Chapter 2
Epidemiology Awareness, Prevalence, and Control: Newest Findings on Hypertension in Blacks

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2.1 Introduction

The racial disparities in hypertension and hypertension-related disease outcomes have been related to mortality and morbidity risks compared with their white counterparts. These excess risks from elevated blood pressure have a dramatic effect on life expectancy for African American men and women which is significantly less than for Caucasian Americans. Stroke risks are twofold greater for African Americans [1]. In addition, the age of onset of diseases such as stroke is significantly earlier for African Americans compared to Caucasians. This race-age interaction impacts the hypertension-related disease risks. For example, a 45-year-old African American man residing in the Southeast has the stroke risk of a 55-year-old white man in the Southeast and a 65-year-old white man residing in the Midwest [1]. While high blood pressure affects all segments of the population, high blood pressure rates are more prevalent among African American men and women [2]. The increased prevalence and relative risks constitute significant population attributable risks [3]. Specifically, the population attributable risk for hypertension and 30-year mortality among white men was 23.8 % compared with 45.2 % among black men and 18.3 % for white women compared with 39.5 % for black women. These excess disease risks have been long recognized and reported from the Evans County Heart Study [4] and the Charleston Heart Study [5] which were both

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K.C. Ferdinand (ed.), *Hypertension in High Risk African Americans*, Clinical Hypertension and Vascular Diseases, DOI 10.1007/978-1-4939-2010-5_2

initiated in 1960 specifically to study these racial disparities in cardiovascular disease in adults. Similarly, the Bogalusa Heart Study [6] assessed the racial differences in children and young adults. More recently, the Jackson Heart Study [7] has been established to assess cardiovascular risk factors in this population. Further, the REasons for Geographic and Racial Differences in Stroke (REGARDS) study has further documented and confirmed the racial and geographic differences in awareness, treatment, and control of hypertension [8]. With these large epidemiology studies, high blood pressure has been a common significant factor associated with the excess disease burden for African Americans [9].

2.2 Blood Pressure and Hypertension Levels

Nearly one-third of the adult population in the United States are considered to have hypertension with elevated blood pressure (≥140/90 mmHg) and/or being treated with antihypertensive medication. The prevalence of hypertension is higher in both middle-aged and older African Americans compared with non-Hispanic whites [10, 11]. As presented in Fig. 2.1, data from the National Health and Nutrition Examination Survey (NHANES) show the racial disparities with black men and women having significantly higher rates of hypertension than white men and women

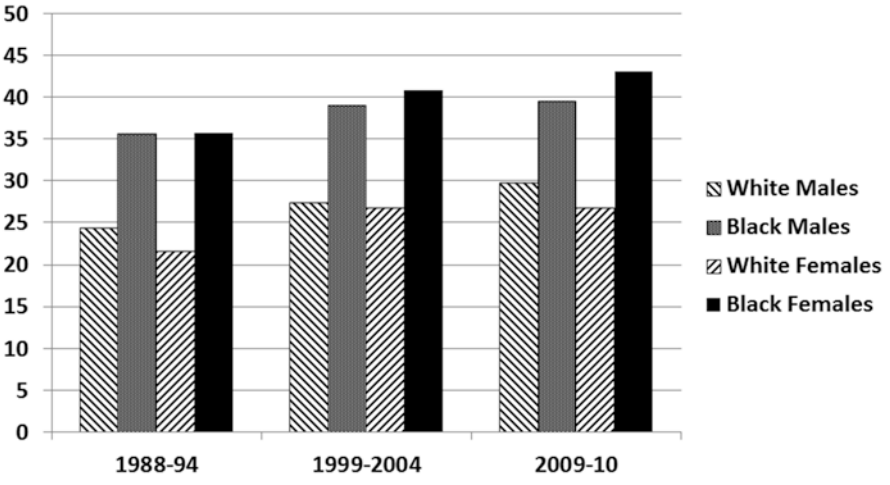

Fig. 2.1 Prevalence of hypertension (percent of adult population) US 1988–1994 and 1999–2004. Adapted from Lackland DT. Racial Differences in Hypertension: Implications for High Blood Pressure Management. American Journal of the Medical Sciences 2014; Cutler JA, Sorlie PD, Wolz M, Thom T, Fields LE, Roccella EJ. Trends in Hypertension Prevalence, Awareness, Treatment, and Control Rates in United States Adults Between 1988–1994 and 1999–2004. Hypertension. 2008;52:818–827; and Guo F, He D, Zhang W, Walton G. Trends in prevalence, awareness, management, and control of hypertension among United States adults 1999 to 2010. J AM Coll Cardiol 2012;60:599–606

[12, 13]. The prevalence rates increased for all four race-sex groups from the 1988–1994 period to the 2009–2010 period. However, the racial disparities in hypertension prevalence remained consistent over the time periods. These racial differences are evident at all ages. Blacks are found to develop hypertension at an earlier age than whites. An assessment of US children aged 8–17 years found systolic blood pressures to be 2.9 and 1.6 mmHg higher in black boys and girls compared with age-matched white boys and girls [14]. With the consistent racial differences at all ages, it is evident that disparities in hypertension represent a lifetime consideration [15–17].

2.3 Hypertension Awareness, Treatment, and Control

While large-scale clinical trials have consistently demonstrated that the control of elevated blood pressure significantly reduces the risk for major cardiovascular disease, stroke, and end-stage renal disease outcomes, a substantial portion of hypertensive patients do not achieve blood pressure control [15]. Data from the National Health and Nutrition Examination Survey suggest that blood pressure is controlled for less than two-thirds of all patients on antihypertensive medications [12, 18]. African Americans demonstrated poorer blood pressure control compared with Caucasians. Figure 2.2 presents the hypertension control rates for all four race-sex

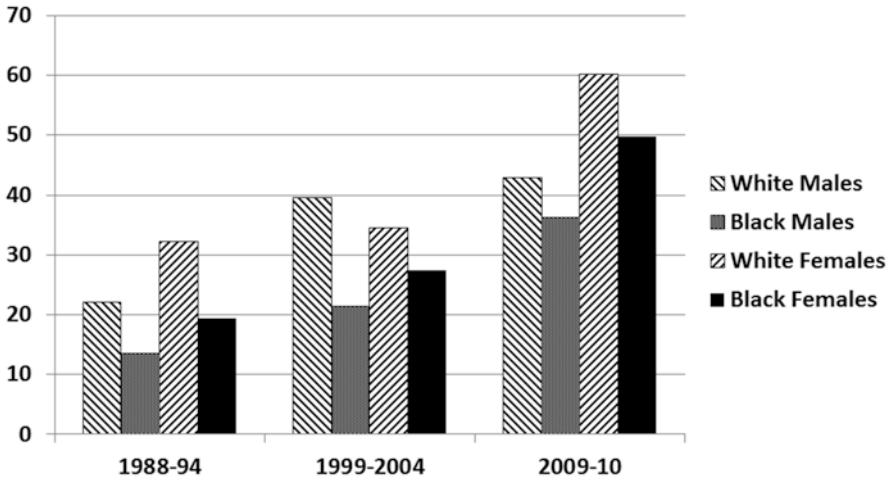

Fig. 2.2 Percent of hypertensive adult population with controlled blood pressure levels. US 1988–1994, 1999–2004, and 2009–2010. Adapted from Lackland DT. Racial Differences in Hypertension: Implications for High Blood Pressure Management. American Journal of the Medical Sciences (in press) Cutler JA, Sorlie PD, Wolz M, Thom T, Fields LE, Roccella EJ. Trends in Hypertension Prevalence, Awareness, Treatment, and Control Rates in United States Adults Between 1988–1994 and 1999–2004. Hypertension. 2008;52:818–827; and Guo F, He D, Zhang W, Walton G. Trends in prevalence, awareness, management, and control of hypertension among United States adults 1999 to 2010. J AM Coll Cardiol 2012; 60:599–606

groups from 1988 to 2010. While the high blood pressure control rates improved from the 1988–1994 period to the 2009–2010 period for all four race-sex groups, the racial disparities remained consistent. These findings of disparities in hypertension control are consistent with other studies [8, 11, 12, 19, 20]. The racial differences in control rates cannot be attributed to differences in rates of awareness and treatment [8, 9, 11, 12, 15, 18, 21]. Rates of awareness of hypertension as well as treatment patterns of antihypertensive therapy are similar for both race groups and even better among black men and women compared to white men and women. Results from the REasons for Geographic And Racial Differences in Stroke study (REGARDS) study indicate that efforts to raise awareness of prevalent hypertension among blacks apparently have been successful (31 % greater odds in blacks relative to whites), and efforts to communicate the importance of receiving treatment for hypertension have been successful (69 % greater odds among blacks relative to whites) [8].

Dietary factors including sodium and potassium, while different for blacks and whites, do not explain the racial disparities in hypertension. The Dietary Approaches to Stop Hypertension (DASH) diet with sodium restriction found better BP reduction for African Americans than Caucasians, indicating that black individuals may respond differently than whites [22, 23]. Similarly, treatment of elevated blood pressure with antihypertensive medications and different medications may produce different effects in African Americans and whites. Calcium channel blockers and diuretics have been proposed as being particularly effective for African Americans with hypertension [24–26]. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) have not been shown to be as effective in black populations compared with white populations [25–27]. Similarly, ACE inhibitors, ARBs, and β-blockers have been reported to be less effective in blacks with heart failure compared with white patients [28]. However, it is important to consider sample size and confounders as well as study design when interpreting these results.

2.4 Hypertension Risks

The higher hypertension prevalence at earlier ages and more severe blood pressure levels correlate with the higher disease risks for blacks compared with whites. The risk ratios for stage 1 (≤140/90 mmHg) and stage 2 (≥160/95 mmHg) hypertension are presented in Table 2.1 for the four race-sex groups and 30-year all-cause mortality [3]. The risk ratios are significant for all but are greater for black men and women. Likewise, the risk ratios are higher in the more severe blood pressure levels for all four race-sex groups with higher risks for black men and women compared with white men and women [3, 29]. The disparities of higher prevalence and greater risks from high blood pressure are most evident with the population attributable risks which are nearly twice as great for black men and women (Table 2.2).

Table 2.1 Thirty-year mortality risk ratios and 95 % CI for elevated blood pressure (140/90 mmHg and greater) adjusting for age, socioeconomic status, smoking, high cholesterol, and diabetes (the Charleston Heart Study and Evans County Heart Studies, 1960)

	White males	White females	Black males	Black females
140/90	1.6 (1.2, 2.0)	1.4 (1.1, 2.0)	2.1 (1.3, 3.1)	2.0 (1.2, 2.8)
160/95	1.8 (1.3, 2.2)	2.0 (1.2, 2.6)	2.4 (1.5, 3.5)	2.4 (1.6, 3.2)

Adapted from Lackland, D.T.; Keil, J.E.; Gazes, P.C.; Hames, C.G.; Tyroler, H.A. Outcomes of black and white hypertensive individuals after 30 years of follow-up. Clinical and Experimental Hypertension 17:1091–1105, 1995

Table 2.2 Thirty-year population attributable risks for hypertension and all-cause mortality (the Charleston Heart Study and Evans County Heart Study, 1960)

White males	23.8 %
White females	18.3 %
Black males	45.2 %
Black females	39.5 %

Adapted from Lackland, D.T.; Keil, J.E.; Gazes, P.C.; Hames, C.G.; Tyroler, H.A. Outcomes of black and white hypertensive individuals after 30 years of follow-up. Clinical and Experimental Hypertension 17: 1091–1105, 1995

Table 2.3 Hazard ratio and 95 % CI for stroke and 10-mmHg systolic blood pressure differential racial susceptibility (the REasons for Geographic And Racial Disparities in Stroke Study)

Whites	Blacks
1.08 (1.0–1.16)	1.25 (1.14–1.35)

Adapted from Howard G, Lackland DT, Kleindorfer DO, Kissela BM, Moy CS, Judd SE, Safford MM, Cushman M, Glasser SP, Howard VJ. Racial Differences in the Impact of Elevated Systolic Blood Pressure on Stroke Risk. JAMA Intern Med. 2013;173(1): 46–51

In addition to hypertension risk from categories, the racial disparity is also evident in blood pressure level. Table 2.3 shows results from REGARDS and an impact of a 10-mmHg higher level of systolic blood pressure for white and black participants [30]. In the total cohort, there was a 14 % increased risk of stroke associated with a 10–mm Hg higher SBP (hazard ratio [HR], 1.14; 95 % CI, 1.08–1.21). However, racial differences in this association were identified (P-value for interaction, 0.02) with an 8 % increase in whites (HR, 1.08; 95 % CI, 1.00–1.16) and a 24 % increase in blacks (HR, 1.24; 95 % CI, 1.14–1.35) [30]. These disparities in risks remained evident after long-term follow-up of the Hypertension Detection and Follow-up Study [31].

2.5 Factors Associated with Racial Disparities

While the disparities in blood pressure levels, hypertension prevalence and control, and high blood pressure risks are evident, the factors associated with the race differences are less evident. However, several parameters are proposed that may contribute to the disparities [32].

Though salt intake affects blood pressure in most individuals and populations, racial differences in intake as well as handling of sodium and potassium have been consistently reported [33]. While the prevalence of salt sensitivity was similar for African American and Caucasian women, the magnitude of blood pressure increase was different [34]. Blood pressure increases were greater in African Americans, with a positive association of salt sensitivity associated with Na Ca2 intake and the ratios of Na to K and Ca2 to Mg2 [34].

Racial differences in body mass index have long been recognized and suggestive of disparities in blood pressure level and hypertension prevalence. African Americans have been identified with higher rates of obesity and overweight at different age groups [35, 36]. However, while body mass affects blood pressure level in both race groups, anthropometric measurements do not explain all of the disparities in high blood pressure levels [33, 35, 36].

Resistant and refractory hypertensions are defined as uncontrolled blood pressure despite the use of three or more antihypertensive agent classes or controlled blood pressure with four or more agents [37]. Refractory hypertension represents the extreme phenotype of hypertension treatment failure and is defined as the use of five or more antihypertensive classes of medication with a systolic blood pressure of greater than or equal 140 mmHg and/or diastolic blood pressure of greater than or equal 90 mmHg [38]. The prevalence ratio for refractory hypertension when compared with individuals with resistant hypertension was 3.00 (1.68–5.37) for African Americans [38].

Likewise, there are numerous other factors with significant racial differences that could affect the disparities in hypertension including social determinants, access to care, fetal/early life origins, and differential treatment response [32, 39–42].

2.6 Implications

The racial disparities in hypertension and hypertension risks have significant implications for high blood pressure prevention, management and control programs and strategies, as well as gaps in research. Decades of hypertension control efforts have been attributed in part to the decline in stroke mortality identified for the past decades [43]. While clinical guidelines and prevention strategies recognize the racial disparities in risks from hypertension [44, 45], the evidence from clinical trials and clinical studies is often inadequate and insufficient with regard to high-risk populations such as African Americans [46]. Likewise, there remain evidence gaps

for the factors associated with the disparities. Thus, the evidence-based guidelines for prevention, treatment, and management of hypertension inadequately address the excess risk of high blood pressure for African Americans. The opportunity is great for the implementation of research epidemiological studies and clinical trials focused on the assessment of the racial disparities in blood pressure levels and hypertension risks. These results could be used to implement strategies to close the racial disparity gap in high blood pressure risks. The adjusted relative risk of stroke, for example, is more than twice as high in hypertensive blacks as compared with hypertensive whites [30]. As a result, effective antihypertensive therapy is particularly important in these patients [47].

2.7 Considerations for the Treatment of High Blood Pressure

The disparities in hypertension prevalence and adverse outcomes have prompted the consideration of treatment specific to the differences. For example, recommendations from the International Society on Hypertension in Blacks suggest antihypertensive therapy for blacks without target organ damage or concomitant cardiovascular diseases at blood pressures greater than 135/85 mmHg and, for those at higher risk, at blood pressures greater than 130/80 mmHg [48]. In addition, monotherapy is deemphasized in favor of combination therapy for blacks with high blood pressure [48]. However, there is not a consensus on this need for earlier treatment and the use of combination therapy for black hypertensive [49]. But there is consensus on the need for widespread and effective therapy of blacks with hypertension, novel methods to enhance screening, and patient education to increase hypertension control in this population [50]. The choice of therapy in black hypertensive patients depends on the presence or absence of comorbid conditions as well as the efficacy of the treatment employed to attain goal blood pressure [51].

2.7.1 Choice of Therapy

While the general treatment and management considerations are similar for all patients with hypertension, some specific recommendations focus on black patients with high blood pressure. Based on the excess disease burden, combination therapy can be a first-line therapy for blacks with hypertension [49]. In addition, African Americans are at greater risk for treatment-resistant hypertension than white patients often requiring a four-drug combination [51]. Black patients who have moderate to advanced chronic kidney disease (estimated glomerular filtration rate <45 mL/min/1.73 m^2) or a baseline serum potassium >4.6 meq/L have an increased risk for hyperkalemia, which requires monitoring for serum potassium that may affect how the blood pressure is treated [51].

2.7.2 Nonpharmacologic Therapy

Nonpharmacologic therapies including dietary salt restriction, weight loss in obese patients, avoidance of excess alcohol, and exercise are the major modes of therapy recommending for high blood pressure interventions among African Americans [52, 53]. While nonpharmacologic interventions have not been well studied in the African American population, current data suggest that the major components of nonpharmacologic therapy are similarly or more effective in black patients as compared with white counterparts [54]. For example, a trial of black hypertensives found 4 weeks of a low-sodium diet was associated with a reduction in the blood pressure from 159/101 to 151/98 mmHg [55]. Likewise, a randomized study of black men with hypertension assessed antihypertensive therapy alone with added regular exercise (45 min of stationary cycling three times per week) which was begun after the blood pressure was under control with treatment [55]. The exercise group showed an additional average of 5 mmHg reduction in blood pressure and regression of left ventricular hypertrophy [55].

2.7.3 Pharmaceutical Therapy

Different classes of antihypertensive therapy have shown efficacy levels specific for African Americans with high blood pressure. Several studies have shown calcium channel blockers to have proven efficacy in blacks [25, 56–58]. For example, a comparative study of black men and women found that dihydropyridine calcium channel blocker provided a statistically greater reduction in blood pressure and control rate of hypertension than a diuretic, a nondihydropyridine calcium channel blocker, or an ACE inhibitor [57]. In a subset of black participants in the Avoiding Cardiovascular Events through Combination Therapy in Patients Living with Systolic Hypertension (ACCOMPLISH) trial which assessed hypertensive high-risk individuals, the patients assigned to combination therapy with ACE-calcium channel blocker showed better cardiovascular outcomes than ACE-diuretic combination [49, 58].

A number of comparative studies have demonstrated that African American hypertensive patients respond well to diuretic therapy, with greater blood pressure reduction than monotherapy with an ACE inhibitor, an ARB, or a beta-blocker [59–63]. This increased efficacy of diuretics (with concurrent salt restriction) suggesting the role for volume is consistent with the observation that blacks have a higher frequency of salt sensitivity than whites (as defined by a rise in blood pressure with salt loading and/or decline of blood pressure with salt restriction) [54].

African Americans with high blood pressure have a smaller blood pressure reduction than white patients in response to ACE inhibitors, ARBs, and most beta-blockers when given as monotherapy [57, 63]. One finding addressing this disparity indicating baseline plasma renin activity as modestly but not significantly lower in the black patients compared to white [27]. Black patients required two to four times

the dose of ACE to achieve the same reduction in blood pressure. This occurred despite no differences between the groups in plasma drug levels or in the degree of ACE inhibition at the same dose suggesting that the hypertension is not as angiotensin II dependent in blacks.

While African American patients are generally more responsive to calcium channel blockers than to monotherapy with ACE inhibitors, benefits are identified for combinations with ACE inhibitors in black patients with chronic kidney disease [64, 65].

2.7.4 Adherence

Adherence is generally lower in black as compared with white hypertensive patients [20, 66]. A variety of factors can reduce compliance with antihypertensive therapy including health literacy [66]. Several intervals have been successfully implemented to improve adherence for African American hypertensive patients. Peer-based education is very effective to increase adherence and control among blacks. The BARBER-1 randomized trial of urban black-owned barbershops found that hypertension control rates were significantly increased with barbers measuring blood pressures for the black male patrons and motivation to follow up with physicians [50]. In another trial of black hypertensive patients with hypertension, significantly improved blood pressure was identified in a video that conveyed the personal stories of other black patients with hypertension [67].

Single-pill combination therapy is another method to improve adherence. Such approaches may be particularly beneficial in black patients with hypertension. In a retrospective cohort assessment of hypertensive patients, single-pill combination therapy was associated with greater blood pressure control at one year than two-pill combination therapy or monotherapy [37]. The difference in control rates comparing single-pill with two-pill combinations was larger among blacks (63 versus 51 %) than among whites (73 versus 67 %) [68].

2.8 Summary

Hypertension is a major problem for blacks with higher incidence and prevalence of hypertension-related outcomes including stroke and cardiovascular and renal complications of hypertension than in other race/ethnicity groups and likely reflects the higher prevalence, earlier onset, and greater severity of hypertension in black patients than other race/ethnicity groups. The prevalence of hypertension is evident for all age groups. Black patients are at greater risk for treatment-resistant hypertension than white patients. The reasons for the significant racial disparities in elevated blood pressure and hypertension-related outcomes risk remain unclear. However, the implications of the disparities of hypertension for prevention and

clinical management are substantial identifying African American men and women with excess hypertension risk. These risks have prompted different clinical treatment considerations and warranting interventions focused on these differences. In addition, focused research to identify the factors attributed to these disparities in risk burden is an essential need to address the evidence gaps. Both pharmaceutical and non-pharmaceutical therapies and strategies are effective for black hypertensive patients. Adherence is generally lower in black as compared with white hypertensive patients with different factors reducing compliance with antihypertensive therapy such as peer-based education and single-pill combination antihypertensive therapy.

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Hypertension in High Risk African Americans
Current Concepts, Evidence-based Therapeutics and Future Considerations
Ferdinand, K.C. (Ed.)
2015, XI, 277 p. 17 illus., 9 illus. in color., Hardcover
ISBN: 978-1-4939-2009-9
A product of Humana Press