(*Continued*)

Table 3. Continued

	Overall			Taking Antihypertensive Medication			Not Taking Antihypertensive Medication				
	BP <140/90 mm Hg n=24 933	BP ≥140/90 mm Hg n=6923	*P* Value	BP <140/90 mm Hg n=9468	BP ≥140/90 mm Hg n=4062	*P* Value	BP <140/90 mm Hg n=15 465	BP ≥140/90 mm Hg n=2861	*P* Value	*P* Value†	*P* Value‡
P value	0.68	0.44		0.51	0.82		0.95	0.14			
Chinese American	1.1 (0.4–1.9)	5.4 (2.2–8.6)	<0.01	1.5 (0.0–3.6)	6.5 (1.7–11.4)	0.07	1.1 (0.2–1.9)	4.2 (0.1–8.3)	0.03	0.67	0.48
P value	0.01	0.28		0.05	0.69		0.15	0.24			
Smoking status											
Nonsmoker	2.9 (1.9–3.9)	7.4 (4.8–10.1)	<0.01	4.7 (2.8–6.6)	8.9 (5.5–12.3)	<0.01	1.7 (1.4–2.0)	4.7 (3.3–6.1)	<0.01	<0.01	0.12
Current	3.0 (2.3–3.7)	7.5 (5.5–9.6)	<0.01	4.5 (2.3–6.7)	9.5 (6.2–12.7)	<0.01	2.4 (1.5–3.4)	5.6 (2.5–8.8)	0.05	<0.01	0.90
P value	0.01	0.08		0.17	0.12		0.04	0.15			
Diabetes mellitus											
No	2.2 (1.7–2.7)	5.2 (4.1–6.3)	<0.01	3.9 (2.5–5.3)	5.6 (4.6–6.5)	<0.01	1.5 (1.2–1.7)	4.2 (3.0–5.3)	<0.01	<0.01	0.38
Yes	7.2 (3.8–10.6)	15.0 (10.4–19.6)	<0.01	7.6 (3.8–11.3)	15.0 (11.2–18.7)	<0.01	5.1 (3.7–6.5)	10.2 (4.0–16.4)	0.03	0.70	0.47
P value	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01			

BP indicates blood pressure. Numbers in the table are incidence rates per 1000 person-years of observation, with 95% confidence intervals in parentheses. BP <140/90 mm Hg defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg. BP ≥140/90 mm Hg defined as systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg. Refer to online-only Data Supplement Tables V through and VII for incidence rates by cohort.

*White race is the reference group for race/ethnicity *P* value calculation; *P* values for blacks versus whites are based on meta-analysis data from the Reasons for Geographic and Racial Differences in Stroke study and the Multi-Ethnic Study of Atherosclerosis (MESA). *P* values for Hispanic compared with whites and Chinese Americans compared with whites are based on MESA data.

†*P* value in column compares the incidence of cardiovascular disease events occurring among participants with blood pressure <140/90 mm Hg by antihypertensive medication use status.

‡*P* value in column compares the incidence of cardiovascular disease events occurring among participants with blood pressure ≥140/90 mm Hg by antihypertensive medication use status.

Finally, 19.5% of participants with SBP between 120 mm Hg and 139 mm Hg who were taking antihypertensive medication met the eligibility criteria for SPRINT and may benefit from a SBP target goal of 120 mm Hg.

The finding that the majority of incident CVD events in the modern era occur in participants with SBP/DBP <140/90 mm Hg represents a change from studies conducted in prior eras. In US cohort studies from the 1960s through the 1990s, a majority of incident CVD events occurred among adults with SBP/DBP ≥140/90 mm Hg.[5–11] The results of the current study, which included contemporary population-based and nationally representative samples, are consistent with the increasing awareness, treatment, and control of hypertension that has occurred in the United States over the past several decades.[13,14] The US NHANES data indicate that from 1988–1991 to 2011–2012, awareness of hypertension among adults increased from 69% to 82%

Table 4. Use of Statins and SPRINT Eligibility Among Participants Taking Antihypertensive Medication With Systolic/Diastolic Blood Pressure <140/90 mm Hg, Overall and by Study Cohort

Characteristics	Overall n=9468	REGARDS n=6874	MESA n=1308	JHS n=1286
Indication for statin*	76.6 (75.8–77.5)	78.7 (77.7–79.7)	77.5 (75.2–79.7)	64.9 (62.3–67.6)
Statin use	33.2 (32.1–34.3)	36.4 (35.1–37.7)	27.3 (24.5–30.0)	19.8 (17.1–22.5)
SBP ≥120 mm Hg and <140 mm Hg	67.2 (66.3–68.2)	68.4 (67.3–69.5)	60.9 (58.2–63.5)	67.7 (65.1–70.2)
Eligible for SPRINT†	19.5 (18.5–20.5)	19.6 (18.5–20.7)	26.3 (23.2–29.3)	12.9 (10.7–15.1)

JHS indicates Jackson Heart Study; MESA, Multi-Ethnic Study of Atherosclerosis; REGARDS, Reasons for Geographic and Racial Differences in Stroke; SBP, systolic blood pressure; and SPRINT, Systolic Blood Pressure Intervention Trial. Numbers in the table are percentage with 95% confidence intervals in parentheses. BP <140/90 mm Hg defined as systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg. Statin use was calculated among participants with an indication for statin, and eligibility for SPRINT was calculated among participants with systolic blood pressure ≥120 mm Hg and <140 mm Hg.

*Indication for statin includes having diabetes mellitus, low-density lipoprotein cholesterol ≥190 mg/dL, or a 10-year cardiovascular disease risk ≥7.5%.

†SPRINT eligibility defined as being ≥50 years of age, having systolic blood pressure between 130 and 180 mm Hg (depending on number of antihypertensive medications. prescribed), high cardiovascular disease risk (presence of an estimated glomerular filtration rate of 20 to 59 mL/min/1.73 m^2, a 10-year Framingham risk score for cardiovascular disease ≥15%, or ≥75 years of age), and being free of diabetes mellitus, end-stage renal disease, overt proteinuria, or prior stroke.

and treatment rates increased from 53% to 75%.[13,14] Also, the percentage of US adults with controlled SBP and DBP increased substantially over this time frame.[13] When NHANES data were examined in the current study, the majority of CVD mortality occurred among individuals with SBP/DBP <140/90 mm Hg. In contrast to these findings, the Global Burden of Hypertension and Systolic Blood Pressure study reported that most CVD deaths worldwide occur at SBP ≥140 mm Hg.[41] Data on CVD deaths were not presented separately for the United States. In the GBS (Global Burden Study), the majority of disability-adjusted life-years lost in the United States occurred at a lower level of SBP compared with other countries and regions, indicating that the United States is an outlier. The current study suggests that this may extend from disability-adjusted life-years lost to incident CVD events.

Elevated BP is a well-established risk factor for stroke, CHD, and HF.[1] Although the majority of CVD events occurred among participants with SBP/DBP <140/90 mm Hg in the current study, participants with SBP/DBP ≥140/90 mm Hg had a higher incidence of CVD. Among participants not taking antihypertensive medication, the incidence of CVD was almost 3 times higher for those with SBP/DBP ≥140/90 mm Hg versus SBP/DBP <140/90 mm Hg. Further improving BP control among US adults has the potential to reduce CVD incidence.[11]

More than 50% of participants with SBP/DBP <140/90 mm Hg had a 10-year predicted CVD risk ≥7.5%. Among those individuals taking antihypertensive medication, >75% with SBP/DBP <140/90 mm Hg had a 10-year CVD risk ≥7.5%, demonstrating that a large percentage of adults are at increased risk for CVD events. Previous studies have shown that controlling BP to <140/90 mm Hg using antihypertensive medication does not return CVD risk to the level of individuals with the same BP without antihypertensive treatment.[42,43] These data highlight the need for primordial prevention of hypertension, earlier detection and treatment of hypertension, and additional CVD risk reduction strategies for adults with hypertension once BP control has been achieved.

Statins may be underutilized among adults taking antihypertensive medication with SBP/DBP <140/90 mm Hg. The 2013 American College of Cardiology/American Heart Association Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults recommends statin use for the primary prevention of CVD among adults with diabetes mellitus, low-density lipoprotein-cholesterol ≥190 mg/dL, or a 10-year predicted CVD risk ≥7.5%.[26] Although >75% of participants who were taking antihypertensive medication with SBP/DBP <140/90 mm Hg had an indication for a statin, only 33% of these participants were taking one. The baseline exams for the current study occurred before the 2013 American College of Cardiology/American Heart Association guideline was published. Results from the HOPE-3 trial (Heart Outcomes Prevention Evaluation 3) suggest that long-term statin use is effective for CVD risk reduction.[44] Specifically, over a median follow-up of 5.6 years in HOPE-3, randomization to 10 mg dose of rosuvastatin daily versus placebo was associated with a 24% CVD risk reduction. Statin medication has also been found to be cost-effective.[45]

SPRINT provides evidence for another risk-reduction strategy among adults with hypertension and SBP/DBP <140/90 mm Hg.[15] SPRINT demonstrated a 25% reduction in CVD events, a 38% reduction in HF, and a 27% reduction in mortality among participants randomized to a SBP target goal of 120 mm Hg compared with their counterparts randomized to the conventional SBP goal of 140 mm Hg.[15] In addition, intensive BP management as tested in SPRINT was determined to be cost-effective at a ratio of $23 777 per quality-adjusted life-year gained.[46] In the current study, 19.5% of participants with SBP between 120 and 139 mm Hg who were taking antihypertensive medication met the SPRINT eligibility criteria. Although absolute risk and cost-effectiveness should be considered when making treatment decisions, these individuals may benefit from a lower SBP target goal.

The current study has a number of strengths. We used data from 3 contemporary population-based cohort studies, and the consistency of results across studies and demographic characteristics suggests that these findings may have a high degree of generalizability. Also, BP was measured using a standardized protocol in each study, and CVD events were adjudicated by trained physicians. The current study should be interpreted in the context of known and potential limitations. Although protocols for measuring variables across studies were similar, there were differences including the devices used to measure BP. The REGARDS study used an aneroid sphygmomanometer to measure BP in the home. Although previous studies have reported only small differences in BP measured by aneroid and oscillometric methods,[38,39] this approach may have resulted in lower BP readings compared with MESA and JHS. However, the majority of CVD events occurred among participants with SBP/DBP <140/90 mm Hg in each study. Also, although we were able to update BP levels and antihypertensive medication use for MESA and JHS participants in sensitivity analyses, the REGARDS study second in-home visit was conducted from May 2013 to November 2016, and outcomes in the REGARDS study have only been adjudicated through December 31, 2012. Therefore, we were unable to analyze data from the follow-up visit for the REGARDS study. Additionally, BP was only measured at a single visit. BP varies from day to day, and some participants may have been misclassified as having SBP/DBP <140/90 mm Hg. However, previous studies report that BP is lower when

based on the average of measurements obtained across multiple clinic visits compared with a single visit.[47,48] Therefore, the percentage of CVD events occurring at SBP/DBP <140/90 mm Hg is likely higher than we estimated in the current study. We did not have information on the cumulative burden of BP in participants before the baseline examination. Prior studies provide evidence that the cumulative burden of BP assessed across the lifespan, rather than measurements from individual visits, may be more strongly associated with subclinical markers of CVD and future CVD events.[43,49] Finally, although the cohorts included in the current analysis were population-based, they do not provide nationally representative data. However, we analyzed data from the NHANES and showed that the majority of CVD deaths occurred among US adults with SBP/DBP <140/90 mm Hg.

CONCLUSIONS

In this pooled analysis of adults without a history of CVD enrolled in 3 large population-based US cohorts conducted in the 2000s, >60% of incident CVD events occurred among participants with BP <140/90 mm Hg. These findings represent a fundamental change from previous studies conducted in the 1980s and 1990s, wherein the majority of CVD events occurred among participants with BP ≥140/90 mm Hg. The incidence of CVD was higher for adults with SBP/DBP ≥140/90 mm Hg, reinforcing the importance of improving BP control among this population. Efforts directed at lowering BP and reducing CVD risk among adults with SBP/DBP <140/90 mm Hg are needed, particularly among those with a 10-year CVD risk ≥7.5%.

SOURCES OF FUNDING

REGARDS: This research project is supported by a cooperative agreement U01 NS041588 from the National Institute of Neurological Disorders and Stroke, National Institutes of Health, Department of Health and Human Service. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Neurological Disorders and Stroke or the National Institutes of Health. Representatives of the funding agency have been involved in the review of the manuscript but not directly involved in the collection, management, analysis, or interpretation of the data. The authors thank the other investigators, staff, and participants of the REGARDS study for their valuable contributions. A full list of participating REGARDS investigators and institutions can be found at http://www.regardsstudy.org. MESA: This research is supported by contracts HHSN268201500003I and, N01-HC-95159 through N01-HC-95169 from the National Heart, Lung, and Blood Institute and by grants UL1-TR-000040 and UL1-TR-001079 from National Center for Research Resources. The authors thank the other investigators, staff, and participants of the MESA study for their valuable contributions. A full list of participating MESA investigators and institutions can be found at http://www.mesa-nhlbi.org. JHS: This research is supported by contracts HHSN268201300046C, HHSN268201300047C, HHSN268201300048C, HHSN268201300049C, and HHSN268201300050C from the National Heart, Lung, and Blood Institute and the National Institute on Minority Health and Health Disparities. The authors thank the JHS participants and data-collection staff. Additional support for this analysis was received through grant R01 HL117323-01 and 5T32 HL00745733 from the NHLBI at the NIH, and the American Heart Association's Strategically Focused Hypertension Research Network grant SFRN 15SFRN2390002.

DISCLOSURES

Drs Safford and Muntner receive grant support from Amgen Inc. The other authors report no conflicts of interest.

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FOOTNOTES

Received January 13, 2017; accepted June 5, 2017.

The online-only Data Supplement is available with this article at http://circ.ahajournals.org/lookup/suppl/doi:10.1161/CIRCULATIONAHA.116.027362/-/DC1.

Circulation is available at http://circ.ahajournals.org.

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Incident Cardiovascular Disease Among Adults With Blood Pressure <140/90 mm Hg

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Circulation. 2017;136:798-812; originally published online June 20, 2017;
doi: 10.1161/CIRCULATIONAHA.117.027362
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0009-7322. Online ISSN: 1524-4539

(SUPPLEMENT) Incident Cardiovascular Disease among Adults with Blood Pressure < 140/90 mm Hg

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Supplemental Table 1. Definitions of study variables by cohort.

Variables	REasons for Geographic and Racial Differences in Stroke (REGARDS)	Multi-Ethnic Study of Atherosclerosis (MESA)	Jackson Heart Study (JHS)
Cohort Description	The REGARDS study enrolled 30,239 black and white adults ≥ 45 years of age from across the 48 contiguous states between January 2003 and October 2007.[1] Blacks and adults residing in the stroke buckle (coastal North Carolina, South Carolina and Georgia) and stroke belt (the remainder of North Carolina, South Carolina and Georgia as well as Alabama, Mississippi, Tennessee, Arkansas and Louisiana) were oversampled by design.	MESA recruited 6,814 adults aged 45–84 years between 2000 and 2002 from four race/ethnic groups (white, black, Hispanic, and Asian primarily of Chinese descent) in 6 US communities (Baltimore, Maryland; Chicago, Illinois; Forsyth County, North Carolina; Los Angeles County, California; northern Manhattan, New York; and St. Paul, Minnesota).[2] MESA enrollment was restricted to adults who were free of clinically evident cardiovascular disease (CVD) at baseline.	The JHS is a community-based prospective cohort study that recruited 5,301 black adults ≥ 21 years of age between September 2000 and March 2004.[3] Study participants were recruited from the Atherosclerosis Risk in Communities (ARIC) site in Jackson, Mississippi, and from a regionally representative sample of urban and rural residents of Jackson and the surrounding counties (Hinds, Madison, and Rankin) that included volunteers, randomly contacted residents, and secondary family members.
Blood Pressure	Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured twice, 30 seconds apart, using an aneroid sphygmomanometer (American Diagnostic Corporation) after the participant had been seated for 5 minutes. The average of these measurements was recorded.[1, 4, 5]	SBP and DBP were measured three times at 2 minute intervals using a Dinamap model Pro 100 automated oscillom±etric sphygmomanometer (GE Medical Systems Information Technologies, Inc., Milwaukee, Wisconsin) after participants rested for 5 minutes in a seated position.[6] The second and third measurements were averaged.[2, 6]	At the baseline assessment, SBP and DBP were measured twice, separated by 1 minute, with an appropriate cuff size using a Hawksley random zero sphygmomanometer (RZS) (Hawksley and Sons Ltd) after a participant had rested for at least 5 minutes. The average of these measurements was recorded.[7] In subsequent JHS study visits, researchers transitioned from using an RZS to an Omron HEM-907XL (Omron Healthcare Inc., Lake Forest, Il.) automatic oscillatory device (AOD) to measure blood pressure (BP) following the same protocol as previously described for the RZS. All BP readings from the RZS were calibrated to the AOD following a blood pressure comparability study. The calibration of blood pressure in JHS is provided in more detail elsewhere.[8]
Total and High Density Lipoprotein-Cholesterol (HDL-C) and Triglycerides	Total and HDL-C and triglycerides were measured from a blood sample using the Ortho Vitros Clinical Chemistry System 950IRC instrument (Johnson & Johnson Clinical Diagnostics).[9, 10]	Total and HDL-C and triglycerides were measured from a blood sample using an enzymatic method and were assayed by the cholesterol oxidase method supplied by Boehringer Mannheim Diagnostics on a Roche COBAS Fara analyzer	Total and HDL-C and triglycerides were measured from a blood sample using an enzymatic method and were assayed by the cholesterol oxidase method supplied by Boehringer Mannheim Diagnostics on a Roche COBAS Fara analyzer

		(Indianapolis, IN).[11, 12]	(Indianapolis, IN).[13, 14]
Diabetes	Fasting serum glucose ≥ 126 mg/dL or self-report of a prior diagnosis of diabetes with antihyperglycemic medication use (insulin or oral hypoglycemic medication).[9, 10]	Fasting serum glucose ≥ 126 mg/dL or self-report of a prior diagnosis of diabetes with antihyperglycemic medication use (insulin or oral hypoglycemic medication).[10,11]	Fasting serum glucose ≥ 126 mg/dL, self-report of a prior diagnosis of diabetes with antihyperglycemic medication use (insulin or oral hypoglycemic medication), or glycosylated hemoglobin A1c (HbA1c) ≥ 48 mmol/mol (6.5%).[15]
Stroke	Definite non-fatal or fatal stroke events were defined as a rapid onset of focal neurological deficits lasting ≥ 24 hours or until death.[16-19] If focal neurological deficits lasted < 24 hours, neuroimaging evidence of a clinically relevant lesion consistent with acute infarct or hemorrhage was required.[16-19]		
Coronary Heart Disease (CHD)	Definite myocardial infarction (MI) was identified by cardiac enzymes or electrocardiogram (ECG) evidence. Probable MI was characterized by less definitive combinations of symptoms, ECG, and cardiac biomarker levels. Definite fatal CHD was defined as an MI within 28 days prior to death, resuscitated cardiac arrest, chest pain within 72 hours prior to death, or history of CHD and absence of a known non-atherosclerotic or non-cardiac cause of death. Probable fatal MI was defined as death within 28 days of hospital admission with cardiac symptoms.[1, 9, 17, 19]		
Heart failure (HF)	Hospitalized probable HF was defined based on clinical signs and symptoms (shortness of breath, peripheral edema, pulmonary rales), biomarkers (b-type natriuretic peptide), and imaging findings (echocardiography or other ventricular imaging with findings consistent with systolic or diastolic dysfunction, chest x-ray with pulmonary edema).[20]	Definite and probable HF both required clinical symptoms (e.g., shortness of breath) or signs (e.g., edema). Probable HF required a physician diagnosis of HF and medical treatment for HF. Definite HF also required identification of pulmonary edema/congestion by chest radiograph; and/or dilated ventricle or poor left ventricular function by echocardiography or ventriculography, or evidence of LV diastolic dysfunction.[21]	Criteria for probable HF in the inpatient setting included: 1) ICD-9 code of 428 and/or underlying cause of death 150; and 2) three signs or symptoms (e.g., shortness of breath, night cough, edema).[19] Criteria for definite HF include: 1) a discharge diagnosis of ICD-9 code 428 and/or underlying cause of death I50; and 2) radiographic findings consistent with HF or increased venous pressure >16, or dilated ventricle/left ventricular ejection fraction <40% by echo/MUGA/magnetic resonance imaging (MRI) scan.[19]

Supplemental Table 2. Baseline characteristics of REasons for Geographic and Racial Differences in Stroke (REGARDS) study, Multi-Ethnic Study of Atherosclerosis (MESA), and Jackson Heart Study (JHS) participants by blood pressure level.

Characteristics	REGARDS			MESA			JHS		
	BP<140/90 mmHg n=16,767	BP≥140/90 mmHg n=4,441	p-value	BP<140/90 mmHg n=5,032	BP≥140/90 mmHg n=1,747	p-value	BP<140/90 mmHg n=3,134	BP≥140/90 mmHg n=735	p-value
Percent of cohort	79.1	20.9	<0.01	74.2	25.8	<0.01	81.0	19.0	<0.01
	Overall								
Age, mean (SD)	63.2 (9.2)	65.5 (9.3)	<0.01	60.5 (10.0)	66.8 (9.4)	<0.01	52.9 (12.4)	60.3 (11.5)	<0.01
Race/ethnicity									
White, %	37.6	52.5	<0.01	41.0	31.3	<0.01	100.0	100.0	-
Black, %	62.4	47.5		24.9	35.7		-	-	-
Hispanic, %	-	-		21.9	22.0		-	-	-
Chinese-American, %	-	-		12.1	10.9		-	-	-
Men, %	40.8	46.8	<0.01	48.2	44.3	<0.01	34.7	39.3	<0.01
Current smoker, %	13.5	16.7	<0.01	13.8	10.8	<0.01	11.2	13.5	<0.01
Obesity, %	34.1	45.1	<0.01	30.5	36.9	<0.01	52.7	53.3	0.03
Diabetes, %	15.2	22.8	<0.01	10.8	17.5	<0.01	16.9	25.1	<0.01
LDL cholesterol, mg/dL mean (SD)	117 (33.7)	119.2 (35.3)	<0.01	117.2 (31.7)	117 (30.7)	0.78	126.6 (36.0)	132.4 (37.6)	<0.01
HDL cholesterol, mg/dL mean (SD)	53.2 (16.3)	52.6 (16.6)	0.02	50.7 (14.8)	51.7 (15.0)	0.02	51.9 (14.2)	52.7 (15.4)	0.20
Statin medication, %	24.1	23.5	0.40	13.7	18.2	<0.01	11.0	10.8	0.06
10-year CVD risk ≥7.5%, %	61.4	91.5	<0.01	49.1	92.8	<0.01	37.4	79.8	<0.01
Antihypertensive medication, %	41.0	60.1	<0.01	26.0	54.3	<0.01	41.0	60.7	<0.01
	Taking antihypertensive medication								
	BP<140/90 mmHg n=6,874	BP≥140/90 mmHg n=2,668	p-value	BP<140/90 mmHg n=1,308	BP≥140/90 mmHg n=948	p-value	BP<140/90 mmHg n=1,286	BP≥140/90 mmHg n=446	p-value
Percent of cohort	71.4	28.6	<0.01	58.0	42.0	<0.01	74.3	25.7	<0.01
Age, mean (SD)	64.8 (8.9)	65.9 (8.9)	<0.01	64.1 (9.5)	67.6 (9.0)	<0.01	58.4 (10.6)	62.3 (10.8)	<0.01
Race/ethnicity									
White, %	49.6	58.3	<0.01	34.3	25.3	<0.01	100.0	100.0	-
Black, %	50.4	41.7		38.5	42.4		-	-	-
Hispanic, %	-	-		18.1	21.4		-	-	-
Chinese-American, %	-	-		9.1	10.9		-	-	-
Men, %	36.6	43.1	<0.01	46.1	40.4	<0.01	26.9	35.2	<0.01
Current smoker, %	12.3	14.6	<0.01	11.1	9.6	0.25	7.9	9.5	<0.01
Obesity, %	45.2	50.0	<0.01	43.6	41.2	0.02	62.2	54.5	<0.01
Diabetes, %	24.0	28.9	<0.01	20.6	23.1	0.16	28.7	31.1	<0.01

Characteristics	REGARDS			MESA			JHS		
LDL cholesterol, mg/dL mean (SD)	111.8 (33.0)	116.3 (34.9)	<0.01	111.7 (31.8)	113.5 (31.1)	0.20	124.6 (35.0)	130.6 (35.8)	<0.01
HDL cholesterol, mg/dL mean (SD)	52.0 (16.1)	52.3 (16.2)	0.48	49.4 (14.1)	51.3 (14.5)	<0.01	52.8 (14.8)	53.1 (15.6)	0.19
Statin medication, %	34.5	29.8	<0.01	24.9	24.1	0.04	16.8	14.0	0.02
10-year CVD risk ≥7.5%, %	77.9	95.6	<0.01	76.8	97.5	<0.01	60.9	89.3	<0.01
	Not taking antihypertensive medication								
	BP<140/90 mmHg n=9,893	BP≥140/90 mmHg n=1,773	p-value	BP<140/90 mmHg n=3,724	BP≥140/90 mmHg n=799	p-value	BP<140/90 mmHg n=1,848	BP≥140/90 mmHg n=289	p-value
Percent of cohort	84.8	15.2	<0.01	82.3	17.7	<0.01	86.5	13.5	<0.01
Age, mean (SD)	62.0 (9.2)	64.9 (9.7)	<0.01	59.3 (9.9)	65.9 (9.7)	<0.01	49.1 (12.1)	57.3 (11.8)	<0.01
Race/ethnicity									
White, %	29.3	43.9	<0.01	43.3	38.4	<0.01	100.0	100.0	-
Black, %	70.7	56.1		20.2	27.8		-	-	-
Hispanic, %	-	-		23.3	22.8		-	-	-
Chinese-American, %	-	-		13.2	11.0		-	-	-
Men, %	43.6	52.3	<0.01	48.9	48.9	0.97	40.0	45.7	0.03
Current smoker, %	14.3	19.8	<0.01	14.8	12.3	0.06	13.5	19.6	<0.01
Obesity, %	26.4	37.7		25.9	31.8	<0.01	46.1	51.4	0.01
Diabetes, %	9.1	13.6	<0.01	7.3	10.9	<0.01	8.7	15.7	<0.01
LDL cholesterol, mg/dL mean (SD)	120.6 (33.7)	123.7 (35.5)	<0.01	119.2 (31.4)	121.2 (29.8)	0.10	127.9 (36.6)	135.0 (40.0)	<0.01
HDL cholesterol, mg/dL mean (SD)	54.1 (16.4)	53 (17.2)	0.01	51.2 (15.0)	52.2 (15.6)	0.11	51.3 (13.8)	52.0 (15.1)	0.41
Statin medication, %	16.9	14.0	<0.01	9.8	11.1	0.03	4.9	3.6	0.11
10-year CVD risk ≥7.5%, %	50.0	85.2	<0.01	39.4	87.2	<0.01	21.8	66.1	<0.01

BP = blood pressure, SD = standard deviation, CVD = cardiovascular disease, LDL = low-density lipoprotein, HDL = high-density lipoprotein.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.
Numbers in the table are percentages with standard deviations in parentheses.

Supplemental Table 3. Percentage of cardiovascular disease events occurring in participants with systolic/diastolic blood pressure < 140/90 mm Hg in the REasons for Geographic and Racial Differences in Stroke (REGARDS) study, Multi-Ethnic Study of Atherosclerosis (MESA), and the Jackson Heart Study (JHS).

	Overall n=24,933		Taking Antihypertensive Medication n=9,468		Not Take Antihypertensive Medication N=15,465		
	Meta-Analysis	p-value	Meta-Analysis	p-value	Meta-Analysis	p-value	p-value†
	Cardiovascular disease						
OVERALL	63.0 (54.9-71.1)		58.4 (47.7-69.2)		68.1 (60.1-76.0)		<0.01
Age, years							
<65	66.7 (60.5-73.0)	<0.01	62.6 (49.2-75.9)	<0.01	70.6 (66.5-74.7)	0.48	0.24
≥65	60.3 (51.0-69.5)		55.4 (46.9-63.8)		67.2 (54.9-79.4)		<0.01
Sex							
Female	61.4 (49.9-72.9)	0.35	57.1 (41.9-72.3)	0.63	67.5 (57.1-77.9)	0.83	0.04
Male	63.8 (58.4-69.1)		58.7 (52.8-64.5)		68.7 (62.1-75.3)		<0.01
Race/ethnicity*							
White	68.7 (66.1-71.3)	ref	63.3 (59.2-67.4)	ref	73.1 (69.8-76.5)	ref	0.08
Black	59.0 (49.5-68.6)	<0.01	57.5 (46.8-68.1)	0.27	63.0 (54.9-71.1)	0.25	0.15
Hispanic	52.7 (45.1-60.4)	0.24	35.6 (24.6-46.6)	0.02	66.3 (56.7-76.0)	0.38	<0.01
Chinese-American	58.5 (45.2-71.8)	0.99	36.4 (16.3-56.5)	0.17	74.2 (58.8-89.6)	0.11	0.02
	Stroke						
OVERALL	63.7 (51.8-75.6)		59.3 (42.6-76.0)		69.4 (62.1-76.7)		0.04
Age, years							
<65	67.9 (59.8-76.0)	0.14	65.0 (47.8-82.3)	0.17	71.9 (64.9-78.9)	0.63	0.49
≥65	60.9 (46.4-75.5)		55.3 (38.4-72.2)		69.4 (58.0-80.9)		<0.01
Sex							
Female	60.3 (46.9-73.7)	0.02	56.4 (39.5-73.3)	0.05	67.2 (57.2-77.2)	0.48	0.01
Male	67.6 (57.0-78.2)		63.3 (46.4-80.2)		72.4 (66.5-78.2)		0.19
Race/ethnicity*							
White	71.6 (67.4-75.8)	ref	66.0 (59.6-72.4)	ref	76.5 (71.1-81.9)	ref	0.16
Black	61.2 (51.3-71.0)	0.61	59.9 (47.6-72.2)	0.99	63.7 (55.8-71.7)	0.96	0.02
Hispanic	45.5 (33.4-57.5)	0.33	27.3 (12.1-42.5)	0.14	63.6 (47.2-80.1)	0.77	<0.01
Chinese-American	76.5 (56.3-96.6)	0.03	80.0 (44.9-100.0)	0.04	75.0 (50.5-99.5)	0.29	0.82
	Coronary heart disease						
OVERALL	63.4 (58.1-68.8)		59.0 (50.9-67.1)		68.5 (61.2-75.8)		<0.01
Age, years							
<65	68.0 (64.0-72.0)	<0.01	65.0 (56.2-73.7)	0.01	71.3 (65.9-76.8)	0.42	0.07
≥65	59.5 (53.1-66.0)		53.5 (48.7-58.4)		66.2 (53.3-79.1)		<0.01
Sex							
Female	61.3 (50.8-71.9)	0.43	56.6 (42.9-70.2)	0.55	68.7 (55.2-82.2)	0.34	<0.01

Male	63.9 (60.4-67.4)		60.1 (52.2-68.1)		68.6 (63.5-73.8)		<0.01
Race/ethnicity*							
White	67.3 (63.6-71.0)	ref	62.4 (56.4-68.3)	ref	71.0 (66.3-75.7)	ref	0.88
Black	59.6 (50.1-69.2)	0.04	58.3 (47.2-69.4)	0.19	63.1 (48.4-77.8)	0.10	0.50
Hispanic	58.0 (47.3-68.8)	0.38	37.5 (20.7-54.3)	0.03	71.4 (58.8-84.1)	0.33	<0.01
Chinese-American	55.6 (36.8-74.3)	0.44	33.3 (6.7-60.0)	0.11	73.3 (51.0-95.7)	0.48	0.07
	Heart failure						
OVERALL	59.2 (52.2-66.2)		53.7 (44.5-62.9)		67.6 (59.4-75.8)		<0.01
Age, years							
<65	60.1 (48.2-72.0)	0.76	54.6 (35.3-73.8)	0.49	67.2 (58.5-75.9)	0.91	0.08
≥65	58.4 (54.0-62.9)		52.6 (47.2-57.9)		67.8 (58.0-77.6)		<0.01
Sex							
Female	59.7 (48.3-71.2)	0.71	54.9 (40.9-68.9)	0.57	68.3 (56.8-79.9)	0.78	<0.01
Male	56.8 (52.0-61.6)		49.5 (41.4-57.6)		66.9 (60.1-73.6)		<0.01
Race/ethnicity*							
White	65.1 (60.0-70.3)	ref	60.9 (53.3-68.4)	ref	69.7 (62.8-76.5)	ref	0.95
Black	53.7 (41.0-66.4)	0.02	49.4 (35.0-63.8)	0.02	64.9 (55.0-74.8)	0.57	0.16
Hispanic	56.1 (43.3-69.0)	0.67	43.3 (25.6-61.1)	0.17	70.4 (53.2-87.6)	0.29	0.05
Chinese-American	42.1 (19.9-64.3)	0.21	22.2 (0.0-49.4)	0.12	60.0 (29.6-90.4)	0.97	0.14

Numbers in the table are percentage with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
*White race is the reference group for race/ethnicity p-value calculation; p-values for blacks vs. whites are based on meta-analysis data from the REasons for Geographic and Racial Differences in Stroke study and the Multi-Ethnic Study of Atherosclerosis (MESA); p-values for Hispanic compared with whites and Chinese-Americans compared with whites are based on MESA data.
[†]P-value in final column compares the percentage of cardiovascular disease events occurring in participants with blood pressure < 140/90 mm Hg by antihypertensive medication use status.

Supplemental Table 4. Percentage of cardiovascular disease, stroke, coronary heart disease, and heart failure events occurring in participants with systolic/diastolic blood pressure < 140/90 mm Hg in the REasons for Geographic and Racial Differences in Stroke (REGARDS) study, the Multi-Ethnic Study of Atherosclerosis (MESA), and the Jackson Heart Study (JHS).

	REGARDS		MESA		JHS	
	BP<140/90 mmHg n=16,767	BP≥140/90 mmHg n=4,441	BP<140/90 mmHg n=5,032	BP≥140/90 mmHg n=1,747	BP<140/90 mmHg n=3,134	BP≥140/90 mmHg n=735
	Overall					
Cardiovascular disease						
Overall	66.0 (63.6-68.3)	34.1 (31.7-36.4)	54.6 (51.0-58.2)	45.4 (41.8-49.1)	68.6 (63.6-73.7)	31.4 (26.3-36.4)
Race						
White	71.5 (68.5-74.4)	28.5 (25.6-31.5)	58.5 (52.9-64.1)	41.5 (35.9-47.1)	-	-
Black	58.3 (54.5-62.1)	41.7 (37.9-45.5)	49.5 (42.7-56.3)	50.5 (43.7-57.3)	68.6 (63.6-73.7)	31.4 (26.3-36.4)
Hispanic	-	-	52.7 (45.1-60.4)	47.3 (39.7-54.9)	-	-
Chinese-American	-	-	58.5 (45.2-71.8)	41.5 (28.2-54.8)	-	-
Stroke						
Overall	69.2 (65.5-72.8)	30.8 (27.2-34.5)	51.7 (45.3-58.1)	48.3 (41.9-54.7)	70.4 (61.4-79.5)	29.6 (20.6-38.6)
Race						
White	75.0 (70.4-79.6)	25.0 (20.4-29.6)	53.5 (43.0-64.0)	46.5 (36.0-57.1)	-	-
Black	61.7 (55.8-67.5)	38.4 (32.5-44.2)	49.3 (37.3-61.2)	50.8 (38.8-62.7)	70.4 (61.4-79.5)	29.6 (20.6-38.6)
Hispanic	-	-	45.5 (33.4-57.5)	54.6 (42.5-66.6)	-	-
Chinese-American	-	-	76.5 (56.3-96.6)	23.5 (3.4-43.7)	-	-
Coronary heart disease						
Overall	64.4 (61.0-67.8)	35.6 (32.2-39.0)	58.2 (53.1-63.3)	41.8 (36.7-47.0)	69.2 (61.3-77.0)	30.8 (23.0-38.7)
Race						
White	68.3 (64.0-72.5)	31.8 (27.5-36.0)	64.0 (56.3-71.7)	36.0 (28.3-43.7)	-	-
Black	58.6 (53.1-64.1)	41.4 (35.9-46.9)	50.0 (40.0-60.0)	50.0 (40.0-60.0)	69.2 (61.3-77.0)	30.8 (23.0-38.7)
Hispanic	-	-	58.0 (47.3-68.8)	42.0 (31.2-52.7)	-	-
Chinese-American	-	-	55.6 (36.8-74.3)	44.4 (25.7-63.2)	-	-
Heart Failure						
Overall	60.3 (55.5-65.1)	39.7 (34.9-44.5)	52.4 (46.5-58.2)	47.7 (41.8-53.5)	65.6 (58.4-72.9)	34.4 (27.1-41.7)
Race						
White	67.7 (61.5-74.0)	32.3 (26.0-38.5)	59.7 (50.6-68.7)	40.4 (31.4-49.4)	-	-
Black	51.6 (44.4-58.8)	48.4 (41.2-55.6)	42.5 (32.1-52.9)	57.5 (47.1-67.9)	65.6 (58.4-72.9)	34.4 (27.1-41.7)
Hispanic	-	-	56.1 (43.3-69.0)	43.9 (31.0-56.7)	-	-
Chinese-American	-	-	42.1 (19.9-64.3)	57.9 (35.7-80.1)	-	-
	On Antihypertensive Treatment					
	BP<140/90 mmHg n=6,874	BP≥140/90 mmHg n=2,668	BP<140/90 mmHg n=1,308	BP≥140/90 mmHg n=948	BP<140/90 mmHg n=1,286	BP≥140/90 mmHg n=446

Cardiovascular disease						
Overall	60.3 (57.0-63.6)	39.7 (36.4-43.0)	46.8 (41.6-52.1)	53.2 (47.9-58.4)	68.3 (62.2-74.5)	31.7 (25.5-37.8)
Race						
White	65.5 (60.9-70.1)	34.5 (29.9-39.1)	54.7 (45.7-63.7)	45.3 (36.3-54.3)	-	-
Black	55.5 (50.9-60.1)	44.5 (39.9-49.1)	47.8 (39.4-56.2)	52.2 (43.8-60.6)	68.3 (62.2-74.5)	31.7 (25.5-37.8)
Hispanic	-	-	35.6 (24.6-46.6)	64.4 (53.4-75.4)	-	-
Chinese-American	-	-	36.4 (16.3-56.5)	63.6 (43.5-83.7)	-	-
Stroke						
Overall	65.7 (60.7-70.7)	34.3 (29.3-39.3)	41.6 (33.0-50.2)	58.4 (49.8-67.0)	71.0 (59.7-82.3)	29.0 (17.7-40.3)
Race						
White	70.1 (63.1-77.1)	29.9 (22.9-36.9)	44.7 (28.9-60.6)	55.3 (39.5-71.1)	-	-
Black	61.7 (54.6-68.8)	38.3 (31.2-45.4)	44.9 (31.0-58.8)	55.1 (41.2-69.0)	71.0 (59.7-82.3)	29.0 (17.7-40.3)
Hispanic	-	-	27.3 (12.1-42.5)	72.7 (57.5-87.9)	-	-
Chinese-American	-	-	80.0 (44.9-100.0)	20.0 (0.0-55.1)	-	-
Coronary heart disease						
Overall	57.2 (52.4-62.0)	42.8 (38.0-47.6)	52.2 (44.4-60.0)	47.8 (40.0-55.6)	69.1 (59.9-78.3)	30.9 (21.7-40.1)
Race						
White	61.7 (55.0-68.4)	38.3 (31.6-45.0)	64.8 (52.1-77.6)	35.2 (22.5-47.9)	-	-
Black	52.9 (46.1-59.6)	47.1 (40.4-53.9)	52.5 (39.8-65.3)	47.5 (34.7-60.2)	69.1 (59.9-78.3)	30.9 (21.7-40.1)
Hispanic	-	-	37.5 (20.7-54.3)	62.5 (45.7-79.3)	-	-
Chinese-American	-	-	33.3 (6.7-60.0)	66.7 (40.0-93.3)	-	-
Heart Failure						
Overall	53.4 (47.2-59.5)	46.6 (40.5-52.8)	45.1 (37.0-53.3)	54.9 (46.7-63.0)	63.2 (54.3-72.0)	36.8 (28.0-45.7)
Race						
White	61.3 (52.2-70.3)	38.7 (29.7-47.8)	60.0 (46.4-73.6)	40.0 (26.4-53.6)	-	-
Black	47.2 (39.0-55.4)	52.8 (44.6-61.0)	36.4 (23.7-49.1)	63.6 (50.9-76.4)	63.2 (54.3-72.0)	36.8 (28.0-45.7)
Hispanic	-	-	43.3 (25.6-61.1)	56.7 (38.9-74.4)	-	-
Chinese-American	-	-	22.2 (0.0-49.4)	77.8 (50.6-100.0)	-	-
	No Antihypertensive Treatment					
	BP<140/90 mmHg n=9,893	BP≥140/90 mmHg n=1,773	BP<140/90 mmHg n=3,724	BP≥140/90 mmHg n=799	BP<140/90 mmHg n=1,848	BP≥140/90 mmHg n=289
Cardiovascular disease						
Overall	73.0 (69.7-76.3)	27.0 (23.7-30.4)	61.8 (56.9-66.8)	38.2 (33.2-43.1)	69.3 (60.3-78.3)	30.7 (21.7-39.7)
Race						
White	76.4 (72.7-80.2)	23.6 (19.8-27.3)	61.0 (53.8-68.2)	39.0 (31.8-46.2)	-	-
Black	64.5 (57.9-71.1)	35.5 (28.9-42.1)	52.8 (41.3-64.3)	47.2 (35.7-58.8)	69.3 (60.3-78.3)	30.7 (21.7-39.7)
Hispanic	-	-	66.3 (56.7-760)	33.7 (24.0-43.4)	-	-
Chinese-American	-	-	74.2 (58.8-89.6)	25.8 (10.4-41.2)	-	-
Stroke						
Overall	73.7 (68.4-79.0)	26.3 (21.0-31.6)	63.1 (54.1-72.0)	36.9 (28.0-45.9)	69.4 (54.4-84.5)	30.6 (15.5-45.6)

Race						
White	79.4 (73.5-85.4)	20.6 (14.7-26.5)	60.4 (46.6-74.3)	39.6 (25.8-53.4)	-	-
Black	61.6 (51.4-71.9)	38.4 (28.1-48.7)	61.1 (38.6-83.6)	38.9 (16.4-61.4)	69.4 (54.4-84.5)	30.6 (15.5-45.6)
Hispanic	-	-	63.6 (47.2-80.1)	36.4 (20.0-52.8)	-	-
Chinese-American	-	-	75.0 (50.5-99.5)	25.0 (0.5-49.5)	-	-
Coronary heart disease						
Overall	72.7 (68.1-77.3)	27.3 (22.7-31.9)	62.9 (56.2-69.7)	37.1 (30.3-43.8)	69.4 (54.4-84.5)	30.6 (15.5-45.6)
Race						
White	73.3 (67.9-78.6)	26.7 (21.4-32.1)	63.5 (53.9-73.2)	36.5 (26.8-46.1)	-	-
Black	71.1 (62.1-80.2)	28.9 (19.9-37.9)	46.0 (29.9-62.0)	54.1 (38.0-70.1)	69.4 (54.4-84.5)	30.6 (15.5-45.6)
Hispanic	-	-	71.4 (58.8-84.1)	28.6 (15.9-41.2)	-	-
Chinese-American	-	-	73.3 (51.0-95.7)	26.7 (4.3-49.1)	-	-
Heart Failure						
Overall	72.0 (64.8-79.2)	28.0 (20.8-35.2)	60.2 (51.8-68.5)	39.9 (31.5-48.2)	71.4 (58.8-84.1)	28.6 (15.9-41.2)
Race						
White	74.5 (66.2-82.8)	25.5 (17.2-33.8)	59.4 (47.3-71.4)	40.6 (28.6-52.7)	-	-
Black	65.9 (51.9-79.9)	34.1 (20.1-48.1)	53.1 (35.8-70.4)	46.9 (29.6-64.2)	71.4 (58.8-84.1)	28.6 (15.9-41.2)
Hispanic	-	-	70.4 (53.2-87.6)	29.6 (12.4-46.9)	-	-
Chinese-American	-	-	60.0 (29.6-90.4)	40.0 (9.6-70.4)	-	-

BP = blood pressure.
Numbers in the table are percentage with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.
Overall CVD, stroke, CHD, and HF rates for MESA are calculated including Hispanic and Asian participants.
Due to rounding, the percentage of events occurring among participants with SBP/DBP < 140/90 mm Hg and SBP/DBP ≥ 140/90 mm Hg may not sum to 100%.

Supplemental Table 5. Incidence rates of cardiovascular disease, stroke, coronary heart disease, and heart failure in the REasons for Geographic and Racial Differences in Stroke study, overall and by antihypertensive medication use.

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP<140/90 mmHg n=16,767	BP≥140/90 mmHg n=4,441	BP<140/90 mmHg n=6,874	BP≥140/90 mmHg n=2,668	BP<140/90 mmHg n=9,893	BP≥140/90 mmHg n=1,773
	Cardiovascular disease					
Overall	9.4 (8.8-10.0)	19.0 (17.4-20.6)	11.8 (10.7-12.8)	20.5 (18.3-22.7)	7.8 (7.1-8.4)	16.7 (14.3-19.1)
Race						
White	9.3 (8.6-10.0)	18.7 (16.4-21.0)	12.0 (10.5-13.4)	19.5 (16.3-22.7)	8.0 (7.2-8.8)	17.9 (14.6-21.2)
Black	9.5 (8.5-10.4)	19.2 (16.9-21.5)	11.5 (10.1-12.9)	21.3 (18.3-24.2)	7.1 (5.9-8.3)	15.1 (11.6-18.6)
	Stroke					
Overall	3.8 (3.5-4.2)	6.7 (5.7-7.6)	5.1 (4.4-5.8)	7.0 (5.7-8.3)	3.0 (2.6-3.4)	6.2 (4.7-7.6)
Race						
White	3.7 (3.3-4.2)	6.2 (4.9-7.5)	5.1 (4.1-6.0)	6.6 (4.8-8.5)	3.0 (2.5-3.5)	5.6 (3.8-7.4)
Black	4.1 (3.5-4.7)	7.2 (5.8-8.6)	5.1 (4.2-6.1)	7.3 (5.6-9.0)	2.9 (2.1-3.7)	7.0 (4.6-9.3)
	Coronary heart disease					
Overall	4.5 (4.1-4.9)	9.7 (8.6-10.9)	5.3 (4.6-6.0)	10.5 (8.9-12.0)	4.0 (3.5-4.5)	8.7 (6.9-10.4)
Race						
White	4.5 (4.0-5.0)	10.6 (8.9-12.3)	5.5 (4.5-6.4)	10.5 (8.2-12.8)	4.1 (3.5-4.7)	10.7 (8.2-13.3)
Black	4.5 (3.8-5.1)	8.9 (7.3-10.4)	5.1 (4.2-6.1)	10.4 (8.4-12.5)	3.8 (2.9-4.7)	5.8 (3.7-8.0)
	Heart failure					
Overall	2.2 (1.9-2.5)	5.6 (4.7-6.4)	3.0 (2.5-3.5)	6.9 (5.6-8.1)	1.6 (1.3-2.0)	3.6 (2.5-4.7)
Race						
White	2.1 (1.8-2.4)	4.9 (3.8-6.1)	3.0 (2.3-3.7)	5.8 (4.0-7.5)	1.7 (1.3-2.0)	4.0 (2.5-5.6)
Black	2.4 (1.9-2.9)	6.2 (4.9-7.5)	3.1 (2.3-3.8)	7.7 (6.0-9.5)	1.6 (1.0-2.1)	3.1 (1.5-4.7)

BP = blood pressure.
Numbers in the table are incidence rates per 1,000 person years of observation with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.

Supplemental Table 6. Incidence rates of cardiovascular disease, stroke, coronary heart disease, and heart failure in the Multi-Ethnic Study of Atherosclerosis, overall and by antihypertensive medication use.

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP<140/90 mmHg n=5,032	BP≥140/90 mmHg n=1,747	BP<140/90 mmHg n=1,308	BP≥140/90 mmHg n=948	BP<140/90 mmHg n=3,724	BP≥140/90 mmHg n=799
	Cardiovascular disease					
Overall	7.1 (6.4-7.8)	18.7 (16.7-20.8)	12.0 (10.1-13.8)	19.8 (17.0-22.7)	5.5 (4.8-6.2)	17.5 (14.6-20.4)
Race/ethnicity						
White	7.4 (6.3-8.5)	21.9 (18.0-25.8)	13.6 (10.3-17.0)	21.8 (15.9-27.7)	5.8 (4.7-6.9)	22.0 (16.8-27.1)
Black	7.7 (6.2-9.2)	16.9 (13.7-20.2)	12.8 (9.7-15.9)	18.1 (13.9-22.3)	4.6 (3.1-6.1)	14.9 (9.9-19.9)
Hispanic	7.2 (5.7-8.7)	21.1 (16.4-25.8)	10.3 (6.3-14.2)	24.3 (17.4-31.3)	6.4 (4.8-8.0)	17.6 (11.4-23.8)
Chinese-American	4.5 (2.9-6.1)	11.0 (6.4-15.6)	6.1 (1.9-10.3)	13.2 (6.3-20.1)	4.1 (2.4-5.8)	8.5 (2.6-14.4)
	Stroke					
Overall	2.2 (1.8-2.5)	6.2 (5.1-7.4)	3.7 (2.7-4.7)	7.5 (5.7-9.2)	1.6 (1.3-2.0)	4.8 (3.4-6.3)
Race/ethnicity						
White	1.9 (1.4-2.5)	6.8 (4.7-8.9)	3.5 (1.8-5.1)	8.2 (4.7-11.7)	1.5 (1.0-2.1)	5.7 (3.1-8.2)
Black	2.4 (1.6-3.3)	5.3 (3.5-7.0)	4.2 (2.4-5.9)	6.6 (4.1-9.1)	1.3 (0.5-2.1)	3.0 (0.8-5.2)
Hispanic	2.5 (1.6-3.3)	9.3 (6.3-12.3)	3.5 (1.2-5.7)	11.7 (7.0-16.4)	2.2 (1.3-3.1)	6.6 (2.9-10.3)
Chinese-American	1.9 (0.9-2.9)	2.0 (0.0-3.9)	3.0 (0.1-6.0)	0.9 (0.0-2.7)	1.6 (0.6-2.6)	3.2 (0.0-6.8)
	Coronary heart disease					
Overall	3.7 (3.2-4.2)	8.1 (6.8-9.4)	5.8 (4.6-7.1)	7.6 (5.9-9.3)	2.9 (2.4-3.4)	8.6 (6.7-10.6)
Race/ethnicity						
White	4.1 (3.2-4.9)	9.1 (6.7-11.6)	7.2 (4.8-9.6)	7.3 (4.0-10.6)	3.2 (2.4-4.1)	10.5 (7.0-14.0)
Black	3.5 (2.5-4.5)	7.4 (5.3-9.5)	5.9 (3.8-8.0)	6.7 (4.2-9.2)	2.0 (1.1-3.0)	8.5 (4.8-12.2)
Hispanic	3.9 (2.8-5.0)	8.8 (5.8-11.7)	4.6 (2.0-7.2)	9.8 (5.5-14.1)	3.6 (2.4-4.8)	7.6 (3.6-11.7)
Chinese-American	2.2 (1.1-3.3)	5.9 (2.6-9.3)	3.0 (0.1-5.9)	7.5 (2.3-12.6)	2.0 (0.8-3.1)	4.2 (0.1-8.3)
	Heart failure					
Overall	2.6 (2.1-3.0)	7.3 (6.0-8.5)	4.6 (3.5-5.8)	8.1 (6.3-9.9)	1.9 (1.5-2.3)	6.3 (4.6-8.0)
Race/ethnicity						
White	2.9 (2.2-3.5)	7.8 (5.6-10.1)	6.2 (4.0-8.4)	7.8 (4.4-11.2)	2.0 (1.4-2.6)	7.9 (4.8-10.9)
Black	2.7 (1.9-3.6)	7.8 (5.7-10.0)	3.8 (2.1-5.5)	8.6 (5.8-11.5)	2.1 (1.1-3.0)	6.4 (3.2-9.7)
Hispanic	2.6 (1.7-3.5)	6.4 (3.9-9.0)	5.0 (2.3-7.7)	8.3 (4.4-12.3)	2.0 (1.1-2.9)	4.3 (1.3-7.4)
Chinese-American	1.1 (0.4-1.9)	5.4 (2.2-8.6)	1.5 (0.0-3.6)	6.5 (1.7-11.4)	1.1 (0.2-1.9)	4.2 (0.1-8.3)

BP = blood pressure.
Numbers in the table are incidence rates per 1,000 person years of observation with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.

Supplemental Table 7. Incidence rates of cardiovascular disease, stroke, coronary heart disease, and heart failure in the Jackson Heart Study, overall and by antihypertensive medication use.

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP<140/90 mmHg n=3,134	BP≥140/90 mmHg n=735	BP<140/90 mmHg n=1,286	BP≥140/90 mmHg n=446	BP<140/90 mmHg n=1,848	BP≥140/90 mmHg n=289
	Cardiovascular disease					
Overall (black race)	7.3 (6.3-8.3)	15.1 (12.2-18.1)	12.4 (10.4-14.3)	17.7 (13.5-21.8)	3.9 (3.0-4.8)	11.4 (7.4-15.4)
	Stroke					
Overall (black race)	2.2 (1.7-2.8)	4.2 (2.7-5.7)	3.5 (2.5-4.5)	4.4 (2.3-6.4)	1.4 (0.8-1.9)	3.9 (1.6-6.3)
	Coronary heart disease					
Overall (black race)	3.0 (2.4-3.6)	5.9 (4.1-7.8)	5.4 (4.1-6.7)	7.3 (4.7-9.9)	1.4 (0.8-1.9)	3.9 (1.6-6.3)
	Heart failure					
Overall (black race)	4.6 (3.7-5.4)	10.9 (8.0-13.8)	7.6 (5.8-9.4)	13.8 (9.6-18.0)	2.5 (1.7-3.3)	6.7 (3.2-10.2)

BP = blood pressure.
Numbers in the table are incidence rates per 1,000 person years of observation with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.
Jackson Heart Study only included black participants.
Heart failure incidence for Jackson Heart Study was calculated using adjudicated events from January 1, 2005 through December 31, 2012.

Supplemental Table 8. Percentage of cardiovascular disease, stroke, coronary heart disease, and heart failure events occurring in participants with systolic/diastolic blood pressure < 140/90 mm Hg based on blood pressure and antihypertensive medication use status updated to the nearest exam visit prior to an incident event in the Multi-Ethnic Study of Atherosclerosis (MESA) and the Jackson Heart Study (JHS).

	MESA		JHS	
	BP<140/90 mmHg n=5,032	BP≥140/90 mmHg n=1,747	BP<140/90 mmHg n=3,134	BP≥140/90 mmHg n=735
	Overall			
Cardiovascular disease				
Overall	59.9 (56.3-63.4)	40.1 (36.6-43.7)	62.7 (57.5-68.0)	37.3 (32-42.6)
Race				
White	67.7 (62.3-73.0)	32.3 (27.0-37.7)	-	-
Black	48.1 (41.3-54.9)	51.9 (45.1-58.7)	62.7 (57.5-68.0)	37.3 (32-42.6)
Hispanic	57.6 (50.0-65.1)	42.4 (34.9-50.0)	-	-
Chinese-American	69.8 (57.5-82.2)	30.2 (17.8-42.6)	-	-
Stroke				
Overall	55.9 (49.6-62.3)	44.1 (37.7-50.4)	57.1 (47.4-66.9)	42.9 (33.1-52.7)
Race				
White	62.8 (52.6-73.0)	37.2 (27.0-47.4)	-	-
Black	49.3 (37.3-61.2)	50.8 (38.8-62.7)	57.1 (47.4-66.9)	42.9 (33.1-52.7)
Hispanic	48.5 (36.4-60.5)	51.5 (39.5-63.6)	-	-
Chinese-American	76.5 (56.3-96.6)	23.5 (3.4-43.7)	-	-
Coronary heart disease				
Overall	63.8 (58.8-68.9)	36.2 (31.2-41.2)	61.7 (53.4-69.9)	38.4 (30.1-46.6)
Race				
White	70.7 (63.4-78.0)	29.3 (22.1-36.6)	-	-
Black	49.0 (39.0-59.0)	51.0 (41.0-61.0)	61.7 (53.4-69.9)	38.4 (30.1-46.6)
Hispanic	66.7 (56.4-76.9)	33.3 (23.1-43.6)	-	-
Chinese-American	70.4 (53.2-87.6)	29.6 (12.4-46.9)	-	-
Heart Failure				
Overall	57.4 (51.6-63.2)	42.6 (36.8-48.4)	63.2 (55.8-70.6)	36.8 (29.4-44.2)
Race				
White	65.8 (57.1-74.5)	34.2 (25.5-42.9)	-	-
Black	46.0 (35.5-56.5)	54.0 (43.6-64.5)	63.2 (55.8-70.6)	36.8 (29.4-44.2)
Hispanic	56.1 (43.3-69.0)	43.9 (31.0-56.7)	-	-
Chinese-American	63.2 (41.5-84.9)	36.8 (15.2-58.5)	-	-
	On Antihypertensive Treatment			
	BP<140/90 mmHg n=1,308	BP≥140/90 mmHg n=948	BP<140/90 mmHg n=1,286	BP≥140/90 mmHg n=446
Cardiovascular disease				
Overall	57.1 (52.6-61.5)	42.9 (38.5-47.4)	63.1 (57.0-69.2)	36.9 (30.8-43.0)
Race				
White	65.4 (58.6-72.2)	34.6 (27.8-41.4)	-	-
Black	47.0 (39.1-55.0)	53.0 (45.0-60.9)	63.1 (57.0-69.2)	36.9 (30.8-43.0)
Hispanic	53.9 (44.3-63.4)	46.2 (36.6-55.7)	-	-
Chinese-American	66.7 (49.8-83.5)	33.3 (16.5-50.2)	-	-
Stroke				
Overall	52.8 (45.1-60.6)	47.2 (39.4-54.9)	57.8 (46.3-69.2)	42.3 (30.8-53.7)
Race				
White	60.0 (47.6-72.4)	40.0 (27.6-52.4)	-	-
Black	47.1 (33.4-60.8)	52.9 (39.2-66.6)	57.8 (46.3-69.2)	42.3 (30.8-53.7)
Hispanic	42.5 (27.2-57.8)	57.5 (42.2-72.8)	-	-

Chinese-American	87.5 (64.6-100.0)	12.5 (0.0-35.4)	-	-
Coronary heart disease				
Overall	62.7 (56.4-69.0)	37.3 (31.0-43.7)	63.5 (54.2-72.7)	36.5 (27.3-45.8)
Race				
White	69.8 (60.6-79.0)	30.2 (21.0-39.4)	-	-
Black	52.4 (40.1-64.7)	47.6 (35.3-60.0)	63.5 (54.2-72.7)	36.5 (27.3-45.8)
Hispanic	60.8 (47.4-74.2)	39.2 (25.8-52.6)	-	-
Chinese-American	66.7 (42.8-90.5)	33.3 (9.5-57.2)	-	-
Heart Failure				
Overall	54.9 (47.9-61.9)	45.1 (38.1-52.1)	61.7 (53.3-70.1)	38.3 (29.9-46.7)
Race				
White	64.0 (53.1-74.9)	36.0 (25.1-46.9)	-	-
Black	42.4 (30.5-54.4)	57.6 (45.7-69.5)	61.7 (53.3-70.1)	38.3 (29.9-46.7)
Hispanic	56.1 (40.9-71.3)	43.9 (28.7-59.1)	-	-
Chinese-American	61.5 (35.1-88.0)	38.5 (12.0-64.9)	-	-
	No Antihypertensive Treatment			
	BP<140/90 mmHg n=3,724	BP≥140/90 mmHg n=799	BP<140/90 mmHg n=1,848	BP≥140/90 mmHg n=289
Cardiovascular disease				
Overall	65.2 (59.2-71.1)	34.8 (28.9-40.8)	61.7 (51.1-72.3)	38.3 (27.7-48.9)
Race				
White	71.7 (63.1-80.3)	28.3 (19.7-36.9)	-	-
Black	50.9 (37.9-63.9)	49.1 (36.1-62.1)	61.7 (51.1-72.3)	38.3 (27.7-48.9)
Hispanic	63.9 (51.9-76.0)	36.1 (24.0-48.1)	-	-
Chinese-American	73.9 (56.0-91.9)	26.1 (8.1-44.0)	-	-
Stroke				
Overall	62.3 (51.5-73.2)	37.7 (26.8-48.5)	55.6 (36.8-74.3)	44.4 (25.7-63.2)
Race				
White	69.2 (51.5-87.0)	30.8 (13.0-48.5)	-	-
Black	56.3 (31.9-80.6)	43.8 (19.4-68.1)	55.6 (36.8-74.3)	44.4 (25.7-63.2)
Hispanic	57.7 (38.7-76.7)	42.3 (23.3-61.3)	-	-
Chinese-American	66.7 (35.9-97.5)	33.3 (2.5-64.1)	-	-
Coronary heart disease				
Overall	65.9 (57.7-74.1)	34.1 (25.9-42.3)	55.2 (37.1-73.3)	44.8 (26.7-62.9)
Race				
White	72.2 (60.3-84.2)	27.8 (15.8-39.7)	-	-
Black	42.4 (25.6-59.3)	57.6 (40.7-74.4)	55.2 (37.1-73.3)	44.8 (26.7-62.9)
Hispanic	76.7 (61.5-91.8)	23.3 (8.2-38.5)	-	-
Chinese-American	75.0 (50.5-99.5)	25.0 (0.5-49.5)	-	-
Heart Failure				
Overall	63.4 (53.0-73.8)	36.6 (26.2-47.0)	68.6 (53.2-84.0)	31.4 (16.1-46.8)
Race				
White	69.2 (54.8-83.7)	30.8 (16.3-45.3)	-	-
Black	57.1 (36.0-78.3)	42.9 (21.7-64.0)	68.6 (53.2-84.0)	31.4 (16.1-46.8)
Hispanic	56.3 (31.9-80.6)	43.8 (19.4-68.1)	-	-
Chinese-American	66.7 (29.0-100.0)	33.3 (0.0-71.1)	-	-

BP = blood pressure.
Numbers in the table are percentage with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.
MESA Exam 1 (baseline) occurred from July 2000 to August 2002, Exam 2 from September 2002 to February 2004, Exam 3 from March 2004 to September 2005, Exam 4 from September 2005 to May 2007, and Exam 5 from April 2010 to February 2012.
JHS Exam 1 (baseline) occurred from September 2000 to March 2004, Exam 2 from October 2005 to December 2008, and Exam 3 from February 2009 to January 2013.

Supplemental Table 9. Incidence rates of cardiovascular disease, stroke, coronary heart disease, and heart failure modeling blood pressure, antihypertensive medication use, age, smoking status, and diabetes status as time-varying covariates in the Multi-Ethnic Study of Atherosclerosis, overall and by antihypertensive medication use.

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP<140/90 mmHg	BP≥140/90 mmHg	BP<140/90 mmHg	BP≥140/90 mmHg	BP<140/90 mmHg	BP≥140/90 mmHg
	Cardiovascular disease					
Overall	7.5 (6.8-8.2)	18.5 (16.3-20.6)	11.6 (10.2-13.0)	21.5 (18.5-24.4)	4.7 (4.0-5.4)	13.9 (10.9-16.8)
Age, years						
<65	3.7 (3.0-4.4)	13.2 (9.9-16.4)	6.6 (4.9-8.3)	17.0 (11.8-22.3)	2.6 (1.9-3.2)	9.5 (5.6-13.3)
≥65	11.7 (10.4-13.0)	20.8 (18.1-23.5)	14.6 (12.6-16.5)	22.9 (19.4-26.4)	8.4 (6.8-10.0)	16.7 (12.6-20.8)
Sex						
Female	5.5 (4.6-6.3)	15.1 (12.6-17.6)	9.2 (7.5-10.9)	18.2 (14.8-21.7)	2.8 (2.0-3.6)	9.4 (6.1-12.7)
Male	9.8 (8.6-10.9)	23.4 (19.6-27.1)	14.3 (12.0-16.6)	27.1 (21.6-32.6)	6.8 (5.5-8.0)	18.9 (13.9-23.9)
Race/ethnicity						
Black	7.2 (5.8-8.6)	19.4 (15.7-23.0)	9.3 (7.1-11.4)	21.1 (16.5-25.8)	4.7 (3.0-6.3)	15.8 (10.0-21.5)
Chinese-American	5.3 (3.6-7.0)	8.5 (4.3-12.6)	9.3 (5.2-13.4)	8.6 (3.3-13.9)	3.5 (1.8-5.2)	8.2 (1.6-14.8)
Hispanic	7.7 (6.1-9.2)	20.8 (15.9-25.6)	12.4 (9.2-15.7)	24.3 (17.4-31.2)	5.0 (3.4-6.5)	15.7 (9.2-22.3)
White	8.3 (7.1-9.4)	19.8 (15.8-23.7)	13.7 (11.3-16.2)	25.6 (19.4-31.7)	5.0 (3.9-6.1)	13.0 (8.2-17.7)
Smoking status						
Nonsmoker	7.2 (6.5-7.9)	17.4 (15.3-19.6)	11.4 (9.9-12.8)	20.5 (17.5-23.5)	4.3 (3.5-5.0)	12.5 (9.6-15.5)
Current	9.9 (7.4-12.4)	28.6 (19.9-37.2)	14.5 (9.0-19.9)	32.5 (19.8-45.2)	8.0 (5.3-10.6)	24.3 (12.7-35.8)
Diabetes						
No	6.6 (5.9-7.4)	15.9 (13.7-18.1)	11.2 (9.6-12.8)	18.7 (15.5-21.9)	4.1 (3.4-4.8)	12.4 (9.5-15.4)
Yes	12.5 (10.1-14.9)	28.5 (22.6-34.3)	12.9 (9.9-15.9)	29.0 (22.4-35.6)	11.6 (7.5-15.7)	26.3 (13.8-38.8)
	Stroke					
Overall	2.3 (1.9-2.6)	6.4 (5.2-7.6)	3.5 (2.7-4.2)	7.6 (5.9-9.4)	1.4 (1.0-1.8)	4.4 (2.8-6.1)
Age, years						
<65	1.0 (0.6-1.3)	4.5 (2.6-6.3)	1.7 (0.8-2.6)	5.3 (2.4-8.2)	0.6 (0.3-1.0)	3.6 (1.3-6.0)
≥65	3.6 (2.9-4.4)	7.2 (5.7-8.8)	4.5 (3.4-5.5)	8.4 (6.3-10.5)	2.7 (1.8-3.5)	5.0 (2.7-7.2)
Sex						
Female	2.0 (1.5-2.5)	6.5 (4.9-8.1)	3.3 (2.3-4.3)	7.4 (5.3-9.5)	1.1 (0.6-1.5)	4.8 (2.5-7.2)
Male	2.5 (1.9-3.1)	6.3 (4.4-8.2)	3.6 (2.5-4.7)	8.1 (5.2-11.0)	1.8 (1.1-2.4)	4.0 (1.7-6.3)
Race/ethnicity						
Black	2.3 (1.5-3.1)	5.9 (3.9-7.9)	3.2 (1.9-4.4)	6.9 (4.3-9.6)	1.2 (0.4-2.1)	3.8 (1.0-6.5)
Chinese-American	1.8 (0.8-2.8)	2.1 (0.0-4.1)	3.1 (0.8-5.5)	0.8 (0.0-2.5)	1.2 (0.2-2.2)	4.1 (0.0-8.8)
Hispanic	2.5 (1.7-3.4)	9.7 (6.5-13.0)	3.4 (1.7-5.1)	11.1 (6.6-15.7)	2.0 (1.0-3.0)	7.8 (3.2-12.3)
White	2.2 (1.6-2.8)	6.3 (4.1-8.5)	3.8 (2.6-5.0)	8.9 (5.4-12.5)	1.2 (0.6-1.7)	3.1 (0.8-5.3)
Smoking status						
Nonsmoker	2.2 (1.8-2.6)	6.1 (4.9-7.4)	3.4 (2.6-4.1)	7.2 (5.5-9)	1.4 (0.9-1.8)	4.3 (2.6-6.0)
Current	2.5 (1.3-3.8)	9.0 (4.3-13.8)	4.6 (1.6-7.6)	12.0 (4.6-19.4)	1.6 (0.4-2.8)	5.6 (0.1-11.1)
Diabetes						

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
No	1.8 (1.4-2.2)	5.9 (4.6-7.3)	3.2 (2.3-4.0)	7.2 (5.3-9.2)	1.0 (0.7-1.4)	4.3 (2.6-6.0)
Yes	4.7 (3.2-6.1)	8.2 (5.2-11.3)	4.4 (2.7-6.1)	8.8 (5.3-12.3)	5.2 (2.5-7.9)	5.9 (0.1-11.8)
	Coronary heart disease					
Overall	3.9 (3.4-4.4)	7.8 (6.5-9.2)	5.8 (4.9-6.8)	8.5 (6.7-10.3)	2.5 (2.0-3.0)	6.8 (4.8-8.8)
Age, years						
<65	2.2 (1.7-2.7)	5.3 (3.2-7.3)	3.6 (2.4-4.9)	6.1 (3.0-9.2)	1.6 (1.1-2.2)	4.4 (1.8-7.0)
≥65	5.7 (4.8-6.5)	9.0 (7.2-10.7)	7.1 (5.8-8.4)	9.3 (7.1-11.5)	4.0 (2.9-5.1)	8.3 (5.4-11.2)
Sex						
Female	2.6 (2.0-3.2)	5.6 (4.1-7.1)	4.4 (3.2-5.6)	6.7 (4.7-8.7)	1.3 (0.8-1.8)	3.6 (1.6-5.6)
Male	5.3 (4.4-6.1)	11.0 (8.5-13.6)	7.4 (5.8-9.0)	11.6 (8.1-15.1)	3.8 (2.9-4.8)	10.3 (6.7-14.0)
Race/ethnicity						
Black	3.3 (2.3-4.2)	8.5 (6.1-10.8)	4.2 (2.8-5.6)	7.7 (4.9-10.4)	2.2 (1.0-3.3)	10.2 (5.6-14.8)
Chinese-American	2.7 (1.5-3.9)	4.2 (1.3-7.0)	4.6 (1.7-7.4)	4.3 (0.5-8.0)	1.9 (0.6-3.1)	4.0 (0.5-8.5)
Hispanic	4.3 (3.2-5.4)	7.7 (4.8-10.6)	6.5 (4.1-8.8)	9.1 (5.0-13.2)	3.0 (1.8-4.3)	5.5 (1.7-9.4)
White	4.3 (3.5-5.2)	8.7 (6.1-11.2)	7.2 (5.5-8.9)	11.1 (7.2-15)	2.6 (1.8-3.4)	5.7 (2.6-8.8)
Smoking status						
Nonsmoker	3.6 (3.1-4.1)	7.5 (6.1-8.9)	5.7 (4.7-6.7)	8.4 (6.5-10.3)	2.1 (1.6-2.6)	6.0 (4.0-8.1)
Current	5.9 (4.0-7.8)	10.9 (5.7-16.1)	7.2 (3.4-11.0)	9.5 (2.9-16.2)	5.3 (3.2-7.5)	12.5 (4.4-20.7)
Diabetes						
No	3.4 (2.9-4.0)	6.8 (5.4-8.3)	5.5 (4.4-6.6)	7.6 (5.6-9.6)	2.2 (1.7-2.8)	5.8 (3.9-7.8)
Yes	6.4 (4.7-8.1)	11.7 (8.1-15.3)	6.8 (4.7-8.9)	11.0 (7.1-14.9)	5.5 (2.7-8.3)	14.4 (5.5-23.3)
	Heart failure					
Overall	2.7 (2.3-3.1)	7.3 (6.0-8.6)	4.6 (3.7-5.4)	9.0 (7.1-10.9)	1.4 (1.0-1.8)	4.7 (3.0-6.4)
Age, years						
<65	1.0 (0.6-1.3)	5.5 (3.4-7.5)	2.2 (1.2-3.1)	7.3 (3.9-10.7)	0.5 (0.2-0.8)	3.6 (1.3-6.0)
≥65	4.6 (3.8-5.4)	8.2 (6.5-9.8)	6.0 (4.7-7.2)	9.5 (7.3-11.8)	3.0 (2.0-3.9)	5.5 (3.1-7.8)
Sex						
Female	1.8 (1.4-2.3)	5.9 (4.4-7.5)	3.3 (2.3-4.3)	7.5 (5.4-9.7)	0.8 (0.4-1.2)	3.0 (1.1-4.8)
Male	3.7 (2.9-4.4)	9.3 (7.0-11.6)	6.0 (4.6-7.4)	11.4 (8.0-14.9)	2.1 (1.4-2.7)	6.7 (3.8-9.7)
Race/ethnicity						
Black	2.8 (1.9-3.7)	8.2 (5.8-10.5)	3.7 (2.4-5.1)	9.5 (6.5-12.6)	1.7 (0.7-2.7)	5.3 (2.0-8.6)
Chinese-American	1.7 (0.7-2.7)	3.6 (0.9-6.3)	3.6 (1.1-6.1)	5.1 (1.0-9.2)	0.8 (0.0-1.6)	1.3 (0.0-3.9)
Hispanic	2.5 (1.7-3.4)	7.1 (4.3-9.9)	5.1 (3.1-7.2)	8.6 (4.6-12.6)	1.0 (0.3-1.7)	4.9 (1.3-8.5)
White	3.0 (2.3-3.7)	7.9 (5.5-10.4)	5.2 (3.7-6.7)	10.1 (6.4-13.9)	1.6 (1.0-2.3)	5.3 (2.3-8.3)
Smoking status						
Nonsmoker	2.7 (2.3-3.2)	7.0 (5.7-8.4)	4.6 (3.7-5.5)	8.6 (6.7-10.5)	1.3 (0.9-1.7)	4.5 (2.7-6.2)
Current	2.7 (1.4-4.0)	10.4 (5.3-15.5)	4.6 (1.6-7.6)	13.4 (5.5-21.3)	1.8 (0.6-3.1)	6.9 (0.9-13.0)
Diabetes						
No	2.4 (1.9-2.8)	5.1 (3.9-6.4)	4.4 (3.5-5.4)	6.4 (4.5-8.2)	1.2 (0.8-1.5)	3.5 (2.0-5.1)
Yes	4.7 (3.2-6.2)	15.8 (11.5-20.0)	5.0 (3.2-6.8)	16.0 (11.2-20.8)	4.1 (1.7-6.5)	14.8 (5.6-24.1)

BP = blood pressure.

Numbers in the table are incidence rates per 1,000 person years of observation with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.
MESA Exam 1 (baseline) occurred from July 2000 to August 2002, Exam 2 from September 2002 to February 2004, Exam 3 from March 2004 to September 2005, Exam 4 from September 2005 to May 2007, and Exam 5 from April 2010 to February 2012.

Supplemental Table 10. Incidence rates of cardiovascular disease, stroke, coronary heart disease, and heart failure modeling blood pressure, antihypertensive medication use, age, smoking status, and diabetes status as time-varying covariates in the in the Jackson Heart Study, overall and by antihypertensive medication use.

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP<140/90 mmHg	BP≥140/90 mmHg	BP<140/90 mmHg	BP≥140/90 mmHg	BP<140/90 mmHg	BP≥140/90 mmHg
	Cardiovascular disease					
Overall (black race)	6.9 (6.0-7.9)	15.6 (12.8-18.3)	10.9 (9.2-12.6)	18.1 (14.3-21.8)	3.3 (2.4-4.2)	11.1 (7.2-15.0)
Age, years						
<65	3.4 (2.7-4.2)	11.3 (8.1-14.4)	5.9 (4.3-7.5)	13.0 (8.5-17.4)	1.7 (1.0-2.5)	9.1 (4.9-13.4)
≥65	29.2 (24.1-34.3)	21.4 (16.4-26.4)	19.8 (15.9-23.7)	23.2 (17.2-29.3)	13.1 (8.2-18.1)	15.7 (7.2-24.3)
Sex						
Female	6.6 (5.4-7.7)	15.1 (11.7-18.6)	10.0 (8.0-11.9)	15.9 (11.6-20.2)	2.9 (1.8-4.0)	13.3 (7.5-19.1)
Male	7.5 (5.8-9.2)	16.3 (11.6-20.9)	13.3 (9.7-16.9)	22.5 (15.2-29.9)	3.9 (2.3-5.4)	8.5 (3.5-13.6)
Smoking status						
Nonsmoker	6.7 (5.7-7.7)	14.5 (11.7-17.4)	10.5 (8.7-12.3)	16.9 (13.1-20.7)	2.9 (2.0-3.9)	9.8 (5.7-13.9)
Current	9.4 (6.0-12.8)	23.3 (13.6-33.1)	15.7 (8.4-22.9)	31.5 (14.4-48.6)	5.7 (2.3-9.0)	17.0 (5.9-28.1)
Diabetes						
No	5.2 (4.3-6.2)	11.2 (8.4-14.0)	9.2 (7.2-11.1)	12.8 (8.8-16.7)	2.5 (1.6-3.3)	9.1 (5.3-12.9)
Yes	13.9 (10.8-16.9)	27.2 (20.2-34.2)	15.1 (11.4-18.7)	27.7 (19.9-35.5)	10.3 (5.1-15.6)	24.8 (8.6-41.0)
	Stroke					
Overall (black race)	1.9 (1.4-2.4)	5.3 (3.7-6.9)	2.9 (2.0-3.7)	5.8 (3.8-7.9)	1.0 (0.5-1.5)	4.2 (1.8-6.6)
Age, years						
<65	1.0 (0.6-1.4)	3.7 (2.0-5.5)	1.7 (0.8-2.5)	3.9 (1.5-6.4)	0.5 (0.1-0.9)	3.5 (0.9-6.1)
≥65	7.7 (5.1-10.3)	7.3 (4.4-10.1)	4.9 (3.0-6.8)	7.7 (4.3-11.1)	3.8 (1.2-6.4)	5.9 (0.7-11.1)
Sex						
Female	1.8 (1.2-2.3)	5.2 (3.2-7.2)	2.5 (1.6-3.5)	5.5 (3.0-8.0)	0.9 (0.3-1.5)	4.6 (1.2-8.0)
Male	2.1 (1.2-3.0)	5.4 (2.7-8.0)	3.7 (1.8-5.5)	6.6 (2.7-10.4)	1.1 (0.3-2.0)	3.8 (0.5-7.2)
Smoking status						
Nonsmoker	1.8 (1.3-2.3)	4.6 (3.0-6.2)	2.7 (1.8-3.6)	4.9 (2.9-6.9)	1.0 (0.4-1.5)	3.9 (1.4-6.5)
Current	2.6 (0.8-4.3)	10.2 (3.9-16.5)	5.1 (1.0-9.2)	16.0 (4.1-27.8)	1.0 (0.0-2.4)	5.5 (0.0-11.7)
Diabetes						
No	1.7 (1.1-2.2)	4.0 (2.4-5.7)	2.8 (1.7-3.8)	4.3 (2.1-6.6)	0.9 (0.4-1.4)	3.7 (1.3-6.1)
Yes	2.9 (1.5-4.2)	8.4 (4.6-12.2)	3.1 (1.5-4.8)	8.6 (4.4-12.8)	2.0 (0.3-4.3)	7.9 (1.0-16.8)
	Coronary heart disease					
Overall (black race)	2.8 (2.2-3.4)	6.4 (4.7-8.2)	4.6 (3.5-5.8)	7.4 (5.1-9.8)	1.0 (0.5-1.6)	4.6 (2.1-7.1)
Age, years						
<65	1.5 (1.0-2.0)	5.3 (3.2-7.4)	3.1 (1.9-4.2)	6.7 (3.5-9.9)	0.5 (0.1-0.8)	3.5 (0.9-6.1)
≥65	11.0 (7.9-14)	7.9 (4.9-10.9)	7.3 (5.0-9.7)	8.1 (4.7-11.6)	4.7 (1.8-7.7)	7.1 (1.4-12.8)
Sex						
Female	2.4 (1.7-3.1)	6.0 (3.8-8.1)	3.8 (2.6-5.0)	6.0 (3.5-8.6)	0.8 (0.2-1.3)	5.9 (2.0-9.7)
Male	3.5 (2.4-4.7)	7.1 (4.1-10.2)	6.7 (4.2-9.2)	10.4 (5.4-15.3)	1.4 (0.5-2.4)	3.1 (0.1-6.1)
Smoking status						

Characteristics	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
Nonsmoker	2.8 (2.1-3.4)	6.4 (4.5-8.2)	4.6 (3.4-5.8)	7.3 (4.9-9.8)	1.0 (0.4-1.5)	4.4 (1.7-7.1)
Current	2.9 (1.0-4.7)	7.1 (1.8-12.3)	5.1 (1.0-9.1)	8.9 (0.2-17.6)	1.5 (0.0-3.3)	5.5 (0.7-11.8)
Diabetes						
No	2.1 (1.5-2.7)	5.1 (3.3-7.0)	4.3 (3.0-5.6)	6.2 (3.5-8.9)	0.6 (0.2-1.0)	3.7 (1.3-6.1)
Yes	5.4 (3.6-7.3)	9.8 (5.7-13.9)	5.4 (3.3-7.6)	9.6 (5.2-14.0)	5.4 (1.7-9.2)	10.6 (0.2-21.0)
	Heart failure					
Overall (black race)	3.5 (2.8-4.1)	7.5 (5.6-9.4)	5.5 (4.3-6.7)	9.5 (6.9-12.2)	1.6 (0.9-2.2)	3.9 (1.6-6.2)
Age, years						
<65	1.5 (1.0-2.0)	4.6 (2.6-6.6)	2.4 (1.4-3.4)	5.5 (2.6-8.3)	0.9 (0.4-1.4)	3.5 (0.9-6.1)
≥65	15.6 (11.9-19.2)	11.4 (7.8-14.9)	10.9 (8.1-13.7)	13.6 (9.1-18.1)	5.6 (2.5-8.8)	4.7 (0.1-9.3)
Sex						
Female	3.7 (2.9-4.6)	8.2 (5.7-10.7)	5.5 (4.0-6.9)	9.6 (6.3-12.8)	1.7 (0.9-2.6)	5.2 (1.6-8.8)
Male	3.0 (1.9-4.1)	6.3 (3.5-9.2)	5.6 (3.3-7.9)	9.5 (4.8-14.1)	1.3 (0.4-2.2)	2.3 (0.0-4.9)
Smoking status						
Nonsmoker	3.3 (2.6-4.0)	7.0 (5.1-9.0)	5.3 (4.0-6.5)	9.0 (6.3-11.7)	1.4 (0.7-2.0)	3.1 (0.8-5.3)
Current	5.1 (2.6-7.6)	11.2 (4.6-17.9)	8.5 (3.2-13.7)	15.9 (4.1-27.6)	3.1 (0.6-5.5)	7.4 (0.1-14.7)
Diabetes						
No	2.4 (1.8-3.0)	5.1 (3.2-6.9)	4.1 (2.8-5.3)	6.4 (3.7-9.2)	1.2 (0.6-1.7)	3.3 (1.0-5.5)
Yes	7.8 (5.5-10)	13.8 (9.0-18.7)	8.8 (6.1-11.6)	15.0 (9.5-20.6)	4.7 (1.2-8.1)	7.9 (0.0-16.9)

BP = blood pressure.
Numbers in the table are incidence rates per 1,000 person years of observation with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.
Jackson Heart Study only included black participants.
Heart failure incidence for Jackson Heart Study was calculated using adjudicated events from January 1st, 2005 through December 31st, 201
JHS Exam 1 (baseline) occurred from September 2000 to March 2004, Exam 2 from October 2005 to December 2008, and Exam 3 from February 2009 to January 2013.

Supplemental Table 11. Percentage of cardiovascular disease deaths occurring in participants with systolic/diastolic blood pressure < 140/90 mm Hg in the National Health and Nutrition Examination Survey from 2001-2008 with mortality follow-up through 2011.

	Overall		Taking Antihypertensive Medication		Not Taking Antihypertensive Medication	
	BP<140/90 mmHg n=13,281 weighted n= 146.1 million	BP≥140/90 mmHg n=3,388 weighted n= 28.9 million	BP<140/90 mmHg n=2,418 weighted n= 22.1 million	BP≥140/90 mmHg n=1,538 weighted n= 12.1 million	BP<140/90 mmHg n=10,863 weighted n= 124.0 million	BP≥140/90 mmHg n=1,850 weighted n= 16.8 million
	Cardiovascular disease mortality					
Overall	58.0 (52.0-63.7)	42.0 (36.3-48.0)	57.8 (50.1-65.0)	42.2 (35.0-49.9)	58.3 (49.1-66.9)	41.7 (33.1-50.9)
Age, years						
<65	67.0 (54.4-77.5)	33.0 (22.5-45.6)	61.6 (45.0-75.9)	38.4 (24.1-55.0)	75.2 (57.1-87.3)	24.8 (12.7-42.9)
≥65	53.8 (47.3-60.2)	46.2 (39.8-52.7)	56.0 (47.9-63.7)	44.0 (36.3-52.1)	50.7 (39.4-61.9)	49.3 (38.1-60.6)
Sex						
Female	49.1 (39.5-58.9)	50.9 (41.1-60.6)	48.0 (36.0-60.3)	52.0 (39.8-64.0)	51.3 (36.8-65.6)	48.7 (34.4-63.3)
Male	65.0 (56.9-72.3)	35.0 (27.7-43.1)	66.9 (56.6-75.8)	33.1 (24.3-43.4)	62.6 (51.2-72.8)	37.4 (27.2-48.8)
Race/ethnicity						
Non-Hispanic white	59.6 (52.5-66.4)	40.4 (33.6-47.5)	61.8 (52.9-70.0)	38.2 (30.0-47.1)	56.4 (45.7-66.5)	43.6 (33.5-54.3)
Non-Hispanic black	48.6 (35.3-62.2)	51.4 (37.8-64.7)	51.8 (36.7-66.6)	48.2 (33.4-63.3)	35.6 (18.7-57.1)*	64.4 (42.9-81.4)*
Hispanic	54.8 (34.6-73.6)	45.2 (26.4-65.4)	29.7 (11.4-58.3)	70.3 (41.7-88.6)	69.7 (48.1-85.1)	30.3 (14.9-51.9)
Other†	57.2 (21.1-88.2)	42.8 (11.8-80.7)	--	100	100	--

*Total events=13; †Total events=7.
BP = blood pressure.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.

Exclusions:
Total participants in NHANES 2001-2008: 41,658
Excluding 18,284 participants ineligible for mortality data: 23,374
Excluding 7 participants with missing cause of death: 23,367
Total participants included in mortality file: 23,367
Excluding 3,150 participants with age <20 years or missing the exam weight: 20,217
Excluding 3,457 participants without 3 BP measurements: 16,760
Excluding 91 participants missing antihypertensive medication use: 16,669
Total participants for analysis: **16,669**

Total deaths: 1,467; CVD deaths: 364; Non-CVD deaths: 1,103

Supplemental Table 12. Cardiovascular disease mortality rates in the National Health and Examination Survey 2001-2008 by age, sex, race/ethnicity, smoking status and diabetes status, overall and by antihypertensive medication use.

	Overall		Taking Antihypertensive Medication		Not Taking Antihypertensive Medication	
	BP<140/90 mmHg n=13,281 weighted n= 146.1 million	BP≥140/90 mmHg n=3,388 weighted n= 28.9 million	BP<140/90 mmHg n=2,418 weighted n= 22.1 million	BP≥140/90 mmHg n=1,538 weighted n= 12.1 million	BP<140/90 mmHg n=10,863 weighted n= 124.0 million	BP≥140/90 mmHg n=1,850 weighted n= 16.8 million
	Cardiovascular disease mortality					
Overall	1.4 (1.2-1.7)	5.3 (4.4-6.5)	6.2 (4.8-7.9)	8.0 (6.2-10.4)	0.7 (0.5-0.9)	3.5 (2.8-4.6)
Age, years						
<65	0.6 (0.4-0.8)	2.0 (1.3-3.0)	3.1 (2.0-4.7)	4.3 (2.5-7.4)	0.3 (0.2-0.5)	0.9 (0.4-1.7)
≥65	9.6 (7.9-11.7)	12.1 (10.2-14.5)	12.9 (9.8-16.9)	12.2 (9.7-15.5)	6.8 (4.8-9.7)	12.0 (9.1-16.0)
Sex						
Female	1.0 (0.7-1.4)	5.5 (4.1-7.4)	4.6 (3.1-6.9)	7.9 (5.6-11.1)	0.4 (0.3-0.7)	3.4 (2.2-5.3)
Male	1.8 (1.4-2.3)	5.2 (4.1-6.6)	8.0 (5.8-10.9)	8.2 (5.8-11.7)	0.9 (0.6-1.3)	3.7 (2.7-5.0)
Race/ethnicity						
Non-Hispanic white	1.6 (1.3-2.0)	5.6 (4.4-7.1)	6.8 (5.1-9.0)	8.0 (5.7-11.1)	0.7 (0.5-1.0)	4.1 (3.0-5.5)
Non-Hispanic black	1.3 (0.9-1.9)	4.9 (3.5-7.0)	6.4 (4.4-9.5)	8.3 (5.5-12.4)	0.2 (0.1-0.5)*	2.2 (1.1-4.6)*
Hispanic	0.9 (0.5-1.5)	5.3 (3.0-9.4)	2.5 (1.2-5.2)	9.8 (3.9-25.0)	0.7 (0.4-1.4)	3.2 (1.7-6.2)
Other†	0.6 (0.1-2.3)	2.5 (0.8-7.2)	---	5.6 (1.8-17.5)	0.7 (0.2-2.6)	---
Smoking status						
Nonsmoker	1.4 (1.1-1.7)	5.8 (4.7-7.2)	5.7 (4.3-7.7)	8.5 (6.4-11.2)	0.6 (0.5-0.9)	3.9 (3.0-5.2)
Current	1.4 (1.0-2.2)	3.3 (2.2-5.0)	8.3 (5.0-13.7)	5.3 (2.6-10.9)	0.7 (0.4-1.3)	2.4 (1.3-4.6)
Diabetes						
No	1.0 (0.8-1.2)	4.8 (3.8-6.0)	5.1 (3.9-6.7)	7.4 (5.5-10.1)	0.5 (0.3-0.7)	3.4 (2.5-4.5)
Yes	7.2 (5.0-10.4)	8.2 (5.8-11.7)	9.7 (6.5-14.3)	9.6 (6.3-14.5)	4.8 (2.5-9.2)	5.4 (3.2-8.9)

*Total events=13; †Total events=7.
BP = blood pressure.
Numbers in the table are mortality rates per 1,000 person years of observation with 95% confidence intervals in parentheses.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.

Exclusions:
Total participants in NHANES 2001-2008: 41,658
Excluding 18,284 participants ineligible for mortality data: 23,374
Excluding 7 participants with missing cause of death: 23,367
Total participants included in mortality file: 23,367
Excluding 3,150 participants with age <20 years or missing the exam weight: 20,217
Excluding 3,457 participants without 3 BP measurements: 16,760
Excluding 91 participants missing antihypertensive medication use: 16,669
Total participants for analysis: **16,669**

Total deaths: 1,467; CVD deaths: 364; Non-CVD deaths: 1,103

Supplemental Table 13. Percentage of cardiovascular disease, stroke, and coronary heart disease events occurring among participants with systolic blood pressure < 130 mm Hg and diastolic blood pressure < 80 mm Hg or with systolic blood pressure ≥ 130 mm Hg or diastolic blood pressure ≥ 80 mm Hg.

Event type	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP < 130/80 mm Hg n=15,589	BP ≥ 130/80 mm Hg n=16,267	BP < 130/80 mm Hg n=5,5058	BP ≥ 130/80 mm Hg n=8,472	BP < 130/80 mm Hg n=10,531	BP ≥ 130/80 mm Hg n=7,795
Cardiovascular disease	35.5 (33.6-37.3)	64.5 (62.7-66.4)	30.3 (26.8-33.8)	69.7 (66.2-73.2)	41.9 (38.8-45.0)	58.1 (55.0-61.2)
Stroke	34.8 (31.8-37.9)	65.2 (62.1-68.2)	29.7 (24.2-35.2)	70.3 (64.8-75.8)	40.2 (35.5-44.9)	59.8 (55.1-64.5)
Coronary heart disease	37.1 (33.8-40.5)	62.9 (59.5-66.2)	31.5 (26.6-36.5)	68.5 (63.5-73.4)	43.5 (39.0-48.0)	56.5 (52.0-61.0)
Heart failure	34.0 (29.6-38.4)	66.0 (61.6-70.4)	28.2 (24.3-32.1)	71.8 (67.9-75.7)	42.9 (34.6-51.2)	57.1 (48.8-65.4)

BP = blood pressure.
Numbers in the table are percentage with 95% confidence intervals in parentheses.

Supplemental Table 14. Percentage of cardiovascular disease, stroke, and coronary heart disease events occurring among participants with systolic blood pressure < 150 mm Hg and diastolic blood pressure < 100 mm Hg or with systolic blood pressure ≥ 150 mm Hg or diastolic blood pressure ≥ 100 mm Hg.

Event type	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP < 150/100 mm Hg n=28,831	BP ≥ 150/100 mm Hg n=3,025	BP < 150/100 mm Hg n=11,670	BP ≥ 150/100 mm Hg n=1,860	BP < 150/100 mm Hg n=17,161	BP ≥ 150/100 mm Hg n=1,165
Cardiovascular disease	79.3 (72.0-86.6)	20.7 (13.4-28.0)	76.0 (67.7-84.4)	24.0 (15.6-32.3)	82.9 (74.4-91.4)	17.1 (8.6-25.6)
Stroke	78.3 (67.8-88.9)	21.7 (11.1-32.2)	75.7 (63.6-87.8)	24.3 (12.2-36.4)	82.1 (72.3-91.8)	17.9 (8.2-27.7)
Coronary heart disease	80.8 (74.6-87.0)	19.2 (13.0-25.4)	77.2 (66.4-87.9)	22.8 (12.1-33.6)	84.3 (77.5-91.1)	15.7 (8.9-22.5)
Heart failure	76.8 (69.3-84.4)	23.2 (15.6-30.7)	73.4 (65.6-81.1)	26.6 (18.9-34.4)	82.4 (72.1-92.7)	17.6 (7.3-27.9)

BP = blood pressure.
Numbers in the table are percentage with 95% confidence intervals in parentheses.

Supplemental Table 15. Percentage of cardiovascular disease, stroke, coronary heart disease, and heart failure events occurring among white and black participants with systolic/diastolic blood pressure < 140/90 mm Hg and separately, systolic/diastolic blood pressure ≥ 140/90 mm Hg.

Event type	Overall		On Antihypertensive Treatment		No Antihypertensive Treatment	
	BP<140/90 mmHg n=23,219	BP≥140/90 mmHg n=6,347	BP<140/90 mmHg n=9,112	BP≥140/90 mmHg n=3,756	BP<140/90 mmHg n=14,107	BP≥140/90 mmHg n=2,591
Cardiovascular disease	63.1 (55.6-70.7)	36.9 (29.3-44.4)	59.9 (51.7-68.1)	40.1 (31.9-48.3)	67.1 (57.4-76.7)	32.9 (23.3-42.6)
Stroke	63.7 (51.8-75.6)	36.3 (24.4-48.2)	60.7 (47.0-74.4)	39.3 (25.6-53.0)	69.1 (60.9-77.4)	30.9 (22.6-39.1)
Coronary heart disease	63.7 (58.8-68.7)	36.3 (31.3-41.2)	60.9 (53.9-67.8)	39.1 (32.2-46.1)	67.0 (56.9-77.1)	33.0 (22.9-43.1)
Heart Failure	59.4 (52.6-66.2)	40.6 (33.8-47.4)	54.7 (46.8-62.7)	45.3 (37.3-53.2)	67.0 (57.3-76.7)	33.0 (23.3-42.7)

BP = blood pressure.
Numbers in the table are percentage with 95% confidence intervals in parentheses.
Analyses excluded 1,489 Hispanic and 801 Chinese-Americans from the Multi-Ethnic Study of Atherosclerosis.
BP<140/90 mmHg defined as systolic blood pressure < 140 mm Hg and diastolic blood pressure < 90 mm Hg.
BP≥140/90 mmHg defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg.

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