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Diagnostic Thresholds for Blood Pressure Measured at Home in the Context of the 2017 Hypertension Guideline: Analysis from 2 US Cohorts

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Abstract

Most guidelines have recommended lower home BP threshold when clinic BP threshold of 140/90 mm Hg is used for diagnosis of hypertension. However, home BP thresholds to define hypertension have never been determined in the general population in the United States. We identified home BP thresholds for stage 1 (BP ≥ 130/80 mmHg) hypertension using a regression-based approach in the Dallas Heart Study (n=5,768) and the North Carolina Masked Hypertension study (n = 420). Home BP thresholds were also assessed using outcome-derived approach based on the composite of all-cause mortality or cardiovascular events in the Dallas Heart Study cohort. For this approach, BP thresholds were identified only for systolic BP as diastolic BP was not associated with the outcome. Among untreated participants, the regression-derived thresholds for home BP corresponding to clinic BP for stage 1 hypertension were 129/80 mmHg in Blacks, 130/80 mmHg in Whites, and 126/78 mmHg in Hispanics, respectively. The results are similar in the North Carolina cohort. The 11-year composite cardiovascular and mortality events corresponding to clinic systolic BP > 130 mmHg were higher in Blacks than Whites and Hispanics (13.3% vs. 5.98% vs. 5.52%, respectively). Using a race/ethnicity-specific composite outcome in the untreated DHS participants, the outcome-derived home systolic BP thresholds corresponding to stage 1 hypertension were 130 mmHg in Blacks, 129 mmHg in Whites, and 131 mmHg in

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Hispanics, respectively. Our data based on both regression-derived and outcome approach support home BP threshold of 130/80 mmHg for diagnosis of hypertension in Blacks, Whites, and Hispanics.

Keywords

Home BP; BP monitoring; self-measurement; diagnostic threshold; out-of-office measurement

Introduction

Several recent hypertension guidelines have placed a major emphasis on out-of-office blood pressure (BP) measurements to confirm the diagnosis of hypertension and assess hypertension control [1–3]. The new recommendation reflects strong evidence for the superiority of out-of-office BP over clinic BP in predicting target organ damage and cardiovascular mortality [4–6]. The new AHA/ACC guideline has also proposed different BP thresholds for home and office BP for initiation or titration of antihypertensive drug treatment [1]. For example, the clinic BP cutoff of 140/90 and 160/100 mmHg are proposed to be equivalent to lower home BP threshold of 135/85 and 145/90 mmHg, respectively. The home BP cutoff level for stage 1 hypertension is proposed to be the same as the clinic BP threshold of 130/80 mmHg.

These home BP thresholds are derived from epidemiological studies comparing home and clinic BP among Asian and European individuals [7]. Although BP measurement in the doctors' office generally yields higher values than measurement outside the clinics (i.e. a white coat phenomenon), recent studies conducted in the US have identified an opposite phenotype, in which out-of-office BP is *higher* than clinic BP. This phenomenon, known as masked hypertension, is particularly common among African Americans [8]. For example, in the Jackson Heart Study, the prevalence of masked hypertension was reported to be between 25–34% among African Americans [9, 10]. Similarly, other studies conducted in more ethnically diverse populations in the Dallas county [11] and New York, NY [12] showed a prevalence of masked hypertension between 20–30% of participants. Despite evidence to suggest that home BP may be higher than office BP, at least in certain US populations, previous studies have not determined home BP thresholds that correspond with office BP cutoffs for each stage of hypertension in the general US adults.

Accordingly, we analyzed data from the Dallas Heart Study (DHS) and the North Carolina Masked Hypertension (NCMH) Study. In these 2 cohorts, BP was measured both at home and in the clinic using a standardized protocol and validated oscillometric BP monitors in all participants. We identified home BP thresholds using both regression approach and outcome approach that yield similar probability of cardiovascular disease events as the clinic BP thresholds from the DHS cohort, which has adjudicated cardiovascular outcome data.

Methods

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Study Population.

DHS: The DHS is a multi-ethnic probability-based population sample of Dallas County residents ages 18–65 years, established in 2000, as previously described [11, 13, 14]. The first DHS data collection (DHS-1) was designed to oversample African Americans, including 54% African Americans and 49% women. All participants in the DHS provided written informed consent, and the UT Southwestern Medical Center Institutional Review Board approved the study. During the first in-home visit (n=6,101), surveyors collected medical history, blood pressure (BP) and anthropometric measurements between years 2000–2002. During the in-home visit, 5 blood pressure measurements were taken in the seated position using an automatic oscillometric device (Welch Allyn Vital Signs, Skaneateles Falls, NY) after resting quietly for 5 minutes. Treatment with antihypertensive medications and the type of antihypertensive treatment by drug, dose and frequency were verified by the surveyors. Of the initial 6,101 participants, 3,271 subjects between the age between 30–65 had BP measurements during separate 2 home visits. Total of 10 home BP measurements were obtained in this group of subjects (5 measurements in visit 1 and 5 measurements in visit 2). Among these subjects, 3,027 subjects completed a 3rd study visit at UT Southwestern Medical Center where 5 clinic BP measurements were obtained in the same fashion as the in-home visit using the same model of oscillometric device (Welch Allyn Vital Signs, Skaneateles Falls, NY). The regression-derived analyses were applied to the 2,934 subjects who had no missing values of both home and clinic BP readings. Non-fatal endpoint surveillance was only collected for the cohort entering visit two, who reported no history of cardiovascular disease at baseline (n= 3,132). Among this group, 2,503 subjects had complete follow-up for the outcome-derived analyses.

NCMH: The NCMH Study is a community-based study that enrolled 420 adults from primary care clinics in North Carolina [15]. The NCMH Study was designed to examine the short-term reproducibility of BP phenotypes defined using ambulatory and home BP monitoring over 2 separate testing sessions. Recruitment was restricted to adults who were ≥30 years of age, had a screening clinic-measured systolic BP (SBP)/Diastolic BP(DBP) between 120–149/ 80–95 mm Hg, had a dedicated primary care physician, and were not taking antihypertensive medication. Exclusion criteria included participants with: clinic-measured BP ≥160/100 mm Hg or <110/70 mm Hg; pregnancy; dementia; any condition that would preclude wearing an ambulatory BP monitor; and persistent atrial fibrillation or other arrhythmia. At each study visit, trained research staff measured nondominant arm brachial artery BP three times at ≥1-minute intervals after the participant had been sitting in a quiet room for 5 minutes, using a validated clinic oscillometric device (Welch Allyn Vital Signs, Skaneateles Falls, NY) [16.] At the second study visit, participants were instructed on how to perform home BP measurements using an Omron 705CP HBPM [17]. Between the second and third visits, and between the fourth and fifth (exit) visits, 3 home BP readings were taken at 1-min intervals with patients in a seated position after a 5-min rest in the morning and evening for 5 consecutive days. Thus, there were total of 60 home BP measurement per each subject (30 between the second and third visits, and 30 between the fourth and fifth visits).

Variable Definitions.

Race/ethnicity was self-reported. We considered the mean of all available home BP measurements. The average of all 5 clinic BP from visit 3 in the DHS and 6 clinic BP in the NCMH cohort (3 readings from visit 3 and 3 from visit 5) which are closer to the time of home BP monitoring) was used as the clinic BP in the analysis.

Outcome Measures.

Mortality data were queried from the National Death Index (NDI) through December 2012. Cardiovascular death was defined by *International Statistical Classification of Diseases, 10th Revision* codes I00-I99. Two overlapping approaches were used to capture non-fatal cardiovascular (CV) disease events occurring after enrollment as previously described [18]. First, a detailed health survey regarding interval cardiovascular events was administered annually to study participants. Second, quarterly tracking was performed for hospital admissions using the Dallas-Fort Worth Hospital Council Data Initiative Database, a consortium of all acute-care hospitals in Dallas County. Primary clinical source documents were reviewed for all suspected non-fatal cardiovascular events and were independently adjudicated by an endpoint committee blinded to all study data. Adjudicated CV events included unstable angina, myocardial infarction, coronary artery bypass grafting, percutaneous coronary intervention, stroke, transient ischemic attack, cerebrovascular revascularization, peripheral artery revascularization, hospitalization for atrial fibrillation or heart failure, and all-cause mortality. Follow-up data for both fatal and nonfatal events were complete through December 31, 2012.

Statistical Analysis

All analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC). We used two approaches to identify thresholds for home BP: a regression-derived approach and an outcome-derived approach.[7, 19–21] To enable evaluation of BP thresholds for initiation of antihypertensive drug in untreated participants, all of these analyses were stratified by antihypertensive drug use. Since prevalence of masked hypertension in blacks was suggested to be higher than the prevalence in other ethnicities based on 24-hour ambulatory BP monitoring studies [9, 10, 22], all analyses were also stratified by race/ethnicity.

Regression-derived approach—The goal of the regression-derived approach was to identify the home BP levels that corresponded to specific clinic BP levels.[19, 20, 23, 24] Using the intercept and beta coefficient from a Deming regression model with home SBP as the dependent and clinic SBP as the independent variable, the level of home SBP and 95% confidence interval (CI) corresponding to clinic SBP level of 140 mmHg were estimated. Home SBP levels corresponding to clinic SBP of 120 mmHg, 130 mmHg, and 160 mmHg were also determined. We used the same approach to determine home DBP levels corresponding with clinic DBP of 80 mmHg, 85 mmHg, and 100 mmHg. Comparisons of home BP thresholds at each level of clinic SBP and DBP among Blacks, Whites, and Hispanics were performed using unpaired t test. The 0.01 level of significance was used for multiple testing. To determine if the order of home vs. clinic visit may influence home BP estimates, we performed additional Deming regression analysis in the NCMH cohort in

which home BP between the second and third clinic visits were used as the dependent and the third clinic visit BP as the independent variable (home before clinic BP measurement) as well as analysis using home BP between fourth to fifth clinic visit as the dependent and the fourth clinic visit BP as independent (clinic before home BP measurement).

Outcome-derived approach—The goal of the outcome-derived approach was to identify the threshold for home BP that corresponded to the same probability of an event associated with a clinic BP level (e.g., SBP of ≥ 130 mmHg).[21, 25] Higher clinic SBP was associated with the composite of CV events or all-cause mortality ($p<0.001$) but clinic DBP was not ($p=0.215$). Therefore, thresholds for home SBP but not DBP thresholds were calculated. Thresholds for home SBP yielding similar 5-year predicted probability of the composite outcome associated with clinic SBP ≥ 130 mmHg were first calculated. To do this, we performed Cox regression with the composite outcome of all-cause mortality or CVD (unstable angina, myocardial infarction, coronary artery bypass grafting, percutaneous coronary intervention, stroke, transient ischemic attack, cerebrovascular revascularization, peripheral artery revascularization, hospitalization for atrial fibrillation or heart failure) and clinic SBP as the independent variable in the primary analysis. In the secondary analysis, only coronary heart disease (CHD), stroke, and heart failure are considered as outcomes. We identified the 5-year predicted probability of CVD or mortality for a clinic BP level of 130 mmHg. Next, we developed a Cox regression model with the composite outcome of all-cause mortality/CVD and home SBP as the independent variable. From this latter model, we determined the home SBP value that corresponded to the 5-year predicted probability of the outcome for a clinic SBP level. A bootstrap with 1,000 data sets was used to calculate a 95% confidence interval for the home SBP yielding a similar 5-year predicted probability of the composite CV events/all-cause mortality outcome. Home SBP levels yielding similar 5-year predicted probability of an outcome associated with clinic SBP ≥ 120 mmHg, ≥ 130 mmHg, ≥ 140 mmHg, and ≥ 160 mmHg were also calculated.

Results

Baseline characteristics of participants in DHS and NCMH cohorts are shown in table 1. Participants taking antihypertensive medication in the DHS cohorts were older and more likely to be black, female, and to have concomitant chronic kidney disease (CKD) or diabetes compared with those not taking antihypertensive medication. Additionally, mean BMI was higher among those taking versus not taking antihypertensive medication. Clinic and home BP were each higher among participants taking versus not taking antihypertensive medication while no differences were present for heart rate. The DHS participants consisted of 757 untreated Whites, 164 treated Whites, 1,080 untreated Blacks, and 412 treated Blacks, 447 untreated Hispanics, 56 treated Hispanics in. The NCMH participants consisted of 305 untreated Whites, 84 untreated Blacks, and only 14 untreated Hispanics. Baseline characteristics of Blacks, Whites, and Hispanics in the DHS are shown in supplemental table S1. Since the number of Hispanics in the NCMH is very small, home BP analysis was not performed in this subgroup.

Regression-derived Approach to Determine Home BP Thresholds in DHS and NCMH

Among participants not taking antihypertensive medication in DHS, the regression-derived thresholds for home BP corresponding to clinic BP for stage 1 hypertension was similar between Blacks and Whites (129/80 vs. 130/80 mmHg, respectively, Table 2). Home BP corresponding to clinic BP for stage 2 hypertension in DHS (clinic BP of 140/90 mmHg) were also similar between Blacks and Whites (134/83 vs.137/88 mmHg respectively, Table 2). Home systolic BP thresholds for stage 1 and 2 hypertension, however, were significantly lower in untreated Hispanics when compared to untreated Blacks and Whites (126 and 130 mmHg, respectively, both $p < 0.001$ vs. Blacks and Whites, Table 2 and Figure 1–2) while diastolic BP thresholds were not (all $p > 0.1$ vs. Blacks and Whites). These ethnic differences in home systolic BP thresholds were not observed among treated participants (Table 3). In the NCMH cohort, the regression-derived thresholds for home BP corresponding to clinic BP for stage 1 and stage 2 hypertension were 131/82 and 138/90 mmHg in untreated Blacks and 130/79 and 139/87 mmHg in Whites, respectively, which are similar to thresholds in the untreated DHS black and white groups (Table 2). In analyses modifying the number of home BP measurements included, the thresholds remained unchanged (Table 2–3). Home SBP/DBP thresholds correlating with clinic BPs of 120/80 mmHg, 130/85 mmHg, and 160/100 mmHg among participants not taking antihypertensive medication are also shown in Table 2 and Figure 1. Home SBP and DBP thresholds corresponding to the same clinic SBP/DBP cutoff were generally higher among participants taking versus not taking antihypertensive medication (Table 3).

Since home visit occurred before clinic visit in DHS, additional regression analysis in the NCMH cohort was performed by comparing home BP thresholds using home BP between the second and third clinic visits as the dependent and BP from the third clinic visit as the independent variable (home before clinic BP measurement) to the thresholds derived from home BP measured between the fourth to fifth clinic visits against clinic BP from the fourth clinic visit (clinic before home BP measurement, supplemental table S2). The results remain similar, suggesting minimal regression to the mean during multiple visits.

Outcome-derived Approach to Determine Home BP Thresholds in DHS

Since cardiovascular outcome data were not available in the NCMH cohort, analysis was conducted only in the DHS cohort. Over a median follow-up of 11 years (25th to percentile to 75th percentile of 10.5 to 11.6 years), there were 341 first composite CVD events and all-cause mortality events. Composite CVD events and all-cause mortality events were higher at increasing levels of clinic SBP and higher in Blacks than Whites and Hispanics (Table 4). The 11-year composite mortality and CVD event rates corresponding to stage 1 (clinic SBP ≥ 130) were 13.3 (11.06–15.54)% in untreated Blacks, 5.98 (4.2–7.52)% in untreated Whites, and 5.52 (2.78–8.24)% in untreated Hispanics, respectively. Among participants not taking antihypertensive medication, home SBP thresholds corresponding to clinic SBP of 130 and 140 mmHg were 130 and 140 mmHg in Blacks and 129 and 135 mmHg in Whites, and 131 and 143 mmHg in Hispanics, respectively (Table 4 and Figure 2). Among participants taking antihypertensive medication, home SBP thresholds corresponding to clinic SBP of 130 and 140 mmHg were 133 and 142 mmHg in Blacks and 129 and 140 mmHg in Whites, and 133 and 140 mmHg in Hispanics, respectively (Table 4). When the

outcomes were restricted only to CHD, stroke, and heart failure, the home SBP thresholds for stage 1 and stage 2 hypertension derived from more restricted outcomes remain similar to the original analysis using composite outcomes and all-cause mortality (supplemental table S3).

Discussion

In both primary care clinic cohort and a population-based sample of Dallas county residents, we determined home BP thresholds which correspond to stage 1 and 2 hypertension according to the new ACC/AHA guidelines, using two independent approaches. We have identified a similar home BP threshold corresponding to stage 1 hypertension proposed by the guidelines by both a regression approach and an outcome approach in treated and untreated Blacks, Whites, and Hispanics, which has implications in both diagnosis and treatment of hypertension. Furthermore, these results are consistent and reproducible even when all or fewer readings of home BP measurements are considered in the analysis.

Previous studies have determined diagnostic thresholds for home BP based on outcome-based approaches [7]. These home BP thresholds were found to be generally lower than clinic BP thresholds for diagnosis of hypertension. However, these BP cutoffs were derived from populations from Japan, Finland, Greece, and Uruguay [7]. None of the data were derived from population-based studies conducted in the US. Furthermore, BP thresholds for diagnosis of hypertension have been reduced from 140/90 mmHg used in these studies to 130/80 mmHg by the current ACC/AHA high BP guidelines. A recent analysis from the Jackson Heart Study (JHS) demonstrated that daytime BP threshold assessed by 24-hr ambulatory BP monitoring is higher than the published recommendation which is also derived from non-US populations [9]. Since JHS was conducted only in blacks, the impact of race/ethnicity on out-of-office BP cannot be evaluated. In another recent study conducted mainly in a university-employed middle-aged white population in New York, the investigators also reported higher awake/daytime ambulatory BP than clinic BP [12]. The inconsistency of thresholds reported from international studies vs. US studies may be due to differences in the prevalence of masked hypertension among populations.

When we used the regression approach, we found that our home BP thresholds for Blacks and Whites generally correlated well with thresholds proposed by the new ACC/AHA guidelines for both stage 1 (clinic BP of 130/80 mmHg = home BP of 130/80 mmHg) and stage 2 hypertension (clinic BP of 140/90 mmHg = home BP of 135/85 mmHg). Home systolic BP thresholds are significantly lower for untreated Hispanics than other ethnic/racial groups. When we used the outcome approach, however, the home SBP thresholds are consistent with the guidelines for stage 1 hypertension, ranging from 130 to134 mmHg in all ethnic/racial groups regardless of hypertension treatment status. Because the outcome approach is considered to be the gold standard approach, our data provide support for the home BP thresholds proposed by the new ACC/AHA guidelines. Since the clinic BP threshold of 130/80 mmHg is also proposed by the ACC/AHA guidelines as the target BP for treatment in the office, our study results suggested that home BP of 130/80 mmHg can be used as home BP target for treatment in most hypertensive patients.

By the outcomes approach, home SBP of 140 mmHg in untreated Blacks and 142–143 mmHg in untreated Hispanics corresponding to stage 2 hypertension was slightly higher than levels in untreated Whites (135–136 mmHg) and the guideline recommended thresholds of 135 mmHg by the outcome approach. Our findings in a multiethnic cohort are consistent with JHS which demonstrated that the mean daytime SBP that corresponded with a clinic SBP of 140 mmHg was also 140 mmHg [9]. Although the outcome approach is considered to be a gold standard in establishing a normal range of home BP and ambulatory BP in a given population, it is unclear how BP thresholds should be determined when cardiovascular outcomes are different among populations. This is particularly important in blacks, the population with highest susceptibility to hypertension-related cardiovascular injury [26], stroke [27], and overall mortality [28]. In a recent population-based longitudinal cohort study, each increase in SBP by 10 mmHg was associated with a 24% increase in risk of stroke in blacks compared to 8% in whites [27]. Nevertheless, the difference between the guideline-recommended home BP threshold for stage 2 hypertension and our outcome derived home SBP threshold is modest (135 vs. 140 mmHg) and is likely to impact a small proportion of the population. In the DHS cohort, only 4.2% of blacks and 3.1% of nonblacks were found to have home SBP between 135–140 mmHg and home DBP < 80 mmHg.

Our study is limited to young and middle-aged adults as we excluded persons older than 65. The majority of our subjects were overweight or obese and results may not be applicable to normal weight or lean subjects. Participants included in the analysis are limited to Dallas-Fort Worth, TX and Durham, NC. The study results may not be applicable to other geographic regions in the US. Nevertheless, our data represent the first population-based study in the US that determined home BP thresholds that correspond to each clinic BP cutoff, using a standardized protocol. Home BP measurement was obtained by surveyors in the DHS, which may yield higher values than self-BP measurement. However, we believe that differences are likely to be minimal as the use of nonmedical ethnically congruent field staff members in the DHS should have minimized the alerting reaction during home BP measurement [11]. Furthermore, home BP thresholds derived from DHS in the regression-based approach were largely identical to home BP thresholds from the NCMH study, which employed up to 60 self-BP measurements in the absence of surveyors during multiple consecutive days. Our data suggested that the impact of an observer during home BP measurement is minimal if an automatic oscillometric device is used to measure BP.

Perspectives

Home BP measurement has the advantage over ambulatory BP monitoring as it is more practical, widely available for clinical use, and lower cost. It was estimated that between 30–45% of hypertensive US adults engage in home BP monitoring at least on a monthly basis [29]. Our data based on 2 independent cohorts provides support for the use of home BP threshold of 130/80 mmHg for diagnosis of hypertension as proposed by the 2017 ACC/AHA high BP guideline in Blacks, Whites, and Hispanics, which should inform clinicians in the diagnosis and treatment of hypertension in a large number of hypertensive patients who regularly monitor their home BP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Novel and Significance

What Is New?

- In both primary care clinic cohort and a population-based sample of Dallas county residents, we have identified home BP threshold of 130/80 mmHg to correspond with clinic BP of 130/80 mmHg which is the threshold for diagnosis of hypertension proposed by the 2017 ACC/AHA guidelines.

What Is Relevant?

- Most guidelines have recommended out-of-office BP monitoring for diagnosis of hypertension but the normal limits of home BP have never been determined in the US population.

Summary

-Our data support the use of home BP threshold of 130/80 mmHg for diagnosis of hypertension in US adults.

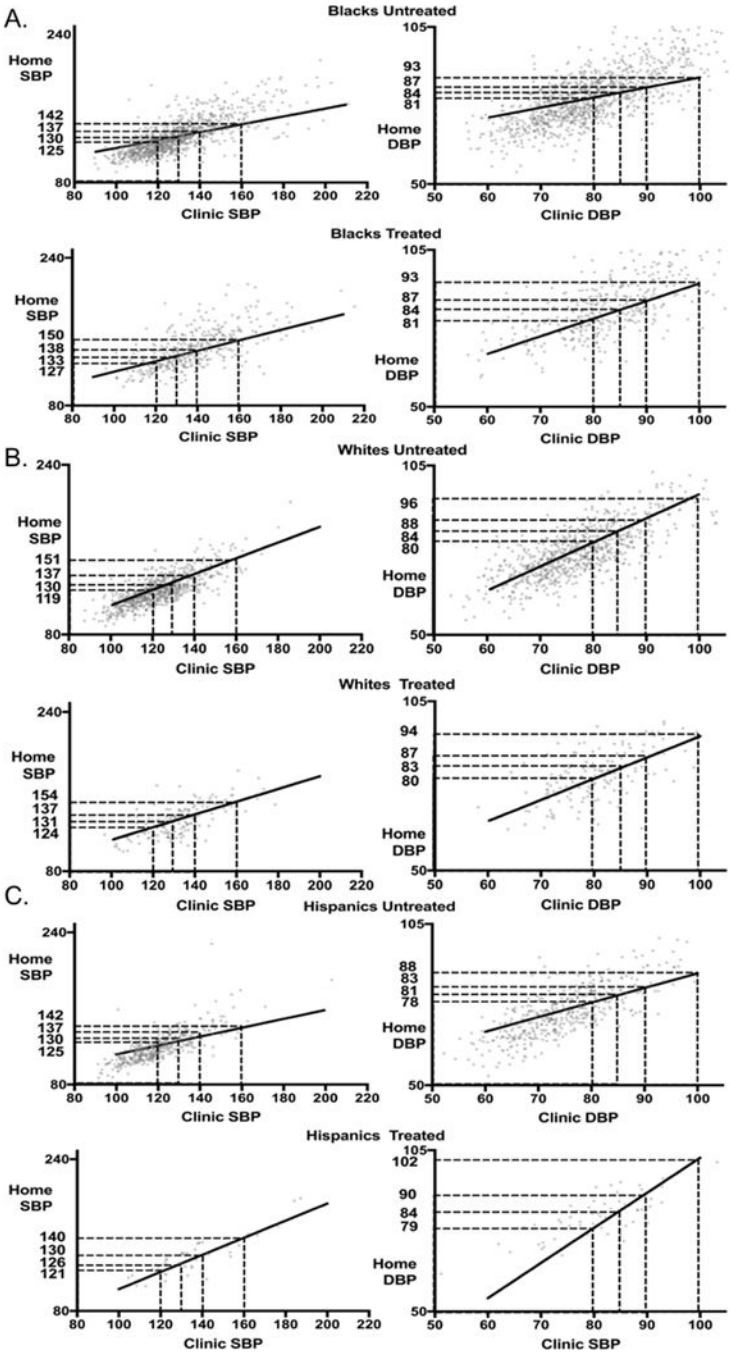

Figure 1:

Home BP thresholds corresponding to a clinic SBP/DBP threshold of 120/80 mmHg, 130/85 mmHg, 140/90 mmHg, and 160/100 mmHg determined using the regression-derived approach in untreated and treated Blacks (A), Whites (B), and Hispanics (C).

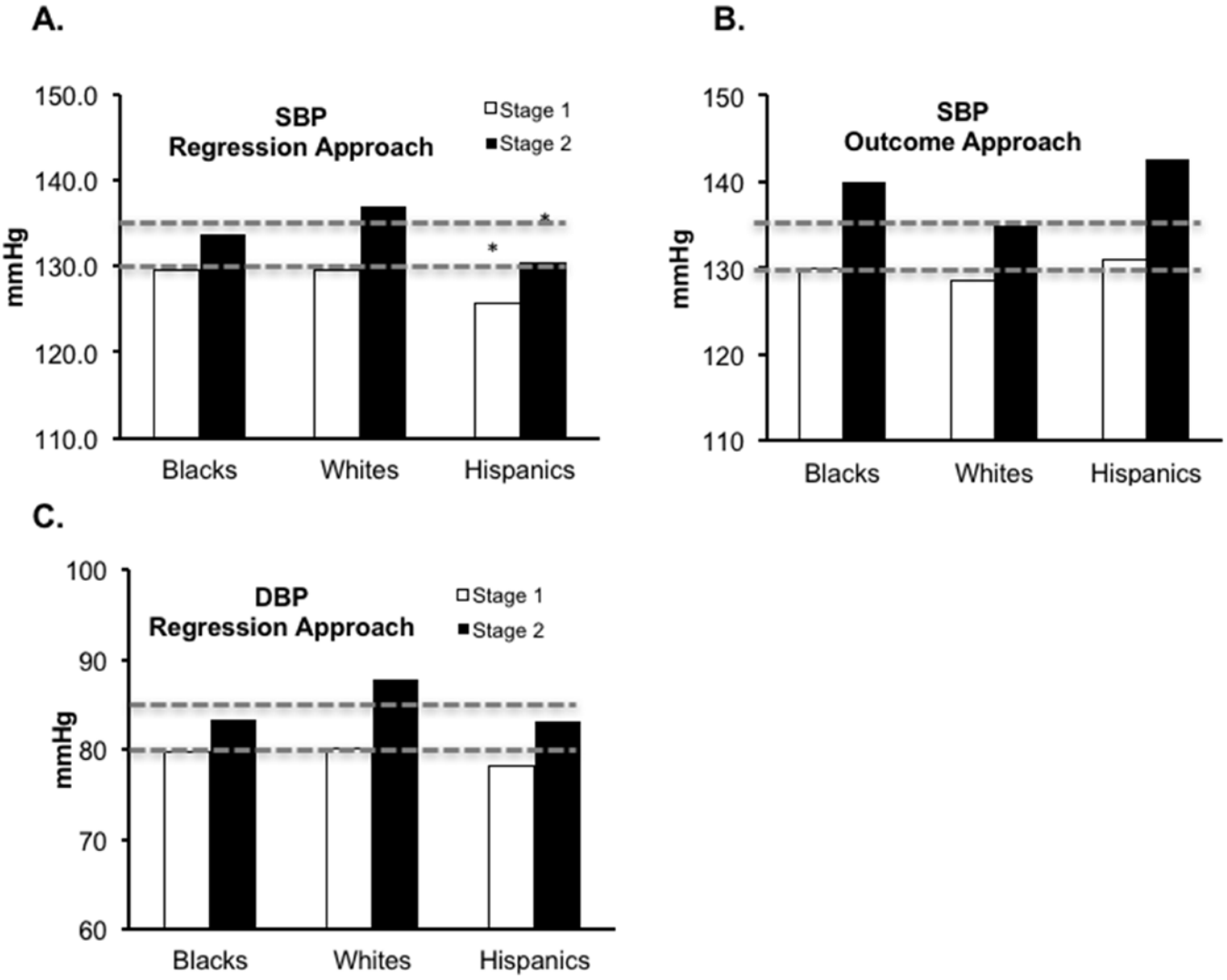

Figure 2:

SBP and DBP thresholds for stage 1 (white bar) and stage 2 (black bar) hypertension among DHS participants not taking antihypertensive medication compared with 2017 ACC/AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. Lines represent recommended SBP and DBP thresholds for stage 1 and stage 2 hypertension. * $p < 0.01$ vs. Blacks and Whites

Table 1.

Characteristics of Dallas Heart Study and North Carolina Masked Hypertension Study participants with home blood pressure monitoring at baseline included in the current analysis.

Variables	DHS		NCMH*
	Untreated n=4,872	**Treated n=896**	**n=420**
Demographic Characteristics			
Age, years	37±12	52±9	48±12
Female sex, %	52%	61%	56%
Blacks, %	53%	68%	21%
Clinical Characteristics			
Body mass index, kg/m^2	28.2±6.6	32.0±7.4	29.2±6.3
Diabetes, %	7%	28%	0%
LDL cholesterol, mg/dL	106.3±34.8	106.4±37.2	142.6±37.8
HDL cholesterol, mg/dL	49.7±14.8	50.2±15.0	57.1±17.8
eGFR, ml/min/1.73 m^2	102.3±23.3	91.6±28.1	N/A
CKD, %	6%	20%	N/A
Current Smoking, %	28%	26%	7%
Clinic measurement			
Clinic systolic BP, *mmHg*	124±16	135±18	129±11
Clinic diastolic BP, *mmHg*	77±10	82±10	81±8
Clinic heart rate, *bpm*	76±11	77±13	74±9
Home measurement			
Systolic BP, *mmHg*	124±18	138±22	129±10
Diastolic BP, *mmHg*	77±10	83±11	80±7
Heart rate, *bpm*	77±12	77±13	N/A

• only untreated subjects are included in the NCMH study

HDL: high-density lipoprotein cholesterol.

LDL: low-density lipoprotein cholesterol.

eGFR: Estimated glomerular filtration rate

N/A: Not available

Table 2.

Regression Approach: mean home SBP and DBP thresholds corresponding to clinic SBP of 160, 140, 130 and 120 mm Hg and clinic DBP of 100, 90, 85 and 80 mm Hg among untreated participants.

Home blood pressure estimates (95% CI) corresponding with specified clinic SBP/DBP levels, mmHg				
NCMH Blacks (n = 84)	**NCMH Whites (n = 305)**	**DHS Blacks (n = 1,080)**	**DHS Whites (n =757)**	**DHS Hispanics (n = 447)**
Clinic SBP 120 mmHg				
123 (121,125)	121 (119,122)	125 (125,126)	122 (122,123)	121 (121–122)
Clinic SBP 130 mmHg				
131 (129,132)	130 (129,131)	129 (129,130)	130 (129,130)	126 * (125–126)
Clinic SBP 140 mmHg				
138 (136,141)	139 (137,141)	134 (133.4,134)	137 (137,138)	130 * (130,131)
Clinic SBP 160 mmHg				
NA	NA	142 (142,143)	152 (151–152)	140 * (139–140)
Clinic DBP 80 mmHg				
82 (81–83)	79 (78,80)	80 (79.5, 79.9)	80 (79.8, 80.3)	78 (78–79)
Clinic DBP 85 mmHg				
86 (84,88)	83 (82,84)	81 (81–82)	84 (83.7–84.2)	81 (80.5–81)
Clinic DBP 90 mmHg				
90 (88,92)	87 (85,88)	83 (83.1–83.4)	88 (87.6–88.2)	83 (83–83.4)
Clinic DBP 100 mmHg				
NA	NA	87 (86.6,87)	96 (95,96)	88 (87.9–88.4)

* $p < 0.01$ vs. Blacks and Whites

Table 3.

Regression Approach: mean home SBP and DBP thresholds corresponding to clinic SBP of 160, 140, 130 and 120 mm Hg and clinic DBP of 100, 90, 85 and 80 mm Hg among participants treated with antihypertensive medications

Home BP estimates (95% CI) corresponding with specified clinic SBP/DBP levels, mmHg		
DHS Blacks (n = 412)	**DHS Whites (n =164)**	**DHS Hispanics (n = 56)**
Clinic SBP 120 mmHg		
127 (126–128)	124 (123,126)	121 (119–123)
Clinic SBP 130 mmHg		
133 (132–134)	131 (129,132)	130 (128,132)
Clinic SBP 140 mmHg		
138 (137–139)	137 (136,138)	139 (137,141)
Clinic SBP 160 mmHg		
150 (149–151)	150 (148,151)	157 (155,159)
Clinic DBP 80 mmHg		
81 (80–81)	80 (79,81)	79 (77,80)
Clinic DBP 85 mmHg		
84 (83–84)	83 (83,84)	84 (83,86)
Clinic DBP 90 mmHg		
87 (86–87)	87 (86,88)	90 (89,92)
Clinic DBP 100 mmHg		
93 (92–94)	94 (93,95)	102 (100,105)

Table 4.

Outcome Approach: Home systolic BP thresholds averaging from 2 home visits yielding an equivalent 11-year predicted probability of the composite outcome of cardiovascular disease or all-cause mortality as clinic systolic blood pressure thresholds of 160 mmHg, 140 mmHg, 130 mmHg, and 120 mmHg from the Dallas Heart Study.

Clinic SBP	11-year predicted probability of composite CVD events and mortality*, %	Mean of all home SBP (95% CI), mmHg
DHS Hispanics, Untreated		
120 mmHg	3.68 (1.93, 5.84)	119 (112, 126)
130 mmHg	5.52 (2.78, 8.24)	131 (126, 136)
140 mmHg	8.56 (3.08, 13.31)	143 (132, 154)
160 mmHg	21.22 (3.04, 40.94)	166 (140, 193)
DHS Hispanics, Treated		
120 mmHg	6.85 (0.64, 15.62)	125 (116, 134)
130 mmHg	9.47 (0.98, 19.5)	133 (127, 138)
140 mmHg	13.69 (1.49, 27.61)	140 (134, 145)
160 mmHg	29.09 (1.91, 77.77)	154 (140, 169)
DHS Blacks, Untreated		
120 mmHg	10.01 (7.98, 12.04)	121 (118, 124)
130 mmHg	13.3 (11.06, 15.54)	130 (129, 132)
140 mmHg	17.59 (14.8, 20.37)	140 (139, 141)
160 mmHg	29.96 (23.93, 35.99)	159 (155, 164)
DHS Blacks, Treated		
120 mmHg	21.28 (14.88, 27.68)	123 (112, 135)
130 mmHg	25.1 (19.65, 30.54)	133 (126, 139)
140 mmHg	29.53 (24.77, 34.29)	142 (140, 145)
160 mmHg	40.34 (32.76, 47.92)	161 (152, 170)
DHS Whites, Untreated		
120 mmHg	4.83 (3.33, 6.17)	122 (119, 126)
130 mmHg	5.98 (4.2, 7.52)	129 (127, 130)
140 mmHg	7.5 (5.05, 9.88)	135 (130, 140)
160 mmHg	12.11 (4.8, 19.83)	148 (135, 160)
DHS Whites, Treated		
120 mmHg	15.02 (7.69, 20.11)	119 (109, 129)
130 mmHg	18.05 (10.31, 24.5)	129 (126, 133)
140 mmHg	21.78 (11.65, 29.96)	140 (135, 145)
160 mmHg	31.71 (16.08, 49.37)	160 (141, 179)

* Probability is based on mean of average of 5 BP measurements.