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# Hypertension and Hypertension-Related Disparities in Underrepresented Minorities

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## Abstract

Racial-ethnic disparities in cardiovascular disease (CVD) have been evident over the past few decades. As such, addressing these disparities have been a part of national programs such as Health People 2020 and the Million Heart initiative. Hypertension (HTN) has been a primary focus of these initiatives due to the significant contribution of HTN as a risk factor for CVD and its role in CVD racial/ethnic disparities. HTN is common among various racial/ethnic groups, in particular non-Hispanic blacks and certain groups of Hispanics. Additionally, both non-Hispanic black and Hispanic adults have been known to have higher prevalence of poorly controlled blood pressure (BP) compared to non-Hispanic whites. Long-standing HTN leads to increased risk of end-organ damage, development of coronary heart disease, stroke, end-stage kidney disease, and increased overall CVD-specific mortality. This chapter provides an update of available data on the prevalence of HTN in various racial/ethnic groups and prevalence of awareness, treatment, and control of HTN in attempts to further demonstrate the significant role HTN plays in racial/ethnic disparities in CVD. We also discuss the most recently published HTN guidelines that has led to debate regarding the potential impact on worsening CVD disparities, through disproportionate effects on the elderly, women, and non-Hispanic blacks.

**Keywords:** hypertension, disparities, hypertensive heart disease, African Americans, Hispanics

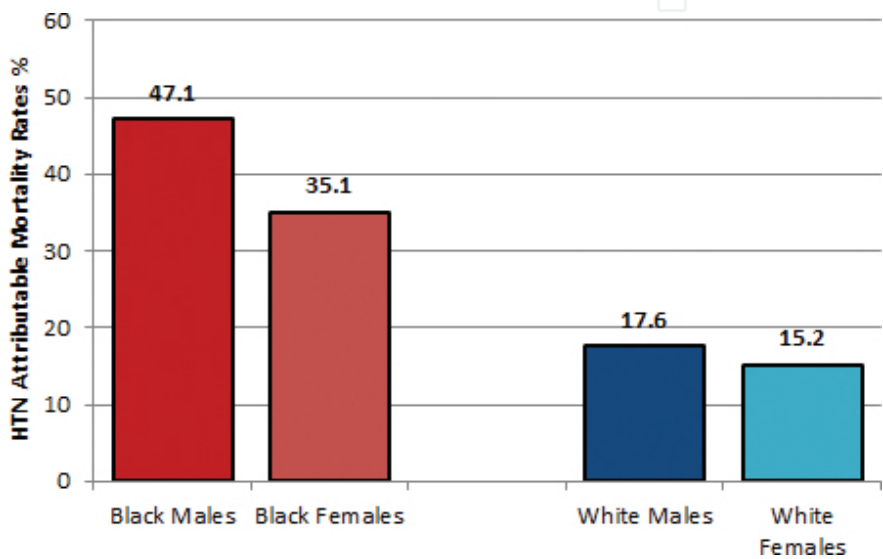
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## 1. Introduction

Race-ethnic disparities in cardiovascular disease (CVD) have been evident over the past several decades in the United States (US). Despite an overall decline in deaths from CVD, the declines

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in CVD mortality have not been as great for US ethnic minorities. CVD age-adjusted death rates are 33% higher for blacks than for the overall population in the US. The overall CVD death rate in 2011 was 230 per 100,000. In black males and females, the rates were 352 and 249 per 100,000 compared to 272 and 188 per 100,000 for white males and females, respectively with similar disparities mirrored in hypertension (HTN) related mortality rates (**Figure 1**) [1]. In 2009, age-adjusted estimates reported by the CDC showed that the rate of premature death from coronary heart disease (CHD) among non-Hispanic blacks was 66% compared to 43% in non-Hispanic whites. Similar findings were reported for premature death due to stroke for non-Hispanic blacks compared to whites (25 and 10%, respectively) [2].



**Figure 1.** Overall mortality rates from causes related to hypertension.

The public health burden from CVD racial/ethnic disparities that exist is in large part due to modifiable risk factors. Ninety percent of CVD events among black participants in the Atherosclerosis Risk in Communities (ARIC) study were explained by having elevated or borderline CV risk factors compared to 65% among white participants [3]. The American Heart Association (AHA) has adopted the new concept of CV health based on seven health metrics, including smoking status, physical activity, healthy diet, body weight, along with optimal blood pressure (BP), blood glucose, and total cholesterol levels [4]. Non-Hispanic blacks (10%) and Mexican Americans (12%) were less likely than whites (19%) to have  $\geq 5$  metrics at ideal levels defined by the AHA [1, 5]. Similarly, the 2009 Behavioral Risk Factor Surveillance System (BRFSS) survey analyzed CV health metrics of US adults demonstrating racial/ethnic disparities. Non-Hispanic blacks, Hispanics, and American Indian/Alaska Native adults were all less likely than non-Hispanic whites to have ideal CV health and had the highest prevalence CV risk factors [6]. Poor CV health (0–2 ideal health metrics) was significantly more prevalent among non-Hispanic blacks (17%), American Indians/Alaska Natives (15%), and Hispanics (13%) when compared to non-Hispanic whites (11%) [5]. Previous data from the 2003 BRFSS demonstrated disparities in both self-reported and measured CVD risk factors which most

adversely affected non-Hispanic blacks, Mexican Americans, and American Indian/Alaska Natives [6].

In particular, HTN or high blood pressure is more prevalent among certain racial/ethnic minority groups in the US, especially African American adults [1]. In addition, the population attributable risk for CVD mortality was estimated to be 41% for HTN, compared to 14% for smoking, 13% for poor diet, and 9% for abnormal blood glucose levels [3, 7]. This means that hypothetically, 41% of CVD mortality is explained by and could be avoided by optimal blood pressure. Since hypertension is significantly more prevalent among race/ethnic minorities, the proportion of CVD mortality that could be avoided in these populations by optimal BP control is much higher. Furthermore, the sequela of HTN morbidity such as heart failure, stroke, renal disease, and coronary heart disease are disproportionate among race/ethnic minorities. As such, HTN plays a major role in the race/ethnic CVD disparities given the various ethnic/racial groups who suffer disproportionately from the condition and the significant contribution of HTN to CVD morbidity and mortality.

## 2. Epidemiology of HTN

According to NHANES 2009–2010 data, the prevalence of HTN was highest among non-Hispanic blacks (40%), followed by non-Hispanic whites (27%) and Hispanics (26%), respectively [8]. Data from the 2012 National Health Interview Survey (NHIS) demonstrated that black adults were more likely to have self-reported hypertension than white adults [9]. In the Multi-Ethnic Study of Atherosclerosis (MESA), measured systolic and diastolic blood pressure was higher among African Americans and Hispanics compared to their white counterparts [10].

Although Hispanics have been reported to have rates not significantly different from non-Hispanic whites, the majority of data has been extrapolated primarily from Mexican Americans [11]. The Hispanic/Latino population is currently the largest ethnic minority in the US with a growing heterogeneous subgroup population as evident by recent census updates [11]. In the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), a cohort of 16,415 Hispanics representative of the major Hispanic subgroups, Sorlie et al. report that the overall age-adjusted prevalence of HTN for Hispanic men and women was 26% and 25%, respectively [12]. There was however variation among Hispanic subgroups with HTN prevalence being higher at upwards of 32% among Hispanics of Caribbean descent (Dominican, Puerto Rican, and Cuban adults). Interestingly, Hispanics of Mexican descent had significantly lower HTN prevalence when compared to all other Hispanic subgroups except South Americans [12]. NHIS data demonstrated that Hispanic blacks had a higher HTN prevalence than Hispanic whites. This disparity remained even for Hispanic blacks with higher income and higher education levels when compared to Hispanic whites of lower socioeconomic status [13].

Analyses from NHANES 1998 to 1994 and 1999 to 2004 data showed an increased in HTN prevalence over the past few decades among both men and women and non-Hispanic blacks and whites. However, non-Hispanic blacks had greater increases in prevalence when com-

pared to non-Hispanic whites during both time periods and the greatest increase was seen among non-Hispanic black women [14]. According to NHANES data from the period 2003 to 2010, among adults with hypertension, non-Hispanic blacks (74%) and Mexican American (72%) were more likely to be aged <65 years, compared with non-Hispanic whites (57%) [15]. Similar data were shown from NHANES 1999–2002 data, where 63% of non-Hispanic blacks and 45% of non-Hispanic whites with HTN were ≤60 years of age.

In addition to US non-Hispanic black adults having the highest HTN prevalence rates in the world, they have been reported to develop HTN earlier in life when compared to non-Hispanic whites [16]. The incidence of HTN among racial/ethnic groups has been examined in the MESA. After a median follow-up of approximately 5 years, blacks had the highest HTN incidence rate (85 per 1000 person-years) followed by Hispanics (66 per 1000 person-years), whites (57 per 1000 person-years), and then Chinese (52 per 1000 person-years). After adjustment for MESA study site, age and sex, blacks and Hispanics had increased incidence rate ratios when compared to whites [16]. A prospective cohort study of 18,865 participants examined the progression of non-Hispanic blacks and whites in the normotensive (28%) and prehypertensive (27%) stages at baseline to the hypertensive stage [17]. After adjustment for multiple covariates, results demonstrated that non-Hispanic blacks had a 35% increased risk of conversion to hypertension when compared to non-Hispanic whites. Additionally, the median conversion time when 50% became hypertensive was significantly shorter for non-Hispanic blacks compared to whites (626 vs 991 days;  $p < 0.001$ ). Non-Hispanic blacks in this sample had accelerated risk of new-onset hypertension [17].

### 3. Hypertension disparities: awareness, treatment, and control

An important aspect regarding the racial/ethnic disparities has been the focus on awareness, treatment, and control of HTN. Overall in 2009–2010, approximately 82, 76, and 53% of adults with hypertension were aware of their condition, taking medication, and HTN was controlled, respectively [9]. There were also no significant changes seen from the periods 2007–2008 and 2009–2010 in the US. There were several differences, however, reported between racial and ethnic groups. According to 2009–2010 National Centers for Health Statistics (NCHS), Hispanic adults were least likely to be aware of their hypertension (78%), when compared to Non-Hispanic whites (81%) and non-Hispanic blacks (87%) [9]. In addition, Hispanic adults were least likely to take medication for their hypertension (70%), compared with non-Hispanic whites (77%) and non-Hispanic black adults (80%). Further NCHS analysis demonstrated that age-adjusted control of hypertension was least likely in Hispanic adults (41%) compared to non-Hispanic black (48%) and non-Hispanic white adults (56%) [9]. Even with the highest rates of hypertension awareness and treatment, non-Hispanic blacks were less likely to have adequate control of their blood pressure compared to their white counterparts. It is important to note that this disparity remains even with increased overall rates of hypertension control in US adults from 48% in 2007–2008 to 53% in 2009–2010 [9].

HCHS/SOL reported notable variation in the rates of awareness, treatment, and control among Hispanic subgroups. Awareness of HTN ranged from as low as 59% among men of Central



American descent to 78% among men of Cuban descent; to as low as 72% among women of South American descent; and to 79% among women of Cuban and Dominican descent. The percentage of those treated for HTN were highest in Cuban men (65%); whereas rates of HTN control were low for all subgroups and lowest among both Central American men and women (12 and 32%, respectively) with the highest rates of control being seen among Cuban men (40%) [12].

Similar racial/ethnic disparities regarding hypertension awareness, treatment, and control have been demonstrated in additional NHANES reports along with population-based cohorts such as MESA, and the REasons for Geographic and Racial Differences in stroke Study (REGARDS). According to NHANES data from 2003–2010, HTN awareness, treatment, and control were lowest among Mexican Americans compared to non-Hispanic blacks and whites [15]. In the REGARDS cohort, awareness was significantly higher in blacks compared to whites [18]. In addition, blacks were more likely to be treated for HTN compared to whites but were significantly less likely to have controlled HTN when compared to whites [18]. In the MESA, non-Hispanic blacks (35%) and Hispanic (32%) adults had a significantly higher prevalence of treated but uncontrolled HTN compared to non-Hispanic white (24%) adults [10].

NHANES has also reported a trend analysis through exam periods 1988–1994 and 1999–2008. Overall hypertension control increased from 27% in 1988–1994 to 50% in 2007–2008, these gains were not seen equally among all US race-ethnic groups, thus race-ethnic disparities remain. The prevalence of adults with uncontrolled hypertension on treatment was reported to be significantly higher among blacks ( $p < 0.001$ ) and Hispanics ( $p = 0.02$ ) compared to whites [19]. Egan and colleagues analyzed NHANES data over 3 survey time periods (1988–1994, 1999–2004, and 2005–2008) to specifically address the prevalence of uncontrolled and treatment-resistant hypertension (TRH). Uncontrolled hypertension was defined by a blood pressure  $\geq 140/90$  mm Hg while treatment-resistant hypertension (TRH) included participants reported taking  $\geq 3$  medications for hypertension. Non-Hispanic blacks and Hispanics had higher prevalence of uncontrolled HTN compared to non-Hispanic whites. Non-Hispanic black race was reported to be independently associated with TRH in the 2005–2008 survey period [20].

#### 4. Hypertension categorization

“Uncontrolled hypertension” signifies blood pressure (BP) that is inadequately treated rather than blood pressure that is refractory to treatment. Refractory hypertension is defined by a blood pressure  $\geq 140/90$  mm Hg or  $\geq 130/80$  mm Hg in patients with diabetes or renal disease despite adherence to at least three antihypertensive medications, including a diuretic [21]. The Health Plan Employer Data and Information Set, as well as the National Center for Health Statistics who orchestrated the National Health and Nutrition Examination Survey serve as a repository for the most comprehensive information concerning the prevalence of uncontrolled hypertension both in the general population as well as those groups deemed at high risk of cardiovascular disease [22].

## 5. Prevalence of refractory hypertension

The best estimates of refractory hypertension prevalence is provided by large outcome studies such as The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial from which we can extrapolate the prevalence of patients with refractory hypertension where despite some participants on three medications and approximately 8% who were on receiving four or more medications at the end of the study, approximately 15% of that entire cohort could be classified as having refractory hypertension [23]. In the Controlled Onset Verapamil Investigation of Cardiovascular Endpoints trial, 18% of participants being treated with three or more medications remained with uncontrolled BP ( $\geq 140/90$  mm Hg) [24]. These two studies suggest that approximately 15–18% of patients with uncontrolled hypertension have refractory hypertension.

A small study in the specialty hypertension clinic setting suggested that among diabetics, African Americans, older patients and men, systolic blood pressure remained difficult to control and fewer patients in those groups achieved HTN goals despite careful drug titration on three or more agents [25]. Additionally, others have found that refractory hypertension is more prevalent in patients over 60 years of age [26]. In the REGARDS study, ~14% of the 14,809 participants had resistant hypertension (defined as being on  $\geq 4$  antihypertensive medications) and only 0.5% had refractory hypertension (defined as being on  $\geq 5$  antihypertensive medications) with a greater proportion of African Americans residing in both categories [27]. Further literature by Meissner and Berlowitz has shown that over 10% of all hypertensive patients remain uncontrolled despite the administration of three or more drugs with good adherence to therapy after excluding causes of secondary systemic arterial hypertension [28, 29]. Importantly these studies also highlight the underuse of spironolactone and long-acting thiazide diuretics such as chlorthalidone as an opportunity to reduce the occurrence of refractory, resistant, and uncontrolled HTN particularly among African Americans.

## 6. Hypertension complications

HTN remains a major risk factor for coronary heart disease, congestive heart failure, stroke, chronic kidney disease, and CV death. Data from NCHS/NHANES surveys showed that HTN was the single largest risk factor for CV mortality in the US, responsible for an estimated 45% of all CV deaths [7]. In 2010, HTN was reported as the 13th leading cause of death in the US. The rate deaths attributed to HTN in 2010 was 50.2 per 100,000 for non-Hispanic black men and 37.1 per 100,000 for non-Hispanic black women compared to 17.2 per 100,000 for non-Hispanic white men, and 15 per 100,000 for non-Hispanic white women [30]. In addition, non-Hispanic blacks have 1.3 and 1.8-times the increased rate of fatal and nonfatal strokes, and 4.2-times the increased rate of end-stage kidney disease compared to non-Hispanic whites [1].

In 2010, HTN, coronary heart disease, and stroke accounted for 56% of preventable deaths which occurred in adults aged  $<65$  years. Death rates were significantly higher for non-Hispanic blacks (83.7 per 100,000) and American Indians/Alaska Natives when compared to

whites. However, death rates were found to be significantly lower for Hispanics and Asian/Pacific islanders compared to whites [31]. As previously stated, age-adjusted HTN prevalence rates for Hispanics have been demonstrated to be similar to that of non-Hispanic whites, although with higher HTN prevalence among Hispanics of Caribbean descent, with lower rates of HTN awareness, treatment, and control. CDC data demonstrates further hypertension-related mortality (HRM) disparities among the Hispanic subgroups. While age-standardized HRM was similar for Hispanics (127.3 per 100,000) compared to non-Hispanic whites (135.9), Hispanics of Puerto Rican background had 13% higher rates ( $p < 0.01$ ) than non-Hispanic whites. Hispanics of Mexican descent had similar and Hispanics of Cuban background had lower HRM rates compared to non-Hispanic whites [32].

## 7. Hypertension guidelines – implications for racial/ethnic minorities

This chapter has attempted to outline the role of HTN among racial/ethnic groups. HTN is a very common, yet modifiable disease that contributes significantly to both CVD morbidity and mortality. Management guidelines for HTN among racial/ethnic groups have been a focus for many national and international organizations such as the Association of Black Cardiologists (ABC), American Heart Association (AHA), American College of Cardiology (ACC), and the International Society of Hypertension in Blacks (ISHIB). One of the major changes in recent guidelines providing recommendations on the management of HTN from the Eight Joint National Committee (JNC8) in 2014 [33] has gained attention due to concerns for the implications on particular subgroup populations including African-Americans, the elderly, and women. This change increased the treatment threshold for the general population age  $\geq 60$  years to SBP  $\geq 150$  mm Hg or DBP  $\geq 90$  mm Hg and to treat to goal SBP  $< 150$  mm Hg and DBP  $< 90$  mm Hg [33]. The JNC8 panel concluded that this recommendation was strongly supported by several reviewed randomized controlled trials (**Table 1**).

Modification	Recommendation	Approximate SBP reduction range
Weight reduction	Maintain normal body weight (BMI 18.5–24.9 kg/m <sup>2</sup> )	5–20 mm Hg/10 kg
DASH-like eating plan	Diet rich in fruits, vegetables, low-fat dairy, and reduced fat	8–14 mm Hg
Restrict sodium intake	Consume no more than 2.4 g of sodium per day	2–8 mm Hg
Physical activity	Regular aerobic exercise for at least 30 minutes most days of the week	4–9 mm Hg
Moderate alcohol consumption	$\leq 2$ drinks/day for men and $\leq 1$ drink/day for women	2–4 mm Hg

**Table 1.** Lifestyle modifications for hypertension control in adults.



However, a recent review highlights a summary of the debate regarding the potential implications of the recent guideline changes on African Americans and women [34]. The ABC stated that the proposed guidelines would put African Americans, who suffer disproportionately from HTN, at further increased risk for HTN-related morbidity and mortality [34]. The 2014 JNC8 recommendations are also discordant with the ISHIB consensus statement on the management of HTN in blacks in 2010. ISHIB recommendations include a lower threshold for SBP (<135/85 mm Hg) in blacks and for black individuals with evidence of target organ damage, preclinical or overt CVD, the threshold is even lower at SBP <130/80 mm Hg [35]. The ABC suggests that clinicians treating high-risk populations, such as African Americans, maintain the previously accepted standard of care and await further guideline recommendations from major professional organizations particularly in light of the recent Systolic Blood Pressure Intervention Trial results [34, 36].

Similarly, the Working Group on Women's Cardiovascular Health was in discordance with the JNC8 HTN recommendations [34] stating that women would be disproportionately affected by changes in treatment target goals as women make up the majority of those with HTN  $\geq 60$  years of age and older. Further, women are already known to have poor BP control with African American women constituting 40% of those with poor BP control and being already at highest risk for target end organ damage [34]. In addition, results from the Women's Health Initiative demonstrate a 93% increased stroke risk in older women who were prehypertensive compared to those that were normotensive.

## 8. Reducing health disparities in hypertension

Hypertension is a major modifiable risk factor for CVD, and thus a significant contributor to premature death [1]. Importantly, there are race-ethnic disparities that remain evident in the US. Several national health initiatives and programs at the individual, community, health system, and population level have attempted to address the goal of decreasing existing HTN disparities through primary and secondary prevention efforts [37].

A major population-based intervention approach is the Million Hearts (MH) public health campaign [37, 38]. The MH initiative, sponsored by the US Department of Health and Human Services, consists of comprehensive evidence-based interventions and strategies aimed at preventing one million heart attacks and strokes over the years of 2012–2016. A central component to this initiative promotes the use of standardized HTN treatment protocols, effective use of health information technology and self-measure blood pressure monitoring with clinical support [37, 38].

Community-based interventions are also instrumental in reducing the public health burden of HTN and reducing HTN-related disparities. Community-based outreach programs such as the Healthy Heart Community Prevention Project (HHCPP) and the Barber-Assisted Reduction in Blood Pressure in Ethnic Residents (BARBER-1) have utilized barbershops and churches to provide HTN education and screening among racial/ethnic groups suffering HTN

disparities [39, 40]. The use of black and Hispanic owned barbershops and beauty salons as part of community outreach programs to increase hypertension awareness and control among non-Hispanic blacks and Hispanics has been an effective screening, monitoring, and referral program shown to increase health-care access and HTN knowledge in risk minority communities [40, 41]. In Hispanic communities, outreach programs utilizing lay community health workers (CHWs), known as *Promotoras de Salud*, share the same ethnicity, culture, language, and life experiences as the people they serve and have been shown to improve hypertension awareness [39].

Health-care system-based approaches are equally as important in reducing HTN disparities given the differences in health outcomes that persist among race-ethnic groups secondary to institutional barriers. Effective approaches to reducing disparities due to institutional barriers include cultural competency training and data-based quality improvement (QI) efforts [42]. Health-care provider cultural competency training may improve health-care quality, along with patient satisfaction and health. Hospital-based QI programs such as the Robert Wood Johnson Foundation-supported Expecting Success and national ACC-supported Get With The Guidelines initiative have shown overall improvement in health-care quality and reduction of racial/ethnic disparities [42]. The use of big data health information technology and electronic medical records (EMRs) can also play an important role in reducing HTN disparities. The Kaiser Permanente large-scale hypertension program included the use of EMR and clinical decision support tools in the development, sharing, and incorporation of HTN performance metrics, evidence-based guidelines, clinic visit blood pressure measurements, and HTN treatment therapies [43] into a successful program that demonstrated high rates of HTN control improvement in adversely affected populations.

## 9. Conclusion

Despite overall decline in CVD morbidity and mortality, racial/ethnic disparities continue to exist in the US. Several racial/ethnic groups are known to suffer disproportionately from many modifiable CVD risk factors. In addition, these high-risk groups are less likely to have markers of ideal CV health. HTN remains a common risk factor that significantly contributes to overall and CVD mortality. Although HTN awareness has increased, non-Hispanic blacks in the US remain with a significantly higher prevalence of HTN when compared to non-Hispanic whites. In addition, non-Hispanic blacks are still more likely to have poor blood pressure control. Certain groups of Hispanics appear to have higher HTN prevalence rates to non-Hispanic whites, and Hispanic adults are least likely to be aware, treated, and have controlled HTN when compared to non-Hispanic blacks and whites. Continuing to move forward in research, clinical, and preventative effort to understand and intervene upon the multifaceted reasons as to why HTN disparities exist among certain populations is central to providing HTN specialty care.

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