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HYPERTENSION AND METABOLIC SYNDROME (JR SOWERS AND A WHALEY-CONNELL, SECTION EDITORS)

Understanding the Importance of Race/Ethnicity in the Care of the Hypertensive Patient

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Abstract Although several risk factors contribute to cardiovascular disease (CVD) overall, hypertension (HTN) is the major controllable risk factor. Hypertension is disproportionately more prevalent among Blacks or African-Americans compared with other race/ethnic populations, and the control rates among this disparate population are alarming. Several pathophysiologic mechanisms have been demonstrated and evaluated among hypertensives and the conglomeration of genetics, environmental, and personal lifestyle activities concurrently impact the progression of hypertension-related comorbidities (i.e., chronic renal disease, CVD, stroke, etc.). Specific pharmacotherapeutic choices are discussed and the most up-to-date data is presented to optimize the care of hypertensives. National and international guidelines for the treatment of HTN are reviewed and analyzed, presenting the most appropriate approach to the care of hypertensive patients overall. Additionally, national efforts supporting the goal of early HTN screening and treatment, as well as the variety of evidence-based pharmacotherapy, are summarized, applying to the public health impact overall.

Keywords Hypertension · Race/ethnicity · African American · Pharmacotherapy · Pathophysiology · Pharmacogenetics

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Introduction

Hypertension (HTN) is the largest contributor to cardiovascular disease (CVD), including coronary heart disease, heart failure (HF), and stroke, among traditional risk factors, as recently confirmed among 13,541 participants (6 % Black) over 10 years in the Atherosclerosis Risk in Communities (ARIC) study [1]. Moreover, along with diabetes mellitus (DM), it is a major cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD). Overall, the HTN control rate is only 53.3 % and prevalence differs by race/ethnicity. Hypertension is more common among Blacks or African-Americans (AAs) (40.4 %) compared with Whites (27.4 %) and Mexican-Americans (26.1 %) [2••]. For AAs, high blood pressure (BP) has an earlier onset, greater severity, and higher rates of target organ damage [3], leading to decreased longevity [2••].

Although race and ethnicity are often included in health-related data [4], they are not true scientific categories, but rather social constructs. Therefore, HTN burdens reflect adverse environments as much as, or even more so than true genetic diversity. This review will offer a better understanding of current concepts and new data to optimize care of HTN among various racial/ethnic patients. Epidemiology, pathophysiology, and responses to treatment are explored. In view of the disproportionate HTN-related complications and more documentation in AAs, this review will focus primarily on that population.

The Conundrum of Race/Ethnicity versus Environment-Causing Hypertension-Related Burden and Complications

According to the Food and Drug Administration (FDA) nomenclature for self-determined race, categories include

American Indian or Alaska Native, Asian, Black or AA, Native Hawaiian or Other Pacific Islander, and White [4]. Subsequent to race self-determination, ethnicity is then accessed as Hispanic or Latino. Clearly, these somewhat arbitrary categories do not often accurately characterize a complex, heterogeneous, integrated society (e.g., *White* can include origins in Europe, the Middle East, or North Africa; *Asian* can be persons from areas ranging from India to Japan).

Conversely, the social determinants of health (SDOH), the circumstances in which people are born, grow up, live, work, and age, as well as the systems put in place to deal with illnesses, disproportionately affect HTN and CVD. Recently, Southern Black women with lower socioeconomic status (SES) were found to have worse cardiovascular health than White women [5•] and in Blacks, higher levels of psychological stress as racism-related vigilance was positively associated with HTN [6]. Nevertheless, even with SES similarities, among 69,211 participants in the Southern Community Cohort Study, both uncontrolled HTN and unreported HTN were twice as high among Blacks as Whites (OR, 2.13; 95 % CI, 1.68–2.69; and OR, 1.99; 95 % CI, 1.59–2.48 [7]. The prevalence of self-reported HTN was significantly higher among Blacks than Whites (59 % versus 52 %; $P<0.001$), driven by the higher prevalence among Black women (64 %) compared with White women (52 %), whereas Black and White men had similar prevalences (51 %).

Hypertension has been shown to be associated with acculturation. In a recent New York City survey, US residency for ≥10 years was associated with higher self-reported HTN prevalence in Blacks and Hispanics [8]. There is significant heterogeneity among Hispanics by racial admixture, country of origin, CVD risks, and disease prevalence; age-adjusted HTN rates appear higher among Puerto Ricans and Dominicans as compared with Mexican-Americans and Cubans [9, 10]. Limited national data on HTN rates are available for Asians and Pacific Islanders, who are very diverse, and significant subgroup differences in HTN and CVD rates [11].

The majority of studies on the prevalence and incidence of CVD in US Hispanics have included primarily Mexicans. There is a greater availability of data on Mexican-Americans compared with other Hispanic groups; however, this data may not be generalizable to the other Hispanic groups. Accordingly, a recent American Heart Association scientific statement describing the diversity and complexity of the Hispanic population and assessing the multiple issues affecting CVD among all subgroups of Hispanics, CVD epidemiology and related personal beliefs and the social and health issues of US Hispanics are discussed, and it identifies potential prevention and treatment opportunities. Notably, Hispanics represent the fastest-growing racial/ethnic population in the USA and are expected to constitute 30 % of the total US population by the year 2050 [12].

In the Reasons for Geographic and Racial Differences in Stroke (REGARDS) cohort, long-term suboptimal CVD risk factor control and unhealthy lifestyles were significantly greater in AAs compared to Whites and poor BP control conferred a three times higher stroke risk among Blacks, for every 10 mmHg increase in systolic BP (SBP) [13]. Paradoxically, despite a higher burden of risk factors for atrial fibrillation (AF) in Blacks than in non-Blacks, there is a widely noted lower AF prevalence and incidence of AF in Blacks among treated hypertensive patients [14].

In view of high CVD burden in AAs, especially for stroke, despite no higher risk for dyslipidemia, the recent 2013 American College of Cardiology (ACC)/American Heart Association (AHA) atherosclerotic cardiovascular disease (ASCVD) risk calculation adds additional points for AA status, primarily driven by more prevalent and severe HTN [15]. Unfortunately, these significant disparities have persisted and possibly worsened in the last two decades [2••,16, 17].

Hypertension as the primary reason for a hospitalization is an indicator of health care system failure to prevent and control HTN. In contemporary Medicare data, AAs had persistently higher and increasingly disparate, preventable hospitalizations than Whites. However, high rates for preventable HTN hospitalizations among Whites were found in Appalachia, a low SES area [18]. Addressing SDOH may assist in BP control and in one urban, bi-racial hypertensive cohort, after adjusting for multiple socioeconomic and demographic variables, race differences in HTN treatment and control were eliminated [19].

Current Hypertension Awareness, Treatment and Control Among Various Race/Ethnicities

Current National Health and Nutrition Examination Survey (NHANES) data confirm among adults aged <65 years, the prevalence of HTN was greater for Blacks (74.1 %) and Mexican-Americans (71.9 %) as compared to Whites (57.4 %). A greater proportion of Mexican-Americans and Blacks have stage 1 and stage 2 hypertension than Whites, and treated stage 1 hypertension was significantly lower for Mexican-Americans compared to non-Hispanics. Control for Whites was 48.6 %, Blacks 43.0 %, and Mexican-Americans 35.5 % [2••]. According to a recent longitudinal cohort study of 16,415 Hispanics/Latinos aged 18–74 years, the Hispanic Community Health Study/Study of Latinos demonstrated the total age-adjusted prevalence of hypertension was 25.5 % as compared with 27.4 % in non-Hispanic Whites in the NHANES. Furthermore, the prevalence of hypertension increased with increasing age groups and was highest in Cuban, Puerto Rican, and Dominican groups. Thus, there exists a significant deficit in treatment and control of hypertension among Hispanics/Latinos residing in the USA [20].

Lack of health care coverage is associated with lower rates of hypertension awareness, treatment, and control [20, 21], which contributes to poor control rates among Mexican-Americans. Health care coverage with uncontrolled hypertension was lowest for Mexican-Americans (59.3 %), compared with Blacks (77.7 %) and Whites (89.4 %). Furthermore, Mexican-Americans and Blacks with hypertension were significantly younger than their White counterparts [22]. Interestingly, as previously demonstrated, awareness and treatment was highest among Blacks, possibly reflecting efforts to identify hypertension among AAs [23, 24].

Unmasking Pathophysiology and Genetic Mechanisms for Hypertension in Blacks

In AAs, hypertension is generally considered related to high reabsorption of sodium (Na) and this low-renin, salt-sensitive hypertension may be, at least in part, genetically-based, with a more active Na, potassium (K), 2 chloride cotransporter (NKCC2), and its regulators in the thick ascending limb [25]. Although, urinary excretion of Na appears similar in Blacks and Whites, indicating similar dietary Na intakes, urinary excretion of K is generally lower in AAs [26]. Postulated hypertension mechanisms in Blacks may involve the intrarenal renin-angiotensin system (RAS), variations in angiotensinogen [27], and increased aldosterone sensitivity. Plasma renin activity (PRA) and aldosterone in 1021 participants in the Multi-Ethnic Study of Atherosclerosis not currently taking antihypertensives showed, compared with Whites, Blacks had 28 % lower PRA and 17.4 % lower aldosterone, and Hispanics had 20.1 % higher PRA but similar aldosterone levels, suggesting a different mechanism of hypertension with Hispanic ethnicity [28].

In a prospective observational study, Black children, but not Whites, had lower levels of plasma renin activity and plasma aldosterone, and their BP was positively associated with the plasma aldosterone concentration ($P=0.004$). Intervening with 9-α fludrocortisone to simulate hyperaldosteronism increased BP in Blacks but not in Whites, pointing to aldosterone sensitivity as a significant determinant [27].

Diminished nitric oxide (NO) bioavailability in Blacks may affect both resting and stimulus-mediated vasodilator tone [29]. In addition, the four to five times greater risk for developing CKD or ESRD in hypertensive Blacks has been linked to unique genetic polymorphisms, including MYH9 and apolipoprotein L1 gene (APOL1), which is found primarily with African ancestry and associated with focal segmental glomerular sclerosis and hypertensive kidney disease [30]. Accordingly, APOL1 risk alleles in the African American Study of Kidney Disease and Hypertension (AASK) participants suggest CKD was unlikely to be related to high blood pressure alone [31].

Early hypertension onset and premature CVD in Blacks may be related to blunted nocturnal blood pressure declines, starting in childhood and exacerbated with age [32]. African-Americans have a higher prevalence of not only clinic-based HTN, but also masked (out-of-office-only) HTN, which may confound effective control and is independently associated with left ventricular hypertrophy, a potent risk factor for CVD morbidity and mortality [33].

The Importance of Therapeutic Lifestyle Interventions (Non-pharmacologic Therapy) in Racial/Ethnic Minorities

Therapeutic lifestyle interventions (TLC) are the bedrock of BP control and overall CVD risk reduction, regardless of race/ethnicity. Adverse lifestyles, including excess sodium intake, excess alcohol, obesity, and sedentary lifestyle may be causal to hypertension, in many patients, and can also blunt the beneficial effects of drug therapy for hypertension [34].

High body mass index (BMI), especially abdominal obesity, may explain much of the variation of hypertension and CVD among groups [35]. In a retrospective study of 150, 753 California adults, Asians had the lowest BMI among all groups, but the impact of increasing BMI on the risk of hypertension and diabetes was significantly greater in Asians; for each one unit increase in BMI, Asians were significantly more likely to have hypertension (OR 1.15; 95 % CI 1.13–1.18) compared to non-Hispanic Whites, Blacks, and Hispanics [36]. Furthermore, in AA's, stress-induced sodium retention and obesity may affect a higher nocturnal pressure to excrete the higher sodium load.

A higher BMI lowers 25-Hydroxyvitamin D (25[OH]D) levels and is a causal risk factor for vitamin D deficiency [37, 38]. A large contemporary meta-analysis including 283, 537 participants, with 55,816 hypertension cases [39] noted the risk for HTN was reduced by 12 % per 10 ng/mL increment of 25(OH)D. Although vitamin D deficiency has been associated with HTN and incident stroke, among White and Black Atherosclerosis Risk in Communities (ARIC) participants with no stroke history; lower 25(OH)D levels were not significantly associated with white matter hyperintensity progression or subclinical brain infarcts [40]. Low vitamin D levels are common in Blacks and appropriate vitamin D supplementation may benefit hypertension therapy in African-Americans [41]. Hydrochlorothiazide (HCTZ) decreases urinary calcium excretion, but the risk for hypercalcemia was low among Blacks using up to 4000 IU vitamin D3 with HCTZ [42].

Especially in Blacks, there is strong evidence for the Dietary Approaches to Stop Hypertension (DASH) diet (high

in fresh fruits and vegetables and low-fat dairy products), Mediterranean eating patterns, and sodium restriction [41, 43–45]. Despite persistent debates on the benefits of widespread sodium restriction, recently, Mozaffarian and colleagues reported that globally 1.65 million deaths (1 out of 10 deaths) from CVD in 2010 were due to sodium consumption of more than 2.0 g per day, with greater effects on BP among Blacks than among Whites [46]. Additional sodium restriction to 1500 mg/day may have a more significant BP reduction [45]. One small ambulatory blood pressure monitoring (ABPM) study confirmed rigorous sodium restriction, if successfully achieved, lowers BP even in drug-treated patients with resistant HTN [47].

In 2043 participants from the REGARDS study with treatment-resistant HTN, positive lifestyles were associated with a lower risk for CVD events [34] and in Black Seventh-day Adventists, compared with non-vegetarians, the vegetarian/vegans had lower odds ratios for hypertension, and other CVD risk factors [48]. Therefore, the preponderance of available data suggests the major approaches to non-pharmacologic therapy, if successfully applied are effective, or even more beneficial in Black patients as compared to Whites [49].

Pharmacogenetics and Pharmacotherapy: Potential Racial/Ethnic Differences Responses

Brewster and colleagues systematically reviewed the international contemporary literature on pharmacotherapy in persons of African ancestry and concluded the response was superior in Blacks for thiazide-like diuretics and calcium channel blockers (CCBs), as compared to β-adrenergic blockers and angiotensin converting enzyme inhibitors (ACEIs)/angiotensin receptor blockers (ARBs). Overall, as compared to genetic markers, self-defined ancestry appeared to be the best predictor of individual responses to antihypertensive drugs [50•]. Nevertheless, the same authors recently cautioned that there was also a large degree of overlap in BP lowering between Blacks and Whites, providing caution for making therapeutic decisions based solely upon ethnicity (race) [51]. Beyond genetics, responsiveness to specific BP agents may be influenced by environmental concerns including dietary sodium, physical inactivity, obesity, and stress and comorbidity.

Thiazide Diuretics

The thiazide-type diuretics effectively lower BP and CVD outcomes across all racial/ethnic groups, but the robust response in Blacks compared to Whites may be influenced by a functional single-nucleotide polymorphism in the G protein β3 subunit gene (GNB3) [52, 53].

In the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT), with 35 % Blacks of over 35,000 subjects, chlorthalidone-based treatments (12.5 to 25 mg/day) produced fewer major cardiovascular complications than with lisinopril, especially in Blacks, and less heart failure than amlodipine-based therapy [54]. Moreover, HCTZ-induced adverse metabolic changes, specifically hypertriglyceridemia, in AAs were recently found to be associated with novel variant alleles [55].

Calcium Channel Blockers

Calcium channel blockers are effective antihypertensive agents across a wide spectrum of patients, regardless of race/ethnicity, salt sensitivity, or age, including extensively documented effectivenenss in Blacks [56, 57]. Although in ALLHAT, in Blacks amlodipine was associated with a higher risk of heart failure (RR 1.37, 95 % CI 1.24–1.51), overall, BP lowering and CVD outcomes were similar to chlorthalidone. In the International Verapamil SR and Trandolapril Study (INVEST), patients randomized to a calcium channel blocker or β-blocker strategy reported no differences in outcomes (composite of death, myocardial infarction, or stroke) by drug strategy for Blacks, Whites, or Hispanics [58].

Angiotensin Converting Enzyme Inhibitors and Angiotensin Receptor Blockers (ARBs)

In ALLHAT, lisinopril in Blacks showed a mean SBP approximately 4 mmHg higher than with chlorthalidone, and an increased relative risk for heart failure (RR 1.3), stroke (RR 1.4), and combined cardiovascular outcomes (RR of 1.19). Similarly, in the Losartan Intervention For Endpoint reduction in hypertension (LIFE) study, although losartan-based therapy was superior to atenolol in non-Blacks (hazard ratio 0.83, 95 % CI 0.73 to 0.94), there was increased risk in Blacks with losartan (hazard ratio 1.67, 95 % CI 1.04 to 2.66) [59]. Also, in the Valsartan Antihypertensive Long-term Use Evaluation (VALUE) trial, valsartan was associated with a 20 % increase in CVD (NS) in Blacks as compared to amlodipine [60]. For Blacks, higher doses of angiotensin converting enzyme inhibitors (ACEIs), as shown with trandolopril, or perhaps with angiotensin receptor blockers (ARBs) may increase efficacy, and assist with better BP control [61].

The circulating renin-angiotensin system (RAS) appears suppressed in salt-sensitive populations, but intrarenal RAS, shown as urinary angiotensinogen excretion, may be associated with BP in salt-sensitive, low-renin Blacks [62]. In hypertensive nephrosclerosis, ACEIs are indicated in Blacks similarly to the general population, as clearly demonstrated in the AASK study [63] of 1094 African-Americans with the ramipril-based therapy superior to metoprolol or amlodipine regimens for composite renal outcomes.

Despite less BP reduction with monotherapy with ACEIs and ARBs in Blacks [64], no causal candidate genes including ACE gene insertion/deletion (I/D) polymorphism or angiotensin type 1 receptor, AGTR1 gene, have been conclusively demonstrated [54, 65, 66]. Moreover, although angioedema with ACE inhibitors is more common in Blacks [67], no specific underlying genetic cause has been elucidated [62].

Beta-blockers

The lesser antihypertensive effects of β-blocker monotherapy in Blacks than diuretics or CCBs may be affected by genetic polymorphisms in the β_1-adrenergic receptor gene (ADRB1), Ser49Gly, and Arg389Gly, where frequency of one of the two most BP responsive diplotypes were found in 54 % of Chinese and 44 % of Whites but only 23 % of Blacks, [68]. In a recent bi-racial ambulatory blood pressure monitoring (ABPM) trial [69], in Blacks, night BP responses to atenolol were absent and baseline higher night/day ratios increased significantly ($P<0.05$). Given the prognostic significance of night-time BP, a beta-blocker, specifically atenolol, is not an optimal first-step therapy.

Heart failure prevalence is higher in Blacks as compared to non-Blacks and more often due to hypertension. In the Beta-Blocker Evaluation of Survival Trial (BEST) for heart failure, unlike in non-Blacks, no CVD mortality benefit was seen in Blacks with bucindolol [70]. Interestingly, GRK5-Leu41 polymorphism, consistent with non-responsive beta-adrenergic receptor signaling and less B-blocker benefits, is more common in Blacks, with a ~35 % frequency in African-Americans and ~1–2 % in Whites [71]. There may be more favorable BP lowering with vasodilating B-blockers, including carvedilol and labetalol in Blacks as compared to conventional B-blockers. Moreover, nebivolol, a vasodilating B-blocking agent associated with increased NO availability, has BP lowering in Blacks similar to Whites [72].

Potassium-Sparing Diuretics and Aldosterone Antagonists

In Blacks, increased aldosterone sensitivity and the aldosterone-sensitive epithelial sodium channel in the collecting tubule [73] supports using amiloride, spironolactone, or eplerenone for robust BP lowering with resistant hypertension. Despite the increased risk of hyperkalemia, with stage 1 or 2 nephropathy and baseline potassium >4.5 meq/dl, aldosterone antagonism appears safe and effective for lowering BP, especially in obese Black females [74].

The Benefits of Combination Therapy and Identifying and Addressing Non-adherence

Most middle-aged and older patients with HTN, across race/ethnic status, will need a combination of medications to effectively control hypertension and reduce CVD risk.

Furthermore, the combination of thiazide-type diuretics or CCBs eliminates observed racial responses to B-blockers, ACEIs, or ARBs. In the Avoiding Cardiovascular Events through Combination Therapy in Patients Living with Systolic Hypertension (ACCOMPLISH) trial, 11,506 (Blacks=12.3 %) high-risk patients on benazepril-amlodipine, the primary cardiovascular endpoints were less, as compared with benazepril–hydrochlorothiazide. Overall, including Blacks, the absolute risk reduction was 2.2 %, and the relative risk reduction was 20 % (HR 0.80; 95%CI 0.72–0.90) [75].

In recognition of the need for multi-drug regimens, low SES, cultural and language barriers, and diminished health literacy in many minority patients, clinicians should take active steps to ensure adherence [49]. Patients with excessive daytime sleepiness, often due to insufficient sleep, sleep apnea, illicit substance use, and other medical and psychiatric conditions are more than twice as likely to be non-adherent (OR 2.28, 95 % CI 1.42–3.67, $P<0.001$) [76]. In a retrospective study of 106,621 hypertensive patients, the percentage of hypertensives controlled at 1 year was significantly higher in Whites than Blacks, for monotherapy (BP control 65 versus 53 %; $P<0.001$), free combinations (67 versus 51 %; $P<0.001$), and single-pill combinations (73 versus 63 %; $P<0.001$) [77].

Patient education may improve adherence, addressing misconceptions about hypertension and medications. Techniques include narrative storytelling, with the culturally relevant vignettes [78], self-monitoring with home BP measurements, behavioral counseling, alerts, and computerized clinical decision-support systems [49]. Unfortunately, in the recent Counseling African Americans to Control Hypertension cluster-randomized clinical trial, home BP monitoring and monthly lifestyle counseling was no better than usual care in improving BP control among hypertensive Blacks [79].

Recent Hypertension Guideline and Reports: Pharmacotherapy in Racial/Ethnic Minorities and Controversies in BP Goal Recommendations

As initial choice or monotherapy, the general present consensus among US and international guidelines is that for Black patients, thiazide-type diuretics or CCBs are the most effective agents as compared to beta-blockers, ACEIs, or ARBs. However, significant controversy has developed related to initiation of drugs and the goals of therapy for patients aged 60–79 years of age.

First of all, the UK National Institute for Health and Clinical Excellence (NICE) (2011) recommended step 1 antihypertensive treatment with a CCB in all patients aged over 55 years, and specifically for Black people of African or Caribbean family origin of any age (Table 1). If a CCB first is not suitable, for example because of edema or intolerance, or with HF or a high HF risk, a thiazide-like diuretic is suggested, preferably chlorthalidone or indapamide [80]. For step 2, in Black people of African or Caribbean family origin, NICE notes an ARB should be considered over preference to an ACE inhibitor, in combination with a CCB. More recently, in July of 2013, the European Societies of Hypertension and Cardiology (ESH/ESC) consensus guideline suggested a diuretic or calcium antagonist medications as first-line for Blacks [81].

In November of 2013, the ACC/AHA/CDC consensus report does not describe specific medications based on race/ethnicity, but does mention tighter BP may be appropriate in Blacks and clearly notes the social determinants of heath and race/ethnicity should be taken into account by clinicians [82]. The May 2014 Canadian Hypertension Education Program (CHEP) notes beta-blockers are not recommended as first-line therapy for uncomplicated hypertension in patients 60 years of age or older (Grade A); and first step ACEIs are not recommended for uncomplicated hypertension in Black patients (Grade A). However, both agents may be used in patients with certain comorbid conditions or in combination therapy [83].

In January of 2014, the American Society of Hypertension and the International Society of Hypertension (ASH/ISH) consensus report notes Blacks (African ancestry) usually respond well to treatment with CCBs and diuretics but have smaller BP reductions with ACEIs, ARBs, and B-blockers [84]. However, ASH/ISH notes that combination therapies provide powerful antihypertensive responses that are similar in both Black and White patients, and most patients (stage 2) will require more than one antihypertensive drug to maintain BP control.

The latest major 2014 US report, published in The Journal of American Medical Association (JAMA) in January of 2014, from members originally appointed to the Eight Joint National Committee (JNC) on the Detection, Evaluation, and Treatment of High Blood Pressure, is not a true "JNC 8" report as often described. Although a rigorous, evidence-based review, the report was not endorsed by the National Heart, Lung, and Blood Institute (NHLBI), other federal agencies, nor any of over three dozen organizations promulgating the previous JNC 7 [85]. The JAMA 2014 HTN US Guideline recommends in Blacks, including those with diabetes, that initial antihypertensive treatment should include a thiazide-type diuretic or CCB (for general Black population: moderate recommendation—Grade B; for Blacks with diabetes: weak recommendation—Grade C).

Nevertheless, a major source of controversy and concern in the 2014 US Guideline has been loosening goals for initiation of antihypertensive therapy and goal attainment for persons greater than 60 years old. In the general population aged ≥60 years, the panel recommends to initiate pharmacologic treatment to lower BP at SBP ≥150 mmHg and treat to a goal SBP <150 mmHg. Interestingly, Wright and others, with 5 of the 17 JAMA US 2014 Panel published in the Annals of

Table 1 Hypertension guideline or report recommendations

Guideline (year)	Evidence review methodology	BP target in general adult population (mm Hg)	First step in Blacks
ISHIB (2010)	Consensus	<135/85 (specifically Blacks)	Diuretic or CCB
ACCF/AHA/CDC (2013)	Consensus	Age<80, ≤140/90 Age≥80, ≤140–145/90	Not identified
NICE (2011)	Systematic review	Age<80, <140/90 Age≥80, <150/90	CCB (if CCB not suitable TZ-like diuretic)
ESH/ESC (2013)	Consensus (graded)	Age<80, <140/90 Age≥80, <150/90	Diuretic or CCB
ASH/ISH (2014)	Consensus	Age<80, <140/90 Age≥80, <150/90	TZD or CCB
CHEP (2014)	Consensus	Age<80, <140/90 Age≥80, <150/90	TZD, TZ-like (A) or (B)=CCB, BB <60, ARBs, −not ACEI
JAMA HTN Guideline (2014)	Systematic review	Age<60, <140/90 Age≥60, <150/90	TZ-like diuretic or CCB

ACCF/AHA/CDC American College of Cardiology Foundation; Centers for Disease Control and Prevention, *ASH/ISH* American Society of Hypertension and the International Society of Hypertension, *CHEP* Canadian Hypertension Education Program, *ESH/ESC* European Society of Hypertension/European Society of Cardiology, *ISHIB* International Society on Hypertension in Blacks, *JAMA* The Journal of American Medical Association, *NICE* National Institute for Health and Clinical, *TZD* thiazide, *CCB* calcium channel blocker, *ARB* angiotensin receptor blocker, *ACEI* angiotensin converting enzyme inhibitor

Internal Medicine a minority opinion against raising the target from <140 mmHg for persons >60 to 79 years of age [86••].

Since it may adversely and disproportionately affect African-Americans and women, a recent State-of-the-Art Review in the Journal of the American College of Cardiology [87••] points to the potential harm with less rigorous BP control in older women and AAs and the Association of Black Cardiologists (ABC) strongly opposes the 2014 HTN Guideline decision. This new paradigm shift would leave approximately half of the untreated hypertensive patients in this age range untreated and is a dangerous public health experiment that could potentially reverse the decades long decline in US CVD mortality, especially stroke, seen with decades of increasingly effective BP control. Blacks are disparately affected by the ravages of uncontrolled HTN, and female hypertensive patients commonly develop hypertension after menopause and remain otherwise healthy [87••].

In consideration of the need for combination therapy, the 2010 working group recommendations from the International Society of Hypertension in Blacks (ISHIB) de-emphasized stepped care in favor of combination therapy even for Blacks without target organ damage or concomitant CVD and suggested pharmacotherapy greater than 135/85 mmHg and, for those at higher risk, at blood pressures greater than 130/80 mmHg [64]. The ASH/ISH consensus report uses combination medications for stage 2 hypertension, and CHEP also supports combination therapy using two first-line agents as initial treatment of hypertension (Grade C), if SBP is 20 mmHg above target or if DBP is 10 mmHg above target. The use of these two classes of drugs as initial antihypertensive therapy is supported only as an optional alternative in the 2014 US Guideline [85], but noted as preferred in the ESH/ESC [81].

Future Considerations

Improved understanding of hypertension among racial/ethnic groups has vast implications for public health and individual clinicians treating a diverse patient population. Efforts are critically needed to increase HTN control, awareness, treatment, and control, especially in Mexican-Americans and more effective treatment in Blacks. The Million Hearts® (MH) initiative is designed to prevent 1 million heart attacks and strokes over 5 years and reduce disparities by implementing proven, effective, multifactorial interventions to reduce CVD [88]. The National Forum for Heart Disease and Stroke Prevention, a coalition of over 65 organizations, spearheads multi-sector collaboration to support the MH® goals [89]. Recently, the MH® announced its 2013 hypertension Control Challenge Champions, encompassing nine health systems and health care providers across the country (http://millionhearts.hhs.gov/index.html) who achieved 70 % control rates, including diverse populations and settings.

Conclusion

Racial/ethnic disparities are persistent, unacceptable, and potentially correctable, including CVD risk with effective antihypertensive therapy. An observed life-long lower 10 mmHg SBP level is associated with a 58 % lower coronary heart disease (CHD) risk, much greater than the 22 % reduction in CHD reported for the same magnitude of SBP reduction in clinical trials [90•]. Earlier, effective hypertension treatment should reap substantial benefits and high-risk minorities suffer disparate, devastating consequences from inadequate control of BP [91].

Multiple national efforts, including MH®, support heart-healthy lifestyles, evidence-based antihypertensive pharmacotherapy, adherence, universal access to effective care, and increasing attention to overall CVD prevention. Blacks respond as monotherapy and first step to thiazide-type diuretics and CCBs, but combination blunts or removes racial/ethnic differences in responses. Although the recent 2014 US Guidelines suggest loosened goals for older adults, other expert opinion cautions against potential adverse, unintended consequences, especially in Blacks and women.

Compliance with Ethics Guidelines

Conflict of Interest Keith C. Ferdinand and Samar A. Nasser declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:
- • Of importance
- •• Of major importance

1. Cheng S, Claggett B, Correia AW, Shah AM, Gupta DK, Skali H, et al. Temporal trends in the population attributable risk for cardiovascular disease: the Atherosclerosis Risk in Communities Study. Circulation. 2014;130:820–8.
2.•• Valderrama AL, Gillespie C, Mercado C. Racial/ethnic disparities in the awareness, treatment, and control of hypertension—United States, 2003–2010. MMWR Morb Mortal Wkly Rep. 2013;62(18):351–5. *This governmental report provides recent detailed information on racial/ethnic disparities, especially on BP control according to the NHANES period of 2003–2010.*

3. Ferdinand KC. Improving approaches to hypertension treatment in African Americans: lessons learned from the Jackson Heart Study. J Clin Hypert. 2013;15:362–4.
4. Website: Collection of Race and Ethnicity Data in Clinical Trials Guidance for Industry - Collection of Race and Ethnicity Data in Clinical Trials. Accessed: 9/9/14 http://www.fda.gov/RegulatoryInformation/Guidances/ucm126340.htm.
5.• Davis SK, Gebreab S, Quarells R, Gibbons GH. Social determinants of cardiovascular health among black and white women residing in Stroke Belt and Buckle regions of the South. Ethn Dis. 2014;24(2):133–43. *This paper discusses the social determinants of health, specifically among black versus white women, and the disproportionate effects on CVD*.
6. Hicken MT, Lee H, Morenoff J, House JS, Williams DR. Racial/ethnic disparities in hypertension prevalence: reconsidering the role of chronic stress. Am J Public Health. 2014;104(1):117–23.
7. Sampson UK, Edwards TL, Jahangir E, Munro H, Wariboko M, Wassef MG, et al. Factors associated with the prevalence of hypertension in the southeastern United States: insights from 69,211 blacks and whites in the Southern Community Cohort Study. Circ Cardiovasc Qual Outcomes. 2014;7(1):33–54.
8. Yi S, Elfassy T, Gupta L, Myers C, Kerker B. Nativity, language spoken at home, length of time in the United States, and race/ethnicity: associations with self-reported hypertension. Am J Hypertens. 2014;27(2):237–44.
9. Pabon-Nau LP, Cohen A, Meigs JB, Grant RW. Hypertension and diabetes prevalence among U.S. Hispanics by country of origin: the national health interview survey 2000–2005. J Gen Intern Med. 2010;25(8):847–52.
10. Daviglus ML, Talavera GA, Aviles-Santa ML, Allison M, Cai J, Criqui MH, et al. Prevalence of major cardiovascular risk factors and cardiovascular diseases among Hispanic/Latino individuals of diverse backgrounds in the United States. JAMA. 2012;308(17):1775–84.
11. Kanaya AM, Adler N, Moffet HH, Liu J, Schillinger D, Adams A, et al. Heterogeneity of diabetes outcomes among asians and pacific islanders in the US: the diabetes study of northern california (DISTANCE). Diabetes Care. 2011;34(4):930–7.
12. Rodriguez CJ, Allison MA, Daviglus ML, Isasi CR,Keller C, Leira EC, et al. On behalf of the American Heart Association Council on Epidemiology and Prevention, Council on Clinical Cardiology, and Council on Cardiovascular and Stroke Nursing Circulation. AHA Science Advisory: Status of Cardiovascular Disease and Stroke in Hispanics/Latinos in the United States: A Science Advisory From the American Heart Association. Circulation. 2014;130:CIR.0000000000000071.
13. Gutierrez J, Williams OA. A decade of racial and ethnic stroke disparities in the United States. Neurology. 2014;82(12):1080–2.
14. Okin PM, Bang CN, Wachtell K, Hille DA, Kjeldsen SE, Julius S, et al. Racial differences in incident atrial fibrillation among hypertensive patients during antihypertensive therapy. Am J Hypertens. 2014;27(7):966–72.
15. Stone NJ, Robinson J, Lichtenstein AH, Bairey Merz CN, Lloyd-Jones DM, Blum CB, et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129:S1–45.
16. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Borden WB, et al. American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2013 update: a report from the American Heart Association. Circulation. 2013;127(1):e6–245.
17. Cheng S, Claggett B, Correia AW, Shah AM, Gupta D, Skali H, et al. Temporal trends in the population attributable risk for cardiovascular disease: the atherosclerosis risk in communities study. Circulation. 2014. doi:10.1161/CIRCULATIONAHA.113.008506.
18. Will JC, Nwaise IA, Schieb L, Zhong Y. Geographic and racial patterns of preventable hospitalizations for hypertension: Medicare beneficiaries, 2004–2009. Public Health Rep. 2014;129(1):8–18.
19. Thorpe Jr RJ, Bowie JV, Smolen JR, Bell CN, Jenkins Jr ML, Jackson J, et al. Racial disparities in hypertension awareness and management: are there differences among African Americans and Whites living under similar social conditions? Ethn Dis. 2014;24(3):269–75.
20. Sorlie PD, Allison MA, Avilés-Santa ML, Cai J, Daviglus ML, Howard AG, et al. Prevalence of hypertension, awareness, treatment and control in the Hispanic Community Health Study/Study of Latinos. Am J Hypertens. 2014;27:793–800.
21. Angell SY, Garg RK, Gwynn RC, Bash L, Thorpe LE, Frieden TR. Prevalence, awareness, treatment, and predictors of control of hypertension in New York City. Circ Cardiovasc Qual Outcomes. 2008;1:46–53.
22. Carson AP, Howard G, Burke GL, Shea S, Levitan EB, Muntner P. Ethnic differences in hypertension incidence among middle-aged and older adults: the multi-ethnic study of atherosclerosis. Hypertension. 2011;57:1101–7.
23. CDC. Control of hypertension among adults—National Health and Nutrition Examination Survey, United States, 2005–2008. MMWR. 2012;61 Suppl 2:19–25.
24. Gu Q, Burt VL, Dillon CF, Yoon S. Trends in antihypertensive medication use and blood pressure control among United States adults with hypertension: the National Health and Nutrition Examination Survey, 2001 to 2010. Circulation. 2012;126:2105–14.
25. Tu W, Pratt JH. A consideration of genetic mechanisms behind the development of hypertension in blacks. Curr Hypertens Rep. 2013;15(2):108–13.
26. Turban S, Thompson CB, Parekh RS, Appel LJ. Effects of sodium intake and diet on racial differences in urinary potassium excretion: results from the Dietary Approaches to Stop Hypertension (DASH)-Sodium trial. Am J Kidney Dis. 2013;61(1):88–95.
27. Tu W, Eckert GJ, Hannon TS, Liu H, Pratt LM, Wagner MA, et al. Racial differences in sensitivity of blood pressure to aldosterone. Hypertension. 2014;63(6):1212–8.
28. Rifkin DE, Khaki AR, Jenny NS, McClelland RL, Budoff M, Watson K, et al. Association of renin and aldosterone with ethnicity and blood pressure: the multi-ethnic study of atherosclerosis. Am J Hypertens. 2014;27(6):801–10.
29. Ozkor MA, Rahman AM, Murrow JR, Kavtaradze N, Lin J, Manatunga A, et al. Differences in vascular nitric oxide and endothelium-derived hyperpolarizing factor bioavailability in blacks and whites. Arterioscler Thromb Vasc Biol. 2014;34(6):1320–7.
30. Tayo BO, Kramer H, Salako BL, Gottesman O, McKenzie CA, Ogunniyi A, et al. Genetic variation in APOL1 and MYH9 genes is associated with chronic kidney disease among Nigerians. Int Urol Nephrol. 2013;45(2):485–94. doi:10.1007/s11255-012-0263-4.
31. Freedman BI, Murea M. Target organ damage in African American hypertension: role of APOL1. Curr Hypertens Rep. 2012;14:21–8.
32. Wang X, Poole JC, Treiber FA, Harshfield GA, Hanevold CD, Snieder H. Ethnic and gender differences in ambulatory blood pressure trajectories: results from a 15-year longitudinal study in youth and young adults. Circulation. 2006;114(25):2780–7.
33. Rader F, Franklin S, Haley R, Li N, Elashoff R, Victor R. Masked hypertension by home blood pressure monitoring in blacks: missed opportunities to prevent hypertensive heart disease. J Am Soc Hypertens. 2014;8(4):e7.

34. Diaz KM, Booth JN, Calhoun DA, Irvin MR, Howard G, Safford MM, et al. Healthy lifestyle factors and risk of cardiovascular events and mortality in treatment-resistant hypertension: the reasons for geographic and racial differences in stroke study. Hypertension. 2014;64(3):465–71.
35. Zhang H, Rodriguez-Monguio R. Racial disparities in the risk of developing obesity-related diseases: a cross-sectional study. Ethn Dis. 2012;22(3):308–16.
36. Wong RJ, Chou C, Sinha SR, Kamal A, Ahmed A. Ethnic disparities in the association of body mass index with the risk of hypertension and diabetes. J Community Health. 2014;39(3):437–45.
37. Vimaleswaran KS, Berry DJ, Lu C, Tikkanen E, Pilz S, Hiraki LT, et al. Causal relationship between obesity and vitamin D status: Bi-directional Mendelian randomization analysis of multiple cohorts. PLoS Med. 2013;10:e1001383.
38. Earthman CP, Beckman LM, Masodkar K, Sibley SD. The link between obesity and low 25-hydroxyvitamin D concentrations: considerations and implications. Int J Obes (Lond). 2012;36:387–96.
39. Kunutsor SK, Apekey TA, Steur M. Vitamin D and risk of future hypertension: meta-analysis of 283,537 participants. Eur J Epidemiol. 2013;28:205–21.
40. Michos ED, Carson KA, Schneider AL, Lutsey PL, Xing L, Sharrett AR, et al. Vitamin D and subclinical cerebrovascular disease: the Atherosclerosis Risk in Communities brain magnetic resonance imaging study. JAMA Neurol. 2014;71(7):863–71.
41. Forman JP, Scott JB, Ng K, Drake BF, Suarez EG, Hayden DL, et al. Effect of Vitamin D supplementation on blood pressure in African-Americans. Hypertension. 2013;61(4):779–85.
42. Chandler PD, Scott JB, Drake BF, Ng K, Forman JP, Chan AT, et al. Risk of hypercalcemia in blacks taking hydrochlorothiazide and vitamin d. Am J Med. 2014;127(8):772–8.
43. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, et al. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. N Engl J Med. 1997;336(16):1117–24.
44. Institute of Medicine. Dietary reference intakes for water, potassium, sodium, chloride, and sulfate. Washington: National Academies Press; 2005.
45. Eckel RH, Jakicic JM, Ard JD, Miller NH, Hubbard VS, Nonas CA, de Jesus JM, Sacks FM, Lee I-M, Smith Jr SC, Lichtenstein AH, Svetkey LP, Loria CM, Wadden TW, Millen BE, Yanovski SZ. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk. J Am Coll Cardiol. 2014;63(25_PA) doi :10.1016/j.jacc.2013.11.003.
46. Mozaffarian D, Fahimi S, Singh GM, Micha R, Khatibzadeh S, Engell RE, et al. Global sodium consumption and death from cardiovascular causes. N Engl J Med. 2014;371:624–34.
47. Pimenta E, Gaddam KK, Oparil S, Aban I, Husain S, Dell'Italia LJ, et al. Effects of dietary sodium reduction on blood pressure in subjects with resistant hypertension: results from a randomized trial. Hypertension. 2009;54:475–81.
48. Fraser G, Katuli S, Anousheh R, Knutsen S, Herring P, Fan J. Vegetarian diets and cardiovascular risk factors in black members of the Adventist Health Study-2. Public Health Nutr. 2014;17:1–9.
49. Odedosu T, Schoenthaler A, Vieira DL, Agyemang C, Ogedegbe G. Overcoming barriers to hypertension control in African Americans. Cleve Clin J Med. 2012;79:46–56.
50.• Brewster LM, Seedat YK. Why do hypertensive patients of African ancestry respond better to calcium blockers and diuretics than to ACE inhibitors and beta-adrenergic blockers? A systematic review. BMC Med. 2013;11:141. *This literature review suggests that there are consistent, although perhaps small, differences in responses between blacks and whites, particularly for ACEIs, ARBs, and β-blockers. However, an important point from the meta-analysis and several other reports is that although a mean difference in response between groups exists, there was also a large degree of overlap in responses between the 2 groups.*
51. Seedat YK, Brewster LM. What role does African ancestry play in how hypertensive patients respond to certain antihypertensive drug therapy? Expert Opin Pharmacother. 2014;15(2):159–61.
52. Schelleman H, Stricker BH, Verschuren WM, de Boer A, Kroon AA, de Leeuw PW, et al. Interactions between five candidate genes and antihypertensive drug therapy on blood pressure. Pharmacogenomics J. 2006;6:22–6.
53. Turner ST, Schwartz GL, Chapman AB, Boerwinkle E. C825T polymorphism of the G protein beta(3)-subunit and antihypertensive response to a thiazide diuretic. Hypertension. 2001;37(part 2):739–43.
54. ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group. The antihypertensive and lipid-lowering treatment to prevent heart attack trial. Major outcomes in high-risk hypertensive patients randomized to angiotensin-converting enzyme inhibitor or calcium channel blocker vs diuretic: the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). JAMA. 2002;288.
55. Del-Aguila JL, Beitelshees AL, Cooper-Dehoff RM, Chapman AB, Gums JG, Bailey K, et al. Genome-wide association analyses suggest NELL1 influences adverse metabolic response to HCTZ in African Americans. Pharmacogenomics J. 2014;14(1):35–40.
56. Materson BJ, Reda DJ, Cushman WC, Massie BM, Freis ED, Kochar MS, et al. Single-drug therapy for hypertension in men. A comparison of six antihypertensive agents with placebo. The Department of Veterans Affairs Cooperative Study Group on Antihypertensive Agents. N Engl J Med. 1993;328:914.
57. Saunders E, Weir MR, Kong BW, Gray J, Vertes V, Sowers JR, et al. A comparison of the efficacy and safety of a beta-blocker, a calcium channel blocker, and a converting enzyme inhibitor in hypertensive blacks. Arch Intern Med. 1990;150:1707.
58. Pepine CJ, Handberg EM, Cooper-DeHoff RM, Marks RG, Kowey P, Messerli FH, et al. A calcium antagonist vs a non-calcium antagonist hypertension treatment strategy for patients with coronary artery disease: the International Verapamil-Trandolapril Study (INVEST): a randomized controlled trial. JAMA. 2003;290:2805–16.
59. Julius S, Alderman MH, Beevers G, Dahlof B, Devereux RB, Douglas JG, et al. Cardiovascular risk reduction in hypertensive black patients with left ventricular hypertrophy: the LIFE study. J Am Coll Cardiol. 2004;43:1047–55.
60. Zanchetti A, Julius S, Kjeldsen S, McInnes GT, Hua T, Weber M, et al. Outcomes in subgroups of hypertensive patients treated with regimens based on valsartan and amlodipine: an analysis of findings from the VALUE trial. J Hypertens. 2006;24(11):2163–8.
61. Weir MR, Gray JM, Paster R, Saunders E. Differing mechanisms of action of angiotensin-converting enzyme inhibition in black and white hypertensive patients. The Trandolapril Multicenter Study Group. Hypertension. 1995;26:124.
62. Michel FS, Norton GR, Maseko MJ, Majane OH, Sareli P, Woodiwiss AJ. Urinary angiotensinogen excretion is associated with blood pressure independent of the circulating renin-angiotensin system in a group of african ancestry. Hypertension. 2014;64(1):149–56.
63. Agodoa LY, Appel L, Bakris GL, Beck G, Bourgoignie J, Briggs JP, et al. Effect of ramipril vs amlodipine on renal outcomes in hypertensive nephrosclerosis: a randomized controlled trial. JAMA. 2001;285:2719.
64. Flack JM, Sica DA, Bakris G, Brown AL, Ferdinand KC, Grimm Jr RH, et al. Management of high blood pressure in Blacks: an update of the International Society on Hypertension in Blacks consensus statement. Hypertension. 2010;56(5):780–800.
65. Arnett DK, Davis BR, Ford CE, Boerwinkle E, Leiendecker-Foster C, Miller MB, et al. Pharmacogenetic association of the

angiotensin-converting enzyme insertion/deletion polymorphism on blood pressure and cardiovascular risk in relation to antihypertensive treatment: the Genetics of Hypertension-Associated Treatment (GenHAT) study. Circulation. 2005;111:3374–83.
66. Brunner M, Cooper-DeHoff RM, Gong Y, Karnes JH, Langaee TY, Pepine CJ, et al. Factors influencing blood pressure response to trandolapril add-on therapy in patients taking verapamil SR (from the International Verapamil SR/Trandolapril [INVEST] Study). Am J Cardiol. 2007;99:1549–54.
67. Wright Jr JT, Dunn JK, Cutler JA, Davis BR, Cushman WC, Ford CE, et al. Outcomes in hypertensive black and nonblack patients treated with chlorthalidone, amlodipine, and lisinopril. JAMA. 2005;293:1595–608.
68. Shin J, Johnson JA. Pharmacogenetics of beta-blockers. Pharmacotherapy. 2007;27:874–87.
69. Chapman AB, Cotsonis G, Parekh V, Schwartz GL, Gong Y, Bailey KR, et al. Night blood pressure responses to atenolol and hydrochlorothiazide in black and white patients with essential hypertension. Am J Hypertens. 2014;27(4):546–54.
70. Smart NA, Kwok N, Holland DJ, Jayaighe S, Giallauria F. Bucindolol: a pharmacogenomic perspective on its use in chronic health failure. Clini Med Insights Cardiol. 2011;5:55–66.
71. Liggett SB, Cresci S, Kelly RJ, Syed FM, Matkovich SJ, Hahn HS, et al. A GRK5 polymorphism that inhibits β-adrenergic receptor signaling is protective in heart failure. Nat Med. 2008;14:510–7.
72. Saunders E, Smith WB, DeSalvo KB, Sullivan WA. The efficacy and tolerability of nebivolol in hypertensive African American patients. J Clin Hypertens (Greenwich). 2007;9:866–75.
73. Pratt JH, Ambrosius WT, Agarwal R, Eckert GJ, Newman S. Racial difference in the activity of the amiloride-sensitive epithelial sodium channel. Hypertension. 2002;40:903.
74. Khosla N, Kalaitzidis R, Bakris GL. Predictors of hyperkalemia risk following hypertension control with aldosterone blockade. Am J Nephrol. 2009;30:418–24.
75. Jamerson K, Weber MA, Bakris GL, Dahlöf B, Pitt B, Shi V, et al. Benazepril plus amlodipine or hydrochlorothiazide for hypertension in high-risk patients. N Engl J Med. 2008;359:2417.
76. Williams NJ, Jean-Louis G, Pandey A, Ravenell J, Boutin-Foster C, Ogedegbe G. Excessive daytime sleepiness and adherence to antihypertensive medications among blacks: analysis of the counseling African Americans to control hypertension (CAATCH) trial. Patient Prefer Adherence. 2014;8:283–7.
77. Egan BM, Bandyopadhyay D, Shaftman SR, Wagner CS, Zhao Y, Yu-Isenberg KS. Initial monotherapy and combination therapy and hypertension control the first year. Hypertension. 2012;59:1124.
78. Houston TK, Allison JJ, Sussman M, Horn W, Holt CL, Trobaugh J, et al. Culturally appropriate storytelling to improve blood pressure: a randomized trial. Ann Intern Med. 2011;154:77.
79. Ogedegbe G, Tobin JN, Fernandez S, Cassells A, Diaz-Gloster M. Counseling African Americans to control hypertension: cluster-randomized clinical trial main effects. Circulation. 2014;129(20):2044–51.
80. National Institute for Health and Clinical Excellence. Hypertension: clinical management of primary hypertension in adults. CG127. http://guidance.nice.org.uk/CG127/Guidance/pdf/English (2011).
81. Mancia G, Fagard R, Narkiewicz K, Redón J, Zanchetti A, Böhm M, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the task force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). J Hypertens. 2013;31(7):1281–357.
82. Go AS, Bauman M, Coleman King SM, Fonarow GC, Lawrence W, Williams KA, et al. An effective approach to high blood pressure control: a science advisory from the American Heart Association, the American College of Cardiology, and the Centers for Disease Control and Prevention. J Am Coll Cardiol. 2014;63(12):1230–8.
83. Dasgupta K, Quinn R, Zarnke K, Rabi DM, Ravani P, Daskalopoulou SS, et al. The 2014 Canadian hypertension education program recommendations for blood pressure measurement, diagnosis, assessment of risk, prevention, and treatment of hypertension. Can J Cardiol. 2014;30(5):485–501.
84. Weber MA, Schiffrin EL, White WB, Mann S, Lindholm LH, Kenerson JG, et al. Clinical practice guidelines for the management of hypertension in the community a statement by the American Society of Hypertension and the International Society of Hypertension. J Hypertens. 2014;32(1):3–15.
85. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the eighth Joint National Committee (JNC 8). JAMA. 2014;311(5):507–20.
86.•• Wright JT, Fine LJ, Lackland DT, Ogedegbe G, Dennison Himmelfarb CR. Evidence supporting a systolic blood pressure goal of less than 150 mm Hg in patients aged 60 years or older: the minority view. Ann Intern Med. 2014;160:499–503. *A conflicting view of the loosened 2014 U.S. Guideline goals in older adults from actual members of the panel apppointed to* "*JNC8*".
87.•• Krakoff LR, Gillespie RL, Ferdinand KC, Fergus IV, Akinboboye O, Williams KA, et al. Hypertension recommendations from the eighth joint national committee panel members raise concerns for elderly black and female populations. J Am Coll Cardiol. 2014;64(4):394–402. *The state-of the-art review examines the loosened recommendations on goals and the initiation of pharmacotherapy in older adults in the 2014 U.S. Guidelines and discusses the potential harm that the new guidelines cause as related to race/ethnicity and women.*
88. Frieden TR, Berwick DM. The "Million Hearts" initiative—preventing heart attacks and strokes. N Engl J Med. 2011;365:e27.
89. The National Forum for Heart Disease and Stroke Prevention Website Accessed 9/11/2014: http://www.hearthealthystrokefree.org/.
90.• Ference BA, Mahajan N, Julius S, Yoo W, Okwuosa T, Afonso L, et al. Effect of naturally random allocation to lower blood pressure beginning before the development of hypertension. J Am Coll Cardiol. 2013; 61(10S). *This reference quantifies the lifetime risk of CVD as being much less for a given magnitude of lower lifetime BP than for the same magnitude lower BP lowering observed in pharmacological trials of BP lowering in middle-aged to older adults. This observation provides information that is unlikely to ever be obtained from a randomized clinical trial.*
91. Flack JM, Ference BA, Levy P. Should African Americans with hypertension be treated differently than non-African Americans? Curr Hypertens Rep. 2014;16(1):409.