

## RACIAL DISPARITIES IN HYPERTENSION AWARENESS AND MANAGEMENT: ARE THERE DIFFERENCES AMONG AFRICAN AMERICANS AND WHITES LIVING UNDER SIMILAR SOCIAL CONDITIONS?

**Objective:** To examine the nature of disparities in hypertension awareness, treatment, and control within a sample of Whites and African Americans living in the same social context and with access to the same health care environment.

**Design:** Cross-sectional study

**Setting:** Southwest Baltimore, Maryland

**Participants:** 949 hypertensive African American and White adults in the Exploring Health Disparities in Integrated Communities-Southwest Baltimore (EHDIC-SWB) Study.

**Main Outcome Measures:** Hypertensive participants who reported having been diagnosed by a doctor were considered to be aware of their hypertension. Among hypertensive adults aware of their condition, those who reported taking antihypertensive medications were classified as being in treatment. Among the treated hypertensive adults who had diabetes, those with systolic BP < 130 mm Hg and diastolic BP < 80 mm Hg were considered to be controlled. Among the treated hypertensive participants who did not have diabetes, those with systolic BP < 140 mmHg and diastolic BP < 90 mm Hg were also considered to be controlled.

**Results:** After adjusting for age, sex, marital status, education, income, health insurance, weight status, smoking status, drinking status, physical activity, cardiovascular disease, stroke, and diabetes, African Americans had greater odds of being aware of their hypertension than Whites (odds ratio = 1.44; 95% confidence

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interval 1.04, 2.01). However, African Americans and Whites had similar odds of being treated for hypertension, and having their hypertension under control.

**Conclusion:** Within this racially integrated sample of hypertensive adults who share similar health care markets, race differences in treatment and control of hypertension were eliminated. Accounting for the social context should be considered in public health interventions to increase hypertension awareness and management. (*Ethn Dis.* 2014;24[3]:269–275)

**Key Words:** Hypertension Awareness, Hypertension Control, Social Environment, Health Disparities, Hypertension Treatment

### INTRODUCTION

Several studies have documented that African Americans are more likely to be aware of their hypertension and more likely to be in treatment compared to Whites.<sup>1–6</sup> However, studies also document that African Americans in treatment are less likely to have their hypertension well controlled compared to their White counterparts.<sup>1–10</sup> Understanding the etiology of race disparities in hypertension management is critical to efforts to eliminate these disparities and to the overall reduction of cardiovascular disease (CVD) morbidity and mortality.

While a variety of possible explanations for race disparities in hypertension awareness and management have been tested,<sup>2,5,10,11</sup> these studies have not accounted for the differing social and health care contexts in which Whites and African Americans live. In a highly segregated society, African Americans generally experience greater exposure to health risks, and less access to medical care.<sup>12–14</sup> That is, these environments are often accompanied by high crime, poor housing quality, reduced educational and employment opportunities, and fewer health care resources.<sup>12–17</sup> Each of these social determinants has been documented as predictors of hypertension.<sup>18–20</sup> Because African Americans and Whites tend to live in very different social environments,<sup>5,21–24</sup> it is possible that differences in hypertension awareness and management result from race differences in social and environmental risk exposures facilitated by racial residential segregation.<sup>25</sup>

Failing to account for race differences in social and environmental risk conditions can lead to inaccurate conclusions regarding the etiology of racial disparities.<sup>26–31</sup> Racial differences observed in national data may be a result of race differences in the health-risk environments. Not accounting for racial segregation may lead to a spurious conclusion that the individual-level factor (race) is primarily responsible for the association rather than community-level factors (the social environment). Accounting for differences in social context and health care resources

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can begin to disentangle race from context. This is important in determining how best to target resources and develop more effective strategies to address health disparities.

Another source of confounding in health disparities is the high correlation between race and socioeconomic status (SES).<sup>25,32</sup> Both race and SES are well-documented correlates of hypertension.<sup>11,33,34</sup> However, the high correlation between race and SES complicates efforts to determine whether race and SES operate independently or jointly to produce racial disparities.

Accounting for the two major challenges in health disparities research may provide additional information regarding the nature of disparities in hypertension awareness, and management. The objective of our study was to examine race disparities in hypertension awareness, treatment, and control within a low-income sample of Whites and African Americans living in the same social context and with access to the same health care environment.

## METHODS

### Data

Exploring Health Disparities in Integrated Communities (EHDIC) is a

multisite study of race disparities within communities where African Americans and non-Hispanic Whites live together and where there are no race differences in SES (as measured by median income). The first EHDIC study site was in Southwest Baltimore, Maryland (EHDIC-SWB). Future EHDIC locations are planned.

The EHDIC-SWB study, is a cross-sectional face-to-face survey of the adult population (aged  $\geq 18$  years) of two contiguous census tracts. In addition to being economically homogenous, the study site was also racially balanced and well integrated, with almost equal proportions of African American and non-Hispanic White residents. Across the two census tracts, the racial distribution was 51% African American and 44% non-Hispanic White, and the median income for the study area was \$24,002, with no race difference in median income. The census tracts were block listed to identify every occupied dwelling in the study area. Of the 2618 structures identified, 1636 structures were determined to be occupied residential housing units (excluding commercial and vacant residential structures). After five attempts at most, contact was made with an eligible adult in 1244 occupied residential housing units. Of that number, 65.8% were enrolled in the study resulting in 1489 study participants (41.9% of the 3555 adults living in these two census tracts recorded in the 2000 Census). Because our survey had similar coverage across each census block group in the study area, the bias to geographic locale and its relationship with socioeconomic status should be minimal.<sup>31</sup>

Comparisons to the 2000 Census for the study area indicated that the EHDIC-SWB sample included a higher proportion of Blacks and women, but was otherwise similar with respect to other demographic and socioeconomic indicators.<sup>31</sup> For instance, EHDIC-SWB was 59.3% African American and 44.4% male, whereas the 2000

Census data showed the population was 51% African American and 49.7% male. Age distributions in EHDIC-SWB and 2000 Census data were similar with a median age range of 35–44 years for both samples. The lack of race difference in median income in the census (\$23,500 for African American and \$24,100 for non-Hispanic White) was replicated in EHDIC (\$23,400 for African American and \$24,900 for non-Hispanic White).

The survey was administered in person by a trained interviewer and consisted of a structured questionnaire that included demographic and socioeconomic information, self-reported health behaviors and chronic conditions, and three blood pressure (BP) measurements. The EHDIC study has been described in greater detail elsewhere.<sup>31</sup> The study was approved by the Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health and all participants gave informed consent. The analyses for this project was restricted to 949 African American and non-Hispanic White adults who were hypertensive and aged  $\geq 20$  years.

### Measures

Hypertension status was based on the mean systolic and diastolic BP derived from three measurements obtained in a seated position using appropriate size electronic cuffs (Omron BP652) that were calibrated to an ambulatory standard. Hypertension was defined as systolic BP  $\geq 140$  mm Hg, or diastolic BP  $\geq 90$  mm Hg, or respondent report of taking antihypertensive medications.<sup>36,37</sup> Hypertensive participants who reported having been diagnosed by a doctor were considered to be aware of their hypertension.<sup>35,36</sup> Among hypertensive adults aware of their condition, those who reported taking antihypertensive medications were classified as being in treatment. Among the treated hypertensive adults who had diabetes, those with systolic BP  $< 130$  mmHg and diastolic BP  $< 80$  mmHg were

**Table 1. Definitions of hypertension awareness, treatment, and control**

|                                | Ever told by a doctor you have hypertension? | Currently taking antihypertensive medication? | BP below threshold? <sup>b</sup> |
|--------------------------------|--|---|----------------------------------|
| Aware <sup>a</sup>             | Yes  |   |                                  |
| Aware and treated              | Yes  | Yes   |                                  |
| Aware, treated, and controlled | Yes  | Yes   | Yes                              |

<sup>a</sup> Includes hypertensives, those with systolic BP $\geq$ 140 mm Hg, diastolic BP $\geq$ 90 mm Hg or reported currently taking antihypertensive medications.  
<sup>b</sup> BP threshold for non-diabetics is systolic BP<140 mm Hg and BP<90 mm Hg, and for diabetics BP<130 mmHg and BP<80 mmHg.

**Table 2. Select demographic and health-related characteristics in EHDIC-SWB hypertensive adults aged  $\geq$ 20 by race<sup>a</sup>**

|                                      | EHDIC-SWB      |                          | P     |
|--------------------------------------|----------------|--------------------------|-------|
|                                      | White (n=378)  | African American (n=571) |       |
| Age, mean $\pm$ SE                   | 47.4 $\pm$ .8  | 41.4 $\pm$ .5            | <.001 |
| Male                                 | 49.2           | 48.3                     | .793  |
| Married                              | 25.7           | 16.3                     | <.001 |
| Education level                      |                |                          | .027  |
| Less than high school graduate       | 44.2           | 35.6                     |       |
| High school graduate or equivalent   | 37.3           | 44.2                     |       |
| More than high school education      | 18.5           | 20.2                     |       |
| Income                               |                |                          | .146  |
| <\$10,000                            | 22.5           | 26.8                     |       |
| \$10,000–\$24,999                    | 30.4           | 32.9                     |       |
| \$25,000–\$34,999                    | 25.4           | 18.9                     |       |
| \$35,000–\$54,999                    | 11.9           | 12.4                     |       |
| $\geq$ \$55,000                      | 9.8            | 8.9                      |       |
| Health insurance                     | 63.1           | 64.4                     | .694  |
| Weight status                        |                |                          | .913  |
| Normal                               | 36.9           | 35.5                     |       |
| Overweight                           | 27.3           | 28.1                     |       |
| Obese                                | 35.8           | 36.4                     |       |
| Smoking status                       |                |                          | <.001 |
| Current                              | 54.8           | 57.4                     |       |
| Former                               | 19.1           | 10.2                     |       |
| Never                                | 26.2           | 32.4                     |       |
| Drinking status                      |                |                          | .005  |
| Current                              | 44.2           | 50.4                     |       |
| Former                               | 40.2           | 30.1                     |       |
| Never                                | 15.6           | 19.5                     |       |
| Physically active                    | 54.4           | 55.3                     | .784  |
| Cardiovascular disease               | 19.2           | 10.9                     | <.001 |
| Stroke                               | 5.6            | 4.7                      | .550  |
| Diabetes                             | 13.6           | 11.6                     | .367  |
| Blood pressure, mm Hg, mean $\pm$ SE |                |                          |       |
| Systolic                             | 138.4 $\pm$ .9 | 141.8 $\pm$ .9           | .009  |
| Diastolic                            | 100.0 $\pm$ .6 | 102.9 $\pm$ .5           | <.001 |
| Awareness among hypertensives        | 36.7           | 35.3                     | .651  |
| Treated among the aware              | 73.4           | 62.8                     | .048  |
| Controlled among the treated         | 18.3           | 13.7                     | .362  |

<sup>a</sup> Data are % unless indicated otherwise.

considered to be controlled. This follows the Seventh Report of the Joint National Committees recommendations as well as previous work.<sup>35,36</sup> Among the treated hypertensive participants who did not have diabetes, those with systolic BP<140 mmHg and diastolic BP<90 mmHg were also considered to be controlled.<sup>35,36</sup> Table 1 contains the decision rubric used to define hypertension outcomes.

Demographic characteristics included: race, age (years), sex, educational attainment (less than high school, high school graduate or equivalent, or more than high school education), and income (<\$10,000, \$10,000–\$24,999, \$25,000–\$34,999, \$35,000–\$54,999,  $\geq$ \$55,000). Health-related factors included: health insurance status, smoking status (current, former, and never), drinking status (current, former, and never), physical activity status, self-report of a physician diagnosis of diabetes, stroke, or CVD, and weight status. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m<sup>2</sup>). Weight status was classified as normal (<25 kg/m<sup>2</sup>), overweight ( $\geq$ 25 kg/m<sup>2</sup> BMI <30 kg/m<sup>2</sup>), and BMI  $\geq$ 30 kg/m<sup>2</sup>.

**Analytic Plan**

The mean and proportional differences between racial categories for the demographic characteristics, health-related factors, and hypertension outcomes were evaluated using Student's t and Chi-square tests, respectively. Logistic regression models were conducted to estimate the relationship between race and hypertension awareness, treatment, and control. All models included race, age, sex, marital status, income, education, insurance status, smoking status, drinking status, weight status, physical activity status, and history of diabetes, cardiovascular disease, and/or stroke. All analyses were conducted using STATA 11.<sup>37</sup> P<.05 were considered statistically significant and all tests were two-tailed.

RESULTS

The demographic and health-related characteristics of the African American and White with hypertension in EHDIC-SWB are shown in Table 2. African Americans were younger than Whites. Compared to Whites, a smaller proportion of African Americans were married; whereas a higher proportion of African Americans were high school graduates. With regard to health-related characteristics, a larger proportion of African Americans were current smokers and drinkers than Whites. A smaller proportion of African Americans reported a physician diagnosis of CVD; yet African Americans had a higher mean systolic and diastolic BP than Whites. There were similar proportions of African Americans and Whites with respect to male sex, income level, health insurance status, weight status, physical activity, having had a stroke, or been diagnosed with diabetes, awareness of their hypertension, and having their hypertension under control.

The relationship between race and hypertension awareness, treatment, and control is presented in Table 3. After controlling for potential confounders, hypertensive African Americans had higher odds of being aware of their hypertension than Whites (odds ratio [OR]=1.44, 95% confidence interval [CI]: 1.04–2.01). However, among those who were aware of their hypertension, African Americans had similar odds of being treated for hypertension (OR=.83, 95% CI: .44–1.54) relative to Whites. Furthermore, among those who were in treatment, African Americans had similar odds of having their hypertension controlled (OR=.98, 95% CI: .37–2.59) compared to Whites.

DISCUSSION

We sought to determine if there were race disparities in hypertension awareness, treatment, and control among

**Table 3. Black-White odds ratios of awareness, treatment among hypertensive adults in EHDIC-SWB<sup>a</sup>**

|                                    | Aware <sup>b</sup><br>(n=922)<br>OR (95% CI) | Treated <sup>c</sup><br>(n=310)<br>OR (95% CI) | Controlled <sup>d</sup><br>(n=208)<br>OR (95% CI) |
|------------------------------------|--|--|---|
| Black                              | 1.44 (1.04–2.01)                             | .83 (.44–1.54)                                 | .98 (.37–2.59)                                    |
| Age, mean ± SE                     | 1.05 (1.04–1.07)                             | 1.07 (1.04–1.10)                               | 1.00 (.96–1.04)                                   |
| Male                               | 1.11 (.80–1.54)                              | .47 (.25–.88)                                  | .27 (.10–.76)                                     |
| Married, %                         | .96 (.64–1.43)                               | 1.80 (.81–3.99)                                | 2.15 (.75–6.22)                                   |
| Education level, %                 |  |  |   |
| Less than high school graduate     | Ref  | Ref  | Ref   |
| High school graduate or equivalent | .61 (.43–.88)                                | 1.57 (.78–3.15)                                | .74 (.25–2.18)                                    |
| More than high school education    | .70 (.44–1.13)                               | 1.58 (.66–3.79)                                | .43 (.09–2.09)                                    |
| Income, %                          |  |  |   |
| <\$10,000                          | Ref  | Ref  | Ref   |
| \$10,000–\$24,999                  | .59 (.40–.88)                                | .91 (.44–1.91)                                 | .99 (.35–2.80)                                    |
| \$25,000–\$34,999                  | .71 (.42–1.21)                               | .49 (.18–1.32)                                 | 1.73 (.37–7.99)                                   |
| \$35,000–\$54,999                  | .74 (.42–1.32)                               | 1.01 (.35–2.98)                                | 1.87 (.33–10.63)                                  |
| ≥\$55,000                          | .89 (.46–1.73)                               | 1.11 (.30–4.17)                                | .27 (.02–3.36)                                    |
| Health insurance, %                | 1.01 (.72–1.42)                              | 2.07 (1.12–3.83)                               | 1.11 (.36–3.36)                                   |
| Weight status, %                   |  |  |   |
| Normal                             | Ref  | Ref  | Ref   |
| Overweight                         | 1.38 (.92–2.08)                              | 1.26 (.59–2.68)                                | 2.66 (.68–10.45)                                  |
| Obese                              | 2.05 (1.39–3.03)                             | 2.30 (1.10–4.82)                               | 3.53 (.96–12.96)                                  |
| Smoking status, %                  |  |  |   |
| Current                            | .89 (.52–1.52)                               | 1.06 (.39–2.84)                                | .95 (.26–3.52)                                    |
| Former                             | 1.07 (.74–1.56)                              | 1.17 (.57–2.40)                                | .96 (.32–2.89)                                    |
| Never                              | Ref  | Ref  | Ref   |
| Drinking status, %                 |  |  |   |
| Current                            | Ref  | Ref  | Ref   |
| Former                             | 1.12 (.78–1.61)                              | 1.55 (.80–3.00)                                | 1.12 (.38–3.29)                                   |
| Never                              | .87 (.55–1.37)                               | .73 (.32–1.66)                                 | .51 (.12–2.22)                                    |
| Physically active, %               | .74 (.54–1.02)                               | 1.41 (.76–2.60)                                | .87 (.35–2.14)                                    |
| Cardiovascular disease, %          | 1.99 (1.26–3.16)                             | 1.17 (.55–2.49)                                | .93 (.32–2.68)                                    |
| Stroke, %                          | 5.51 (2.42–12.52)                            | 2.25 (.77–6.60)                                | 1.73 (.45–6.57)                                   |
| Diabetes, %                        | 2.44 (1.50–3.95)                             | 1.71 (.76–3.85)                                | .04 (.004–.31)                                    |

<sup>a</sup> Models controlled for age, sex, marital status, income, education, insurance status, smoking status, drinking status, weight status, physical activity, diabetes, stroke, and cardiovascular disease; hypertensive is defined as SBP≥140 or DBP≥90 or taking antihypertensive medication.

<sup>b</sup> Defined as been told by a doctor they have hypertension.

<sup>c</sup> Defined as aware and currently taking antihypertensive medication

<sup>d</sup> Defined as treated and BP<140/90 mmHg for non-diabetics, BP<130/80 mmHg for diabetics.

hypertensive African Americans and Whites living in the same social environment and who have access to the same health care market. We found that African Americans had higher odds of being aware of their hypertension, but had similar odds of being treated for their hypertension and having their hypertension controlled. These findings highlight the importance of social context in hypertension treatment and control.

While our analysis confirms previous findings that African Americans have

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greater awareness of hypertension, it extends to African Americans and Whites who live in similar social and health care resource environments.<sup>1-3,5,8-10</sup> Although the study design of EHDIC-SWB likely accounts for as much unmeasured SES heterogeneity as possible without using an experimental design, disparities still persist, suggesting that social context has little impact on the relationship between race and hypertension awareness. A study that analyzed neighborhood context found no statistical difference in the odds of awareness of hypertension between African Americans and Whites, but did find that neighborhood disadvantage was significantly associated with higher awareness of hypertension among hypertensives.<sup>14</sup> Our study improves on those findings by showing that when African Americans and Whites live together in a disadvantaged neighborhood, African Americans still have greater awareness of their hypertension. In this study, demographic factors (age, education, and income) and health-related factors (being obese, reporting CVD, diabetes or stroke) were related to hypertension awareness. Additional research is needed to better understand how these factors contribute to hypertension awareness among Black and White individuals. Identifying and understanding factors that influence race differences in hypertension awareness are important to the reduction of CVD morbidity and mortality.

African Americans and Whites who were aware of their hypertension in EHDIC-SWB had similar odds of being treated for their hypertension. The literature examining race differences in hypertension treatment yields mixed results. For example, consistent with our work, two studies demonstrated that African Americans and Whites have similar odds of hypertension treatment after adjusting for demographic characteristics, health care access and utilization, and comorbid conditions<sup>37</sup> and neighborhood level factors.<sup>14</sup> Yet, other

scholars have shown that African Americans were more likely to be treated for their hypertension than Whites.<sup>2,5,38</sup> These findings suggest that social context should be considered when understanding race differences in hypertension treatment.

Several explanations exist for these findings. First, while not assessed in the survey, we speculate that greater vigilance existed among patients and/or health care providers within the EHDIC-SWB communities about detection and control of hypertension among African Americans. Second, this may be attributed to health communication campaigns promoted by local health care and voluntary health organizations (eg, American Heart Association) designed to increase African Americans' awareness of the risks resulting from untreated hypertension in African Americans. Health care providers also consistently check blood pressure and recommend modifications and treatment regimens for management. Third, the absence of a race difference in treatment of hypertension is likely due to the fact that these participants share similar health care resources and had similar number of doctor visits.<sup>12</sup> Fourth, because this is a racially balanced community, providers might be more accustomed to a racially diverse patient panel. As such they may be less likely to have unconscious bias and therefore less likely to discriminate.

In EHDIC-SWB, Whites and African Americans had similar odds of having controlled hypertension among those in treatment for their hypertension. Previous research using national data<sup>2,38</sup> as well as work that has accounted for neighborhood differences,<sup>14</sup> have documented that non-Hispanic Blacks were less likely to have controlled hypertension compared to Whites. This persistent race difference has been hypothesized to be due to less aggressive treatment in Blacks or poorer follow-up, fewer drugs or less effective drugs, or that genetic or other factors make medications less effective for

Blacks than Whites.<sup>5</sup> Yet in our study, which accounts for the differing social and health care contexts, African Americans and Whites had similar odds of controlled hypertension. Thus, the disparity observed in hypertension control in previous research may actually be due to differences in social and health care environments resulting from racial residential segregation rather than the previously mentioned hypotheses. Further, it is worth noting that the lack of race disparity between African Americans and Whites partially results from high rates of uncontrolled hypertension among Whites. In EHDIC-SWB, approximately half of African Americans (48.5%) and half of Whites (51.5%) whose hypertension was being treated had their hypertension under control. Using data for the 1999–2004 NHANES, Ostchega and colleagues<sup>36</sup> documented that 55% of African Americans and 45% of Whites whose hypertension was being treated had their hypertension under control. This highlights the fact that when Whites and African Americans live in the same conditions of a low-income urban environment, the health profile of Whites becomes similar to that of African Americans.<sup>27</sup> Public health officials and health care providers need to consider social context when seeking to understand race differences in hypertension control.

National samples such as NHANES do not account for segregation. But the fact that African Americans and Whites often live in dramatically different social and physical environments facilitates differences in their risk exposures and the quality of care they can access. Studies of racial residential segregation have found that upwards of 60% of African Americans would need to move to another census tract to achieve complete integration between African Americans and non-Hispanic White Americans.<sup>23,39,40</sup>

The EHDIC study represents a new direction in health disparities research, one which accounts for unmeasured

environmental heterogeneity that is associated with race but not accounted for in most analyses. Additionally EHDIC-SWB accounted for the confounding of race and SES that is present in national data such as NHANES. Nevertheless, interpretation of these results should be considered in the following context. The external validity of our results may be limited because EHDIC-SWB was conducted in a low-income urban population. Results may differ in higher SES and non-urban environments. Our analyses only included African American and White participants, and are not generalizable to other ethnic groups. Despite these limitations, our study contributes to our understanding of race disparities in hypertension awareness, treatment, and control by using a study design that significantly minimizes the confounding of race, SES, and residential segregation.

## CONCLUSION

The management of hypertension is a key public health goal. Based on our study's findings, future efforts should consider possible racial differences in social and environmental conditions, health care resources, and nonpharmacological treatment that provide insight into race differences in treatment and control of hypertension, especially in national samples. Furthermore, these findings support the continuing value of ongoing efforts and surveillance to diagnose, treat and control high blood pressure but equally salient is to emphasize the importance of the social and the health care resource environment in hypertension management.

## REFERENCES

1. Ong KL, Cheung BM, Man YB, et al. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999–2004. *Hypertension*. 2007;49:69–75.
2. Hertz RP, Unger AN, Cornell JA, et al. Racial disparities in hypertension prevalence, awareness, and management. *Arch Intern Med*. 2005;165:2098–2104.

3. Sheats N, Lin Y, Zhao W, et al. Prevalence, treatment, and control of hypertension among African Americans and Caucasians at primary care sites for medically under-served patients. *Ethn Dis*. 2005;15:25–32.
4. Ostchega Y, Yoon SS, Hughes J, et al. Hypertension awareness, treatment, and control—continued disparities in adults: United States, 2005–2006. *NCHS Data Brief*; 2008; (3):1–8.
5. Howard G, Prineas R, Moy C, et al. Racial and geographic differences in awareness, treatment, and control of hypertension: the Reasons for Geographic And Racial Differences in Stroke study. *Stroke*. 2006;37:1171–1178.
6. Cutler JA, Sorlie PD, Wolz M, et al. Trends in hypertension prevalence, awareness, treatment, and control rates in United States adults between 1988–1994 and 1999–2004. *Hypertension*. 2008;52:818–827.
7. Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988–2000. *JAMA*. 2003;290:199–206.
8. Hicks LS, Fairchild DG, Hornig MS, et al. Determinants of JNC VI guideline adherence, intensity of drug therapy, and blood pressure control by race and ethnicity. *Hypertension*. 2004;44:429–434.
9. Kramer H, Han C, Post W, et al. Racial/ethnic differences in hypertension and hypertension treatment and control in the multi-ethnic study of atherosclerosis (MESA). *Am J Hypertens*. 2004;17:963–970.
10. Bosworth HB, Dudley T, Olsen MK, et al. Racial differences in blood pressure control: potential explanatory factors. *Am J Med*. 2006;119:70.
11. Ashaye MO, Giles WH. Hypertension in Blacks: a literature review. *Ethn Dis*. 2003;13:456–462.
12. Gaskin DJ, Price A, Brandon DT, et al. Segregation and disparities in health services use. *Med Care Res Rev*. 2009;66:578–589.
13. Williams DR, Collins C. Racial residential segregation: a fundamental cause of racial disparities in health. *Public Health Rep*. 2001; 116:404–416.
14. Morenoff JD, House JS, Hansen BB, et al. Understanding social disparities in hypertension prevalence, awareness, treatment, and control: The role of neighborhood context. *Soc Sci Med*. 2007.
15. Kershaw KN, Diez Roux AV, Burgard SA, et al. Metropolitan-level racial residential segregation and Black-White disparities in hypertension. *Am J Epidemiol*. 2011;174: 537–545.
16. Mujahid MS, Diez Roux AV, Morenoff JD, et al. Neighborhood characteristics and hypertension. *Epidemiology*. 2008;19:590–598.
17. Schulz AJ, Zenk SN, Israel BA, et al. Do neighborhood economic characteristics, racial composition, and residential stability predict perceptions of stress associated with the physical and social environment? Findings from a multilevel analysis in Detroit. *J Urban Health*. 2008;85:642–661.
18. James SA, Van Hoewyk J, Belli RF, et al. Life-course socioeconomic position and hypertension in African American men: the Pitt County Study. *Am J Public Health*. 2006;96:812–817.
19. Clougherty JE, Eisen EA, Slade MD, et al. Gender and sex differences in job status and hypertension. *Occup Environ Med*. 2011;68: 16–23.
20. Laraia BA, Karter AJ, Warton EM, et al. Place matters: neighborhood deprivation and cardiometabolic risk factors in the Diabetes Study of Northern California (DISTANCE). *Soc Sci Med*. 2012;74:1082–1090.
21. Iceland J. Beyond Black and White: Residential segregation in multiethnic America. *Soc Sci Res*. 2004;33:248–271.
22. Wilkes R, Iceland J. Hypersegregation in the twenty-first century: An update and analysis. *Demography*. 2004;41:23–36.
23. Massey DS, Denton NA. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, Mass: Harvard University Press; 1993.
24. Massey DS, Hajnal ZL. The Changing Geographic Structure of Black-White Segregation in the United States. *Soc Sci Q*. 1995;76:527–542.
25. LaVeist TA. Disentangling race and socioeconomic status: a key to understanding health inequalities. *J Urban Health*. 2005;82:iii26–34.
26. Fesahazion RG, Thorpe R Jr, Bell CN, et al. Disparities in alcohol use: Does race matter as much as place? *Prev Med*. 2012;55(5):482–484.
27. Laveist T, Pollack K, Thorpe R Jr, et al. Place, not race: disparities dissipate in southwest Baltimore when Blacks and Whites live under similar conditions. *Health Aff (Millwood)*. 2011;30:1880–1887.
28. Bleich SN, Thorpe R Jr, Sharif-Harris H, et al. Social context explains race disparities in obesity among women. *J Epidemiol Community Health*. 2010;64:465–469.
29. LaVeist TA, Thorpe R Jr, Galarraga JE, et al. Environmental and socioeconomic factors as contributors to racial disparities in diabetes prevalence. *J Gen Intern Med*. 2009;24: 1144–1148.
30. Thorpe R Jr, Brandon DT, LaVeist TA. Social context as an explanation for race disparities in hypertension: findings from the Exploring Health Disparities in Integrated Communities (EHDIC) Study. *Soc Sci Med*. 2008;67:1604–1611.
31. LaVeist T, Thorpe R Jr, Bowen-Reid T, et al. Exploring health disparities in integrated communities: overview of the EHDIC study. *J Urban Health*. 2008;85:11–21.

32. Braveman PA, Cubbin C, Egerter S, et al. Socioeconomic status in health research: one size does not fit all. *JAMA*. 2005;294:2879–2888.
33. Bell AC, Adair LS, Popkin BM. Understanding the role of mediating risk factors and proxy effects in the association between socioeconomic status and untreated hypertension. *Soc Sci Med*. 2004;59:275–283.
34. Sharma S, Malarcher AM, Giles WH, et al. Racial, ethnic, and socioeconomic disparities in the clustering of cardiovascular disease risk factors. *Ethn Dis*. 2004;14:43–48.
35. Chobanian AV, Bakris GL, Black HR, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension*. 2003;42:1206–1252.
36. Ostchega Y, Hughes JP, Wright JD, et al. Are demographic characteristics, health care access and utilization, and comorbid conditions associated with hypertension among US adults? *Am J Hypertens*. 2008;21:159–65.
37. StataCorp. Stata Statistical Software: Release 11. College Station, TX: StataCorp LP; 2009.
38. Egan BM, Zhao Y, Axon RN. US trends in prevalence, awareness, treatment, and control of hypertension, 1988–2008. *JAMA*. 2010; 303:2043–2050.
39. Iceland J, Weinberg DH, Steinmetz E, United States Bureau of the Census. Racial and Ethnic Residential Segregation in the United States: 1980–2000. Washington, DC: U.S. Government Printing Office; 2002;Series CENSR-3:151.
40. Iceland J. *Where we Live Now: Immigration and Race in the United States*. 1st ed. Berkeley and Los Angeles: University of California Press; 2009.

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