

EFFECT OF AFRICAN AMERICAN RACE ON HYPERTENSION MANAGEMENT: A REAL-WORLD OBSERVATIONAL STUDY AMONG 28 US PHYSICIAN PRACTICES

Bryan Batson, MD; Daniel Belletti, MA; Jenifer Wogen, MS

Objective: To assess the impact of African American race on hypertension management among a real-world hypertensive population.

Design: Cross-sectional study.

Setting: 28 US physician practices.

Patients: Adult patients with a hypertension diagnosis between November 2006 and September 2008.

Main Outcome Measures: Blood pressure (BP) control (<140/90 mm Hg for non-diabetic, and <130/80 mm Hg for diabetic, patients).

Results: African American patients ($n=1,079$) were younger than Caucasian patients ($n=3,884$) (60.2 vs 66.0 years, $P<.01$), were more likely to be female (60.1% vs 52.5%, $P<.01$), were more likely to be obese (55.9% vs 48.5%, $P<.01$) and had a higher diabetes prevalence (29.4% vs 23.8%, $P<.01$). African American hypertensive patients had significantly higher BP as compared to Caucasian hypertensive patients (135.2/82.9 mm Hg vs 130.5/76.4 mm Hg, $P<.01$). Both diabetic and non-diabetic African Americans were prescribed more antihypertensive medications than Caucasians and were more likely to be prescribed combination regimens. African Americans were less likely to be prescribed beta blockers, and more likely to be prescribed calcium channel blockers or diuretics. Among non-diabetic and diabetic patients, African Americans had 54% and 53% lower adjusted odds, respectively, of controlled BP. The use of specific antihypertensive medication classes was not associated with BP control.

Conclusions: Although African Americans were prescribed more aggressive medication regimens, they had lower probability of BP control. While African American race influenced the choice of prescribed antihypertensive medications, those regimens did not affect the probability of BP control. African American race should not deter providers from prescribing specific antihypertensive medication classes, particularly in the presence of compelling indications. (*Ethn Dis.* 2010;20:409-415)

Key Words: Hypertension, Blood Pressure Control, Community-based Studies

From Regional Outcomes Research, Novartis Pharmaceuticals Corporation (DB); and MedMentis Consulting, LLC (JW); and Hattiesburg Clinic (BB).

INTRODUCTION

Racial/ethnic disparities in the management of cardiovascular-related diseases in the United States have been well documented.¹⁻³ In the United States, among all major racial/ethnic groups, African Americans have the highest age-adjusted prevalence of hypertension.^{1,4} Among medication-treated hypertensive patients, compared to non-Hispanic Whites, adjusted odds of blood pressure (BP) control among non-Hispanic Blacks are .59 (confidence interval, .44-.78).¹

Guideline-based prescribing recommendations are determined, in part, on the presence of underlying co-morbid conditions, such as angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) use in hypertensive patients with diabetes or renal disease.⁵ JNC 7 guidelines do not include formal treatment recommendations for use of specific medication classes for minority populations.⁵ However, JNC 7 notes that reduced responses to beta blockers (BBs), ACEIs, or ARBs, used in monotherapy as compared to diuretics or calcium channel blockers (CCBs) have been documented in African Americans; this effect may be attenuated by use in combinations that include a diuretic.⁵ The consensus statement of the International Society on Hypertension in Blacks (ISHIB)⁶ states that among African Americans, while all antihypertensive drug classes are associated with BP-lowering efficacy, thiazide diuretics and CCBs may have greater BP-lowering effects.^{7,8} Further-

more, when used in monotherapy or in the absence of a diuretic in the treatment of the hypertensive patient, BBs, ACEIs, and ARBs do not produce as great of a BP-lowering effect in African Americans as in White patients.^{7,9-11}

While African American race influenced the choice of prescribed antihypertensive medications, those regimens did not affect the probability of BP control.

Our study sought to identify the impact of African American race on hypertension management and BP control among a usual-care hypertensive patient population. Secondary objectives were to evaluate treatment patterns, including specific antihypertensive medication classes and use of combination antihypertensive therapy, for African American patients, as well as the relationship to BP control.

METHODS

This study utilized a subgroup of patients from a larger cross-sectional study that has been described previously.¹² Retrospective chart reviews were performed at 28 physician practices across the United States. Data was collected between November 2007 and September 2008 at participating practices by study investigators at each location. Investigators identified their patient population diagnosed with hy-

Address correspondence to Jenifer Wogen, MS; MedMentis Consulting LLC; 145 Waughaw Rd; Towaco NJ 07082; 973-588-4966; 973-588-4967 (fax); jen@medmentis.com

pertension during the previous year using ICD9 codes of 401.x or a clinical diagnosis from the patient's record. The study was limited to adults aged ≥ 18 years with at least 1 year of visit history with the practice. The final study sample included both newly- and previously-diagnosed hypertensive patients, excluding pregnant women. Investigators identified a random sample of 150–300 patients from the eligible population at each site.

The primary outcome variable was BP control, defined as BP $< 130/80$ mm Hg for diabetic patients and $< 140/90$ mm Hg for non-diabetic patients, determined using each patient's most recently recorded office-based BP measurement at the time of the chart review. The BP measurement for the visit immediately preceding this most recent one was also recorded. If multiple measurements were performed on the same date, investigators recorded the average of these measurements. Other recorded information included: demographics; specific risk factors such as body mass index (BMI), calculated from height and weight, smoking status, and documentation of lifestyle modification counseling (such as weight reduction, dietary changes, increased physical activity); current antihypertensive medication regimen; and total number of different medications used daily for all non-acute conditions. The presence of coronary arterial disease (CAD), prior myocardial infarction, diabetes, dyslipidemia, renal disease, heart failure, and cerebrovascular accident/transient ischemic attack was identified based on corresponding ICD-9 codes or documentation of clinical diagnosis in the patient's medical record. Body mass index was categorized as normal (< 25 kg/m²), overweight (≥ 25 and < 30 kg/m²), and obese (≥ 30 kg/m²).

Prior to beginning data collection, a training session was conducted with investigators at each site, and detailed chart review instructions were provided.

The study was approved and monitored by an independent institutional review board.

Statistical Methods

To estimate the impact of African American race on hypertension management, we used a comparison group of Caucasian patients as a control group for African American patients. Although the original study included a small number of patients with other racial/ethnic backgrounds, for all study analyses described in this article, the subgroups of interest consisted of African American and Caucasian patients only. Univariate statistics included mean, median, and standard deviation for continuous variables, and frequency distributions for categorical variables. Bivariate analyses were performed using *t* tests, analysis of variance, and general linear models for continuous variables, and the chi-square test for categorical variables. Multivariate logistic regression analysis was used to assess the association of independent variables, including age, sex, race, obesity, total number of chronic medications, and antihypertensive regimen on the probability of BP control. Variables included in the final model were selected based on clinical relevance and the results of bivariate analyses. SPSS version 17.0 was used for all study analyses.

RESULTS

The study cohort comprised 4,963 patients; 22% were African American, and 78% were Caucasian. African American patients were younger and were more likely to be female (Table 1). African American patients were more likely to be obese, and more likely to have diabetes, than Caucasian patients. African American patients had a higher prevalence of congestive heart failure and lower prevalence of dyslipidemia, and were significantly more likely to have received lifestyle modification

counseling as compared to Caucasian patients.

Forty-one percent of African American patients had controlled BP, compared to 61% of Caucasian patients. About 1 in 5 patients (21.4%) had a BP measurement that was greater than target BP by ≤ 10 mm Hg systolic or 5 mm Hg diastolic, while an additional 21.9% had a BP that was greater than goal by more than 10 mm Hg systolic or 5 mm Hg diastolic (Figure 1). Among both diabetic and non-diabetic African American patients, the proportion of patients with BP elevated 10/5 mm Hg or more above goal was higher than the proportion who were $\leq 10/5$ mm Hg from goal (Figure 1).

Among the subset of the hypertensive population with co-morbid diabetes, only about 20% of African American patients had BP controlled to less than 130/80 mm Hg, compared to 39% of Caucasian patients. Within the non-diabetic study population, 49% of African American patients had BP controlled to less than 140/90 mm Hg. As compared to African Americans, the proportion of Caucasian non-diabetic patients with controlled BP was significantly higher (68.2% vs 49.1%, $P < .001$). Obese patients were less likely to have controlled BP (49.6%) than non-obese (60.2%) patients ($P < .001$). However, the effect of obesity on BP control was only evident among non-diabetic patients (Figure 2). Among non-diabetic patients, the presence of obesity was associated with lower rates of BP control among both Caucasian ($P < .01$), and, to a lesser extent, African American patients ($P = .07$). Regardless of obesity, among both non-diabetic and diabetic patients, African Americans had lower BP control rates.

African American patients were prescribed a significantly higher mean number of antihypertensive medication classes than Caucasian patients. Table 2 compares the mean number of prescribed antihypertensive medications per patient. Among obese patients, for

Table 1. Study population demographic and clinical characteristics

	African-American (n=1,079)	Caucasian (n=3,884)	Total (N=4,963, 100%)
Age in years, mean (SD)	60.2 (13.6)	66.0† (13.9)	64.8 (14.0)
Female, %	60.1	52.5‡	54.2
Age groups, %			
18–34 years	2.9	1.4	1.7
35–44 years	10.0	5.1	6.2
45–54 years	21.0	14.4	15.8
55–64 years	28.9	24.5	25.4
65–74 years	21.0	24.9	24.1
>74 years	16.1	29.7	26.8
BMI (kg/m ²), mean (SD)	32.4 (7.6)	30.8‡ (6.9)	31.1 (7.1)
BMI category, %			
Normal (<25 kg/m ²)	14.2	18.5	17.5
Overweight (25–29.9 kg/m ²)	29.9	32.9	32.3
Obese (≥30 kg/m ²)	55.9	48.5‡	50.2
Current smokers, %	12.0	11.8	11.8
Lifestyle modification counseling, %	80.4	59.0‡	63.7
Co-morbid cardiovascular-related conditions, %			
Congestive heart failure	6.7	4.0‡	4.6
Coronary artery disease without myocardial infarction	10.6	17.6‡	16.1
cerebrovascular accidents/transient ischemic attack/carotid stenosis	7.8	5.8†	6.2
Diabetes	29.4	23.8‡	25.0
Dyslipidemia	45.8	61.6‡	58.2
Renal disease/insufficiency	6.2	8.2†	7.8
Myocardial infarction	2.3	3.2	3.0
Provider Specialty, %			
Family practice	37.3	31.1	32.4
Internal medicine	51.2	52.1	51.9
Cardiology	11.5	16.6‡	15.5
Total number of medications for all chronic conditions, mean (SD)	5.2 (3.3)	5.5† (3.5)	5.4 (3.5)
BP- most recent measurement in mm Hg, mean (SD)	135.2/82.9 (18.0/11.8)	130.5‡/76.4‡ (15.6/10.1)	131.5/77.8 (16.3/10.8)
Controlled BP*, %	40.9	61.2‡	56.8

* BP control was defined as <130/80 mm Hg in diabetic patients, and <140/90 mm Hg in non-diabetic patients.

† Indicates significant at $P < .05$.

‡ Indicates significant at $P < .01$.

both diabetic and non-diabetic patients, African American patients were prescribed more antihypertensive medications than Caucasian patients. Among diabetic and non-diabetic patients, obese African American patients were prescribed more antihypertensive medications than non-obese patients (Table 2). African American obese diabetic patients were prescribed the most antihypertensive medications (mean=2.7), while non-obese, non-diabetic Cauca-

sian patients were prescribed the fewest (mean=1.8).

Use of combination antihypertensive therapy was significantly more common among both African American diabetic and non-diabetic patients compared to their Caucasian counterparts. However, among both African American and Caucasian patients, mean number of antihypertensive medications in the patient regimen was similar among controlled and uncontrolled

patients (2.2 vs 2.2, $P = .44$ for African Americans and 1.9 vs 1.9, $P = .67$ for Caucasians). Among the non-diabetic patient subgroup, African Americans were equally as likely to be prescribed ACEI/ARB as Caucasians, but were significantly less likely to be prescribed BB, and more likely to be prescribed a diuretic or a CCB. Among diabetic patients, these findings persisted: African Americans were as likely to be prescribed an ACEI/ARB as Caucasian

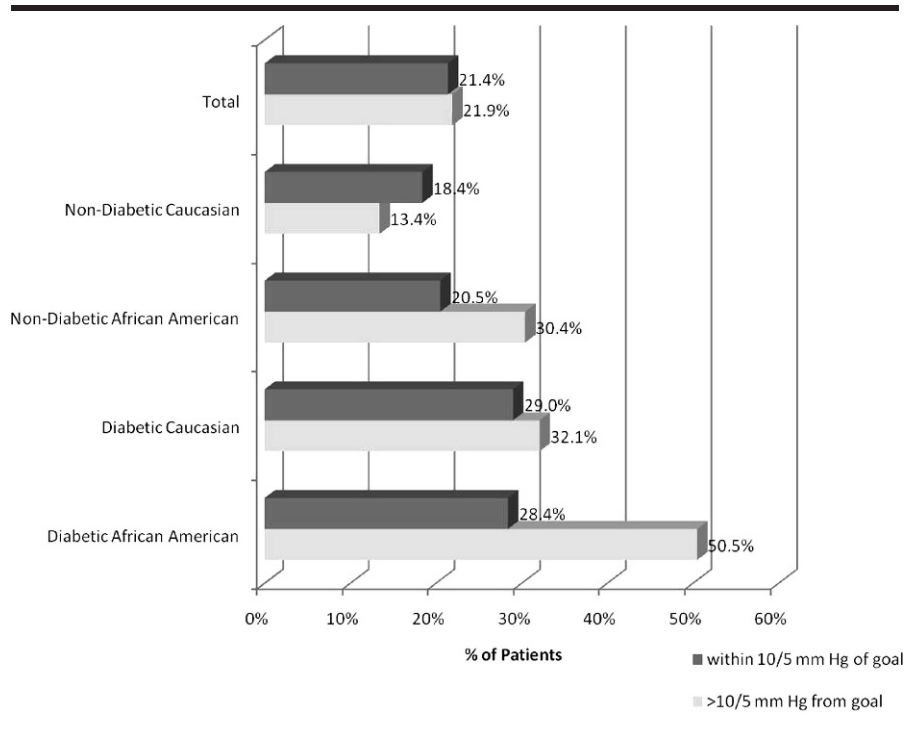


Fig 1. Distribution of patient BP distance from goal BP by patient race and diabetes status¹

¹Goal BP was defined as <130/80 mm Hg in diabetic patients, and <140/90 mm Hg in non-diabetic patients. Patients were classified based on the highest measurement (systolic or diastolic).

diabetic patients, but were less likely to be prescribed a BB, and more likely to be prescribed a diuretic or CCB. Among both diabetic and non-diabetic African American and Caucasian patients, the most common 2 drug combination was an ACEI/ARB and diuretic. Among all commonly used 2-drug combinations, BB were significantly less likely to be included in the regimen among African Americans, regardless of the presence of diabetes.

Adjusted odds of BP control revealed that African American race was associated with a 54% (non-diabetic) and 53% (diabetic) lower adjusted odds of controlled BP compared to Caucasians. Among non-diabetic patients only, obesity (OR=.74, 95% CI .63-.88) and age ≥ 65 years (OR=.81, 95% CI .69-.95) were also associated with reduced odds of BP control. Neither the number of medications comprising the antihypertensive drug regimen nor the

presence of any specific class of medications was associated with BP control.

DISCUSSION

African American hypertensive study patients were more likely to be high-risk, as they were more likely to be obese, more likely to have diabetes, and had a higher mean BP compared to Caucasian patients. While ISHIB BP goals and approach to initial treatment recommendations for African Americans are similar to JNC 7 guidelines, one notable exception is that the threshold BP for initiating a multi-drug antihypertensive regimen among patients not at goal BP is lower in the ISHIB consensus (systolic BP [SBP] ≥ 15 mm Hg or diastolic BP [DBP] ≥ 10 mm Hg over target BP) as compared to JNC 7 (SBP > 20 mm Hg or DBP > 10 mm Hg

over target BP).^{5,6} Data from large hypertension clinical trials have demonstrated that antihypertensive therapy regimens using 2–4 different drugs are needed to achieve goal BP in uncomplicated hypertension,^{9,13} and that patients with diabetes and/or renal disease will require an average of 2.6 to 4.3 different antihypertensive drugs to achieve goal BP.¹⁴ In our study, among non-diabetic patients, 33% of African American and 44% of Caucasian patients not at goal BP were prescribed fewer than 2 antihypertensive medications; among diabetic patients, 22% of African American patients and 31% of Caucasian patients not at goal were prescribed less than 2 antihypertensive drugs. Regardless of the presence of diabetes, prescribers treated African American patients with a greater number of antihypertensive drugs than their Caucasian counterparts, yet this did not translate into better, or even equal, probability of controlled BP; adjusted analyses indicated that African Americans had odds of BP control that were 53%–54% lower than the odds for Caucasians and were similar regardless of the presence of co-morbid diabetes. In addition to African American race, poorer BP control rates among non-diabetic patients in our study were related to obesity, with non-obese African American and Caucasian patients both more likely to have BP controlled to <140/90 mm Hg than obese patients. In fact, both diabetic and non-diabetic obese patients were more likely to be prescribed a higher mean number of antihypertensive medications than non-obese patients. Documentation of lifestyle modification counseling, which included weight-loss counseling, dietary restrictions, and/or the recommendation of increased physical activity, was only found in the patient record for 59% of our study population overall, yet was documented for 80% of African Americans. This suggests that while most providers may recognize the importance of such counseling, imple-

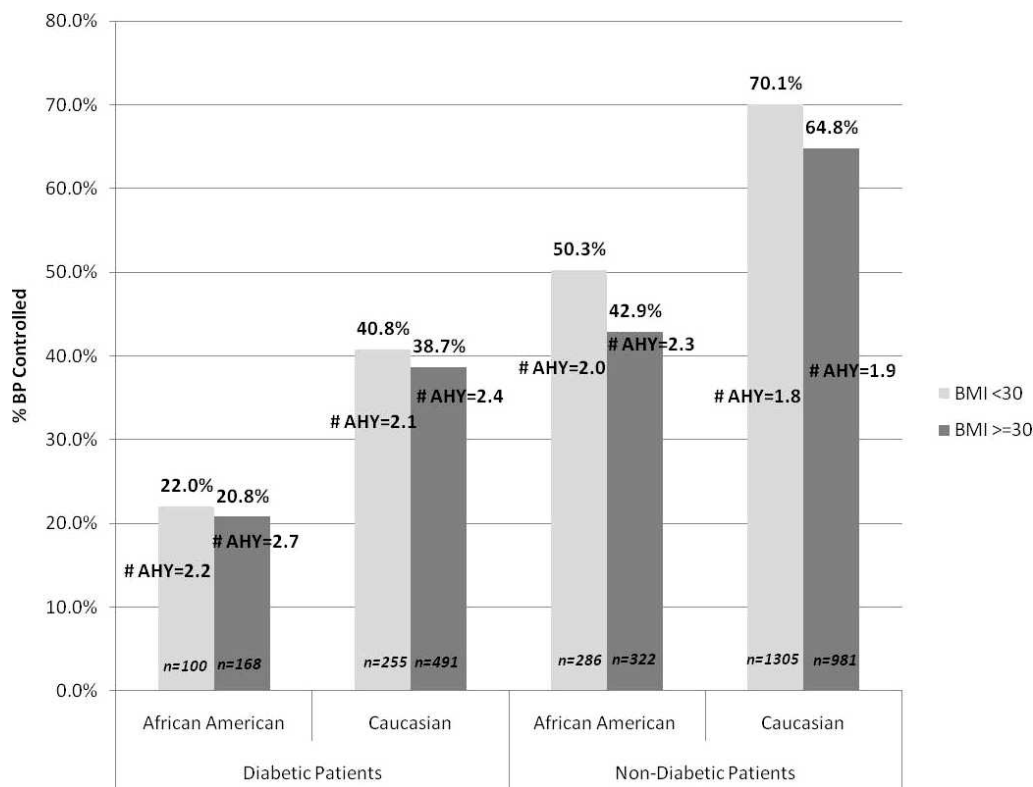


Fig 2. Association of BP control with race, obesity, diabetes, and antihypertensive medication (AHY) use among African American and Caucasian hypertensive patients

AHY = the mean number of antihypertensive medications used by each patient subgroup.

mentation by the patient does not occur in many instances.

Our study design permitted the examination of hypertension management and prescribing patterns in a non-clinical trial, real-world setting, among a large diverse cohort of hypertensive patients across the United States. In the current study, African American hypertensive patients were equally as likely to be prescribed an ACEI and/or ARB as their Caucasian counterparts, and this trend was evident among both diabetic and non-diabetic patients. However, African Americans were less likely to be prescribed a BB, and more likely to be prescribed a CCB or diuretic, compared to Caucasian patients. It is interesting to consider these prescribing patterns in the context of current treatment recommendations for hypertension. Prescriber preference for CCBs and diuretics for African American patients in our study

may be explained, in part, by the influence of JNC 7 recommendations, as JNC 7 suggests that BBs, ACEIs, or ARBs, when used in monotherapy, may lower BP less than diuretics or CCBs among African Americans.⁵ The high rate of ACEI/ARB use among diabetic patients suggests that JNC 7 has influenced the use of ACEI/ARB in diabetic patients regardless of patient race, since African American patients were as likely to receive them (despite reported decreased monotherapy efficacy). Despite these trends, we did not find evidence that, in our study setting, the use of a regimen containing either a CCB or a diuretic was associated with an increased probability of BP control among African Americans. Multivariate logistic regression results indicated that, among both diabetic and non-diabetic hypertensive patients, African American race was significantly associated with a lower

adjusted probability of BP control, while neither the use of more antihypertensive medications nor the use of specific antihypertensive medication classes was significantly associated with BP control. Thus, poorer control rates among African American were not related to either using too few antihypertensive medications or for lack of the using the correct medications according to JNC 7.

In ALLHAT, the thiazide diuretic chlorthalidone was superior in lowering BP and decreasing major cardiovascular events compared to amlodipine (a CCB) or lisinopril (an ACEI) based regimens.⁹ However, among Black patients, use of lisinopril (vs chlorthalidone) was associated with a 40% increased stroke risk. However, this finding may, at least partially, be explained by a 4–5 mm Hg increased reduction in SBP with chlorthalidone vs lisinopril among Black patients in ALLHAT. The ALLHAT

Table 2. Treatment patterns by diabetes status and racial/ethnic background

	Non-diabetic patients		Diabetic patients	
	African-American (n=762)	Caucasian (n=2961)	African-American (n=317)	Caucasian (n=923)
n of antihypertensive medication classes mean (SD)	2.1 (1.1)	1.8 (1.1)†	2.5 (1.3)*	2.3 (1.2)†
Use of combination antihypertensive therapy, %	69.4	58.4	80.1	72.3
2 antihypertensive classes	37.1	35.0 (P<.001)	36.3	35.1 (P<.03)
3 antihypertensive classes	22.0	15.9	23.7	22.9
≥4 antihypertensive classes	10.2	7.5	20.2	14.3
Antihypertensive medication classes, any use, %				
ACEI or ARB	65.1	61.8 (P=.09)	80.4	76.3 (P=.14)
BB	25.2	38.3 (P<.001)	32.8	46.2 (P<.001)
Any diuretic use	56.3	44.2 (P<.001)	63.7	52.7 (P<.001)
CCB	37.4	26.5 (P<.001)	40.4	28.8 (P<.001)
Most frequently used combination therapies, 2 class combinations, %	n=203	n=1037	n=115	n=324
ACEI/ARB and diuretic	44.9	39.5 (P=0.12)	49.6	42.3 (P=.19)
ACEI/ARB and BB	6.7	15.3 (P<.001)	7.8	24.4 (P<.001)
ACEI/ARB and CCB	16.3	15.2 (P=ns)	23.5	11.7 (P<.01)
BB and diuretic	6.7	11.4 (P<.03)	3.5	9.9 (P=0.03)
CCB and diuretic	7.1	4.5 (P=0.09)	2.6	3.7 (P=ns)
CCB and BB	4.9	6.2 (P=ns)	2.6	3.4 (P=ns)

* Indicates significant at P<.05.

† Indicates significant at P<.01.

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, beta blocker; CCB, calcium channel blocker.

study design prevented the addition of a CCB or a diuretic to the ACEI-based regimen, which may have attenuated the effect of race on BP lowering and stroke risk.^{9,15} Other early studies that have concluded that Black patients treated with an ACEI had poorer outcomes as compared to other regimens may have failed to adequately control for important baseline differences in Black vs. Caucasian patients.¹⁵ More recent large-scale randomized trials have demonstrated the efficacy of an ACEI regimen plus either a thiazide diuretic or CCB in the African American hypertensive patient population.¹⁶ A recent analysis of high-risk African American men compared mortality between those who received ACEI (n=237) and those who did not (n=573) and found that patients not taking an ACEI had an 80% higher relative risk of all-cause mortality during follow-up than patients taking an ACEI.¹⁷ Providers in our population were more amenable to prescribing a RAS-blocking agent than the population

used in that study, in which only 29% of the African American cohort was prescribed an ACEI; in our study, 65% of non-diabetic, and 80% of diabetic, African American patients were prescribed an ACEI or ARB regimen.

Several limitations should be considered in the interpretation of our study's findings. Some potential factors were unavailable; these included the duration of hypertension disease and of antihypertensive medication use, patient compliance with prescribed antihypertensive medications, and type of health insurance. Since we used a retrospective study design, BP measurements were not standardized or validated. The study was not designed to include a population that was demographically representative of the entire US hypertensive population.

CONCLUSIONS

Our African American hypertensive patient population was at higher risk

compared to their Caucasian counterparts: they were younger, more likely to have diabetes, more likely to be obese, and more likely to have a BP greater than goal by >10 mm Hg systolic or

Our African American hypertensive patient population was at higher risk compared to their Caucasian counterparts: they were younger, more likely to have diabetes, more likely to be obese, and more likely to have a BP greater than goal by >10mm Hg systolic or >5mm Hg diastolic.

>5 mm Hg diastolic. Obesity plays a key role in the management of cardiometabolic risk in patients with hypertension, regardless of race. Strategies to effectively combat obesity, such as lifestyle management practices, are a public health imperative. Provider management strategies, to some extent, reflected this risk, as regardless of the presence of obesity or diabetes, African American patients were prescribed a higher number of antihypertensive medications than Caucasian patients, and were more likely to receive lifestyle modification counseling regarding hypertension management. Despite these efforts, the adjusted odds of controlled BP among non-diabetic and diabetic hypertensive African American patients were 0.46 and 0.47, respectively, as compared to Caucasian patients. We did not find any correlation between any specific antihypertensive regimen and BP control among African American patients. In our study population, diabetic and non-diabetic African Americans were equally as likely to be prescribed an ACEI/ARB as Caucasians. These findings support the idea that guideline implementation regarding the treatment of the diabetic hypertensive patient (and potentially patients with other specific compelling indications) should not be compromised for African American patients on the basis of race. Further research assessing the causes of lack of BP control in the African American hypertensive population is warranted.

ACKNOWLEDGMENTS

This study was funded by Novartis Pharmaceuticals Corporation. The authors would like to thank Waymon Drummond, MD and Gregory Ciliberti, MD for their review

and suggestions during the manuscript preparation process.

REFERENCES

- Giles T, Aranda JM, Suh DC, Choi IS, et al. Ethnic/racial variations in blood pressure awareness, treatment, and control. *J Clin Hypertens*. 2007;9:345–354.
- Suh DC, Choi I-S, Plauschnat C, Kwon J, Baron M. Impact of comorbid conditions and race/ethnicity on glycemic control among the US population with type 2 diabetes, 1988–1994 to 1999–2004. *J Diabetes Complications*. 2009;Aug 26 [epub ahead of print].
- Saydah S, Cowie C, Eberhardt MS, DeRekenneire N, Narayan KM. Race and ethnic differences in glycemic control among adults with diagnosed diabetes in the United States. *Ethn Dis*. 2007;17:529–535.
- Ong KL, Cheung BMY, Man YB, Lau CP, Lam KSL. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999–2004. *Hypertension*. 2007;49:69–75.
- Chobanian A, Bakris G, Black H. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 report. *JAMA*. 2003;289:2560–2572.
- Douglas JG, Bakris GL, Epstein M, et al. Management of high blood pressure in African Americans: consensus statement of the Hypertension in African Americans Working Group of the International Society on Hypertension in Blacks. *Arch Intern Med*. 2003;163:525–541.
- Saunders E, Weir MR, Kong BW, et al. A comparison of the efficacy and safety of a β -blocker, a calcium channel blocker, and a converting enzyme inhibitor in hypertensive Blacks. *Arch Intern Med*. 1990;150:1707–1713.
- Materson BJ, Reda DJ, Williams D. Lessons from combination therapy in Veterans Affairs Studies. Department of Veterans Affairs Cooperative Study Group on Antihypertensive Agents. *Am J Hypertens*. 1996;9:187S–191S.
- ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group. 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;288:2981–2197.
- He J, Whelton PK. Elevated systolic blood pressure and risk of cardiovascular and renal disease: overview of evidence from observational epidemiologic studies and randomized controlled trials. *Am Heart J*. 1999;138(3 Pt 2):211–219.
- Cushman WC, Reda DJ, Perry HM, et al. Regional and racial differences in response to antihypertensive medication use in a randomized controlled trial of men with hypertension in the United States. *Arch Intern Med*. 2000;160:825–831.
- Belletti DA, Zacker C, Wogen J. Effect of cardiometabolic risk factors on hypertension management: a cross-sectional study among 28 physician practices in the United States. *Cardiovasc Diabetol*. 2010;9(7).
- Wright JT, Bakris G, Greene T, et al. Effect of blood pressure lowering and antihypertensive drug class on progression of hypertensive kidney disease: results from the AASK trial. *JAMA*. 2002;288:2421–2431.
- Bakris GL. Maximizing cardiorenal benefit in the management of hypertension: achieve blood pressure goals. *J Clin Hypertens*. 1999;1:141–147.
- Ferdinand KC. Underutilization of angiotensin-converting enzyme inhibitors in high-risk blacks: a case of missed opportunities. *J Clin Hypertens*. 2009;11:648–650.
- Jamerson K, Weber MA, Bakris GL, et al. Benazepril plus amlodipine or hydrochlorothiazide for hypertension in high-risk patients. *N Engl J Med*. 2008;359:2417–2428.
- Papademetriou V, Kaoutzianis C, Dumas M, et al. Protective effects of angiotensin-converting enzyme inhibitors in high-risk African American men with coronary heart disease. *J Clin Hypertens*. 2009;11:621–626.

AUTHOR CONTRIBUTIONS

Design concept of study: Batson, Belletti, Wogen
Acquisition of data: Batson, Belletti, Wogen
Data analysis and interpretation: Batson, Wogen
Manuscript draft: Batson, Belletti, Wogen
Statistical expertise: Wogen
Acquisition of funding: Belletti
Administrative: Belletti, Wogen
Supervision: Batson, Belletti, Wogen