

Research Article

Racial/Ethnic Variability in Hypertension Prevalence and Risk Factors in National Health Interview Survey

L. Holmes Jr.,^{1,2,3} J. Hossain,^{2,4} D. Ward,⁵ and F. Opara¹

¹ American Health Research Institute, Houston, TX 77008, USA

² University of Delaware, Newark, DE, USA

³ Nemours/A.I.duPont Hospital for Children, Office of Health Equity & Inclusion, Newark, DE 19716, USA

⁴ Nemours Biomedical Research, Wilmington, DE 19803, USA

⁵ Christiana Care Health System, Newark, DE, USA

Correspondence should be addressed to L. Holmes Jr.; lhoh@ahrresearch.org

Received 4 July 2012; Accepted 24 July 2012

Academic Editors: K. Kotani and R. S. Padwal

Copyright © 2013 L. Holmes Jr et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Objective. Hypertension is one of the leading causes of death attributed to cardiovascular diseases, and the prevalence varies across racial/ethnic groups, with African Americans being disproportionately affected. The underlying causes of these disparities are not fully understood despite volume of literature in this perspective. We aimed in this current study to examine ethnic/racial disparities in hypertension utilizing Hispanics as the base racial/ethnic group for comparison. **Research Design and Methods.** We utilized the National Health Interview Survey (NHIS), which is a large cross-sectional survey of the United States non-institutionalized residents to investigate the racial/ethnic disparities in hypertension after the adjustment of other socio-economic, demographic, and prognostic risk factors. The study participants were adults ($n = 30,852$). Data were analyzed using Chi square statistic, and logistic regression model. **Results.** There were statistically significant differences by race/ethnicity with respect to income, education, marital status, smoking, alcohol, physical activities, body mass index, and age, $P < 0.01$, but not insurance coverage, $P > 0.01$. Hispanic ethnicity (18.9%) compared to either non-Hispanic White (27.7%) or non-Hispanic Black (35.5%) was associated with the lowest prevalence of hypertension. Race/ethnicity was a single independent predictor of hypertension, with non-Hispanic Black more likely to be hypertensive compare with Hispanic, prevalence odds ratio (POR), 2.38, 99% Confidence Interval (CI), 2.17–2.61 and non-Hispanic White, POR, 1.64, 99% CI, 1.52–1.77. After controlling for the confounding variables, the racial/ethnic differences in hypertension persisted. **Conclusions.** Racial/ethnic disparities in hypertension persisted after controlling for potential predictors of hypertension in NHIS, implying the inability of known hypertension risk factors to account for racial/ethnic variability in hypertension in US.

1. Introduction

Hypertension remains one of the leading causes of cardiovascular mortality in the United States population, affecting disproportionately non-Hispanic blacks [1–4]. The etiology of hypertension is multifactorial and incidence, prevalence and mortality vary by race/ethnicity [5–7]. A study has shown that the age-adjusted prevalence of hypertension by race, in the year 2003–2004, among the United States residents of age 20 years or older was 39.1% non-Hispanic Black, 28.5% non-Hispanic White, and 27.8% Hispanic, while

age-unadjusted prevalence rate was 34.4%, 30.3%, and 16.9% for three racial groups, respectively [8]. However, it is not fully understood whether the observed variance is due to race or other factors associated with race or hypertensive risk factors per se.

Explanatory factors for racial/ethnic differences in hypertension include racial/ethnic differences in family income, education and insurance status. Other predictors of hypertension include socioeconomic, demographic, and prognostic factors [9–11]. Because there are racial/ethnic differences in the distribution of the postulated risk factors in hypertension,

these factors may very well explain the ethnic/racial variations in hypertension prevalence in our population.

This present study was conducted to examine the racial/ethnic disparities in hypertension, using the National Health Interview Survey (NHIS) data, and to determine whether or not the observed variance could be explained by the racial/ethnic disparities in the utilization of insurance coverage, income, education, and other socio-economic parameters that constantly define racial/ethnic group in the US. We hypothesized that the racial/ethnic disparities in hypertension may be explained by ethnic and racial variance in income, insurance status and related socio-economic, demographic, and prognostic factors.

2. Materials and Methods

This research utilized secondary data to examine the relationship between the outcome variable hypertension (HTN) and main predictor variable race/ethnicity, as well as factors known to predispose to high blood pressure (HBP), namely, family income, insurance status and other sociodemographic and prognostic variables age, sex, education level, employment status, marital status, body mass index (BMI), cigarette smoking, physical activity, and alcohol drinking status.

2.1. Study Population. The sample of the NHIS, 2003 consisted of 30,852 adults. Participants were non-Hispanic whites, $n = 20,169$ (65.37%), non-Hispanic blacks, $n = 4,168$ (13.51%), Hispanics $n = 5,416$ (17.55%), and others, $n = 1,099$ (3.56%). Participants were either male, $n = 13,427$ (43.52%) or female, $n = 17,425$ (56.48%), ages 18 years and older.

2.2. Data Collection and Sampling Techniques

2.2.1. Data Collection Procedures. Data were collected via a personal household interview by Census interviewers. The details of the sampling are published elsewhere [12].

2.3. Study Variables

2.3.1. Outcome Variable. The outcome variable hypertension was measured as a self-reported variable and was dichotomized as “yes” and “no.” Subjects were asked if they were ever told by their health care provider of having hypertension.

2.3.2. Main Predictor (Explanatory) Variable. The main predictor variable for this study is race. The variable race was categorized into non-Hispanic whites, non-Hispanic blacks, Hispanics, and others.

2.3.3. Other Potential Explanatory Variables. Insurance coverage was measured by any family members having insurance coverage and was categorized into “yes,” “no,” “refused,” “not ascertained,” and “do not know.” The responses “refused,” “not ascertained,” and “do not know,” because of the small numbers, were not included in the analysis. Income is

measured by family income greater than \$20,000 and less than \$20,000. This variable was categorized into “greater than \$20,000,” “less than \$20,000,” “refused,” “not ascertained,” and “do not know.” The responses “refused,” “not ascertained,” and “do not know” were not included in the analysis.

The socio-demographic variables are age, sex, education level, employment status, and marital status. The age of participants was originally measured as a continuous variable and later categorized into a binary scale (≥ 50 years versus < 50 year) variable given that clinical relevance of age in the predisposition to hypertension. Both males and females were eligible for the survey provided the age requirement was satisfied. Education level was measured by the years of school attainment. This variable was collected as categorical but was recoded for suitable categories in comparing “less or equal to high school,” “some college,” and “greater than,” or equal to a bachelor’s degree. Employment status was measured by a categorical variable that elicited information on job profile. This variable was recoded in order to examine unemployment versus employment, with respect to racial distribution and the association with the outcome variables. Marital status was measured by a categorical variable and was used to examine the influence of social support system on the outcome variable hypertension.

2.3.4. Prognostic Variables. Body mass index (BMI) is conceptualized by relationship between height and weight. This variable was collected on a continuous scale and was recoded into four distinct categories to reflect normal BMI and overweight BMI, utilizing the Centers for Disease Control and Prevention’s cut-off points for BMI. Smoking is conceptualized as a historical variable. This variable was collected as categorical with the main variable eliciting information on “ever smoked” and “never smoked.” The responses “refused,” “not ascertained,” and “do not know” were not included in the analysis. This variable was recoded into a binary variable. Physical activity is measured by frequency of exercise. This variable is categorized into ten groups with major categories including “never exercise,” “exercise” and “unable to exercise.” This variable was recoded into “ever exercise” (including daily, weekly, monthly, and yearly basis), versus “never exercise” (including unable to exercise), in order to examine the outcome variables and the association with race. Alcohol drinking status is collected as a categorical variable and is measured by the number of drinks within a period of time. This variable was recoded into “lifetime abstainer,” “former drinker,” and “current drinker.” This variable was used as a confounding and controlled for in association between race and hypertension.

2.4. Statistical Analyses. Categorical variables were described using frequency and percentages, while continuous variables were summarized using mean and standard deviation. Pearson Chi-Square statistic was used to examine racial/ethnic differences with respect to the distribution of the outcome variable hypertension, and potential explanatory variables, namely, family income, insurance coverage, socio-economic factors and other prognostic factors. The association between

the main predictor variable race/ethnicity, and hypertension was assessed using unconditional univariable logistic regression model. In addition, multivariable logistic regression model was used to simultaneously adjust for the mixing effects of the potential confounding variables on the association between race and hypertension. *We entered into this model age, education, marital status, sex, body mass index, family income, physical activities, alcohol, and smoking.* To enter into the multivariable model, a variable must have been significant at $P < 0.25$ or $P < 0.10$ for an interaction term. Further, variables with biological or clinical relevance such as *age and sex* were entered into the multivariable model. All analyses were two-tailed at 0.01 significance level (1% type I error tolerance). The analyses were performed using STATA statistical software version 11.0 (STATA Incorporation, College Station, Texas).

3. Results

There were 30,852, in which less than 4% were others, implying other racial/ethnic group in the United States population besides Caucasian (non-Hispanic White), African American (non-Hispanic Black), and Hispanic. The majority of the study participants were non-Hispanic whites, $n = 20,169$ (65.4%). The remaining racial/ethnic groups were non-Hispanic blacks, $n = 4,168$ (13.5%), and Hispanics, $n = 5,416$ (17.5%).

Table 1 presents the study characteristics by race/ethnicity. There were statistically significant racial/ethnic differences with respect to education, family income, marital status, current smoking status, history of alcohol use, physical activity, body mass index (BMI), and age group, $P < 0.01$. In contrast, there was no statistically significant racial/ethnic differences in insurance status, $P > 0.01$. Compared to non-Hispanic whites, non-Hispanic blacks and Hispanics were less likely to acquire undergraduate and graduate degrees, (26.8%) versus (15.2% and 9.6%), respectively. Family income was significantly higher among non-Hispanic whites (72.5%) compared with non-Hispanic blacks (55.1%) and Hispanics (57.7%). In addition, Hispanics (31.1%) were less likely to smoke compared to non-Hispanic blacks (37.7%) and non-Hispanic whites (47.9%). Non-Hispanic whites (65.8%) were more likely to report of alcohol use compared to non-Hispanic blacks (49.3%) and Hispanics (51.1%). Further, Hispanics (20.1%) were less likely to exercise compared with non-Hispanic blacks (24.6%) and non-Hispanic whites (28.8%). Non-Hispanic whites (21.7%) were less likely to be overweight and obese compared with non-Hispanic blacks (33.5%) and Hispanics (25.1%). Furthermore, compared to non-Hispanic blacks (54.9%) and non-Hispanic whites (64.1%), Hispanics (42.3%) were less likely to be in the older age group (>50 years).

Table 2 demonstrates the comparison of race/ethnicity by hypertension prevalence as well as race by blood pressure levels. There was a statistically significant difference in the prevalence of hypertension by race/ethnicity, χ^2 (2, $N = 29,753$) = 343.5, $P \leq 0.001$. Hispanics (18.9%) compared to non-Hispanic blacks (35.8%) and non-Hispanic whites

(27.7%) were less likely to report of being diagnosed with hypertension. Likewise, there was a statistically significant difference in the levels of blood pressure by race/ethnicity. χ^2 (8, $N = 29,753$) = 216.7, $P \leq 0.001$. Compared with non-Hispanic whites (9.7%) and Hispanics (10.3%), non-Hispanic blacks (14.7%) were more likely to report of higher blood pressure levels. Next, Hispanics (1.5%), compared to non-Hispanic blacks (2.7%) and non-Hispanic whites (2.1%), were less likely to be in border line hypertension level.

Table 3 shows the crude or unadjusted association between race/ethnicity and hypertension. There was a statistically significant difference in the prevalence of hypertension by race/ethnicity. Compared with Hispanics, non-Hispanic blacks were two times as likely to be hypertensive, prevalence odds ratio (POR) = 2.38, 99% Confidence Interval (CI), 2.17–2.61, while non-Hispanic whites were 64% more likely to be hypertensive, POR = 1.64, 99% CI, 1.52–1.77. Hypertension was statistically significantly associated with lower education, advanced age, higher BMI, lack of physical activities, and not being married, $P < 0.01$. In contrast, there was no statistically significant association between hypertension and insurance status, POR = 0.97, 99% CI, 0.89–1.05. There was statistically significant increase in the prevalence of hypertension among smokers, compared with nonsmokers (27%), POR = 1.27, 99% CI, 1.21–1.34.

Table 4 presents the multivariable analysis of the effect of race on hypertension after controlling for family income, education, age, BMI, smoking, alcohol history, physical activities, and marital status. The statistically significant association between race and hypertension persisted after controlling these variables, adjusted POR = 2.12, 99% CI, 1.90–2.35 for non-Hispanic blacks and adjusted POR = 1.64, 99% CI, 1.40–1.67, for non-Hispanic whites compared to Hispanics.

4. Discussion

We aimed in this study to examine the prevalence of HTN by race/ethnicity in the US, and to determine whether or not health disparities in HTN could be explained by racial/ethnic distribution of the factors known to be associated with hypertension that are unequally distributed across racial/ethnic groups in the US. There are a few significant findings in this study. First, there is a significant racial/ethnic variation in the prevalence of hypertension. Second, there are racial/ethnic differences in family income, educational level, age, marital status, physical activities, body mass index, and physical activities. Third, racial/ethnic disparity in hypertension between non-Hispanic blacks and Hispanics is not explained by the differences in the socio-demographic, and prognostic factors, which are known risk factors for HBP.

In the univariable model, non-Hispanic blacks had a greater risk of developing hypertension compared with Hispanics and non-Hispanic whites. These findings support previous literature with respect to race/ethnicity and hypertension in the United States [1–4]. In this sample, Hispanics presented with a higher family income level compared with non-Hispanic blacks. Education level [13–16], and family income [17], and insurance coverage are variables that have

TABLE 1: Study characteristics comparing covariates by race/ethnicity in a sample of community-based United States residents.

Variables	Caucasian		African American		Hispanic		Others		χ^2 (df)	P
	n	%	n	%	n	%	n	%		
Education									1800.0 (6)	<.0001
≤High School	8,672	43.0	2,257	54.2	3,852	71.1	368	33.5		
Some College	6,090	30.2	1,278	30.7	1,046	19.3	277	25.2		
≥Bachelor's degree	5,407	26.8	633	15.2	518	9.6	454	41.3		
Income									772.3 (3)	<.0001
≤\$20,000	5,547	27.5	1,872	44.9	2,290	42.3	301	27.4		
>\$20,000	14,622	72.5	2,296	55.1	3,126	57.7	798	72.6		
Marital status									744.0 (3)	<.0001
Married	9,407	46.6	2,895	69.5	2,566	47.4	505	46.0		
Nonmarried	10,762	53.4	1,273	30.5	2,850	52.6	594	54.0		
Insurance status									4.3 (3)	0.222
Yes	18,005	89.3	3,717	89.2	4,799	88.6	996	90.6		
No	2,164	10.7	451	10.8	617	11.4	103	9.4		
Current smoking status									673.9 (3)	<.0001
Yes	9,666	47.9	1,572	37.7	1,630	30.1	347	31.6		
No	10,503	52.1	2,596	62.3	3,786	69.9	752	68.4		
Alcohol history									660.5 (2)	<.0001
Yes	13,277	65.8	2,054	49.3	2,767	51.1				
No	6,892	34.2	2,114	50.7	2,649	48.9				
Physical activity									182.0 (3)	<.0001
Yes	5,816	28.8	1,025	24.6	1,087	20.1	323	29.4		
No	14,353	71.2	3,143	75.4	4,329	79.9	776	70.6		
Body mass index									575.3 (9)	<.0001
Underweight	421	2.2	47	1.2	62	1.22	53	5.1		
Normal weight	7,812	40.8	1,169	29.9	1,782	35.0	588	56.0		
Overweight	6,776	35.3	1,384	35.4	1,969	38.7	289	27.6		
Obese	4,152	21.7	1,307	33.5	1,280	25.1	119	11.3		
Age group									927.7 (3)	<.0001
≤50 years	7244	35.9	1,878	45.1	3,125	57.7	585	53.2		
>50 years	12,925	64.1	2,290	54.9	2,291	42.3	514	46.8		

TABLE 2: The comparison of hypertension prevalence and blood pressure levels by race/ethnicity in a sample of community-based United States residents.

Variables	Caucasian		African American		Hispanic		χ^2	P
	n	%	n	%	n	%		
Hypertension							343.5	<0.0001
Yes	5,594	27.7	1,491	35.8	1,026	18.9		
No	14,575	72.3	2,677	64.8	4,390	81.1		
Blood pressure level							216.7	<0.0001
Not told	440	2.3	75	1.9	142	3.0		
High	1,852	9.7	571	14.7	478	10.3		
Normal	15,436	80.5	3,032	78.1	3,839	82.6		
Low	1,036	5.4	97	2.5	123	2.6		
Borderline	400	2.1	105	2.7	68	1.5		

Notes and abbreviations: the significance level was <0.01 (1% type I error tolerance); χ^2 = Pearson Chi-Square value.

TABLE 3: Unconditional univariable logistic regression model of racial/ethnic disparities in hypertension prevalence in a large sample of community-based United States residents.

Variables	Prevalence odds ratio	99% Confidence interval	P
Race			
Hispanics	1.00	Reference	Reference
Non-Hispanic blacks	2.38	2.17–2.61	<0.0001
Non-Hispanic whites	1.64	1.52–1.77	<0.0001
Family income			
≤\$20,000	1.00	Reference	Reference
>\$20,000	0.67	0.64–0.71	<0.0001
Insurance status			
Yes	1.00	Reference	Reference
No	0.97	0.89–1.05	0.43
Education			
≤High school	1.00	Reference	Reference
Some college	0.70	0.66–0.74	<0.0001
≥Bachelor's degree	0.59	0.55–0.64	<0.0001
Age			
≤50 years	1.00	Reference	Reference
>50 years	6.20	5.79–6.63	<0.0001
Body mass index			
Underweight	1.00	Reference	Reference
Normal weight	0.98	0.78–1.22	0.85
Overweight	1.64	1.31–2.06	<0.0001
Obese	3.19	2.55–4.00	<0.0001
Smoking			
No	1.00	Reference	Reference
Yes	1.27	1.21–1.34	<0.0001
Alcohol			
No	1.00	Reference	Reference
Yes	0.65	0.62–0.69	<0.0001
Physical activities			
No	1.00	Reference	Reference
Yes	0.69	0.65–0.73	<0.0001
Marital status			
Nonmarried	1.00	Reference	Reference
Married	.85	0.81–0.90	<0.0001

Notes: the significance level was <0.01 (1% type I error tolerance).

been well studied in association with hypertension. This study has shown that Hispanics compared to non-Hispanic whites were less likely to be in the higher income stratum, but, were more likely to be in the higher income stratum compared to non-Hispanic blacks. Lower income level has been associated with increased risk of hypertension and other chronic diseases [7, 9, 18–21]. However, our data failed to support

this observation while comparing non-Hispanic whites to Hispanics. Whereas, lower education has been associated with increased prevalence of hypertension, our findings did not support this observation. Hispanics were less likely to have higher education compared with non-Hispanic blacks and non-Hispanic whites, but had the lowest prevalence of hypertension.

TABLE 4: Unconditional multivariable logistic regression model of racial/ethnic disparities in hypertension prevalence in a large sample of community-based United States residents.

Variables	Prevalence odds ratio	99% Confidence interval	P
Race			
Hispanics	1.00	Reference	Reference
Non-Hispanic blacks	2.12	1.90–2.35	<0.0001
Non-Hispanic whites	1.64	1.40–1.67	<0.0001
Family income			
≤\$20,000	1.00	Reference	Reference
>\$20,000	0.74	0.70–0.79	<0.0001
Education			
≤High school	1.00	Reference	Reference
Some college	0.78	0.73–0.84	<0.0001
≥Bachelor's degree	0.71	0.65–0.77	<0.0001
Age			
≤50 years	1.00	Reference	Reference
>50 years	5.99	5.57–6.45	<0.0001
Body mass index			
Underweight	1.00	Reference	Reference
Normal weight	1.03	0.81–1.30	0.838
Overweight	1.59	1.25–2.02	<0.0001
Obese	3.18	2.50–4.05	<0.0001
Smoking			
No	1.00	Reference	Reference
Yes	1.09	1.02–1.15	0.008
Alcohol			
No	1.00	Reference	Reference
Yes	0.79	0.74–0.84	<0.0001
Physical activities			
No	1.00	Reference	Reference
Yes	0.96	0.89–1.03	0.226
Marital status			
Nonmarried	1.00	Reference	Reference
Married	.89	0.83–0.94	<0.0001

Notes: the significance level was <0.01 (1% type I error tolerance).

We have also demonstrated that the prevalence of hypertension is associated with current smoking, alcohol, physical activity, body mass index, and age. Non-Hispanic whites were more likely to smoke compared with either non-Hispanic blacks or Hispanics. Smoking is a risk factor in hypertension as it results in the constriction of the blood vessels, increasing peripheral resistance, and hence elevating the blood pressure [22–24]. Compared with other racial/ethnic group, Hispanics were less likely to exercise. Physical activity is known to lower blood pressure and to be protective against the development of hypertension. Exercise can reduce the obstacles to the flow of blood by increasing the elasticity of the arterial lumen, thus

decreasing peripheral resistance [25]. It is therefore unclear why hypertension is lower among the Hispanics given their lower level involvement in physical activities. Nonetheless, this observation is indicative of multifactorial etiology in hypertension, some which remain to be fully understood.

This study has also shown that BMI varies by race and it associated with hypertension. Elevated BMI is associated with increased risk of hypertension due to the extra load placed on the myocardium because of increased cardiac contractility, which leads to increased heart rate and stroke volume [26]. Therefore, by increasing cardiac output, the blood pressure is subject to elevation.

Whereas Hispanics were more likely to be overweight compared with non-Hispanic whites, the prevalence of hypertension was lowest among Hispanics. Because hypertension increases with increase in body weight (overweight), it is difficult to use this as a single factor in contrasting the low prevalence of hypertension experienced by the Hispanics. In addition, Hypertension increases with advancing age due to development arterial plaques leading to arteriosclerosis and hence increasing peripheral resistance through the stiffening of the blood vessels [25–27]. Hispanics were more likely to be in the younger age group where hypertension is less prevalent. This may explain in part why hypertension was less prevalent among this racial/ethnic group compared with non-Hispanic whites and non-Hispanic blacks.

We adjusted for variables in our dataset known to be confounding in the association between race/ethnicity and hypertension prevalence in order to offer possible explanations to the persistent racial/ethnic disparities in hypertension in the United States. Despite this adjustment, we found a statistically significant difference in hypertension prevalence by race/ethnicity, mainly between non-Hispanic blacks and Hispanic. Unlike other studies [7, 18, 21, 22], that have shown that racial/ethnic differences in hypertension prevalence between non-Hispanic blacks and non-Hispanic whites are removed by controlling for socio-demographic variables (income, occupation, and poverty level), racial difference in hypertension prevalence between non-Hispanic blacks and Hispanics persisted after controlling for these confounding variables. Hypertension was lowest among Hispanics, intermediate among non-Hispanic whites, and highest among non-Hispanic blacks. Despite the predisposing factors in hypertension such as education, BMI, physical activities observed largely among Hispanic ethnicity, hypertension prevalence was lowest among Hispanics. The observed lowest prevalence in HTN may be explained by the “Hispanic Paradox” which claims the role of family support system in buffering stress, thus decreasing blood pressure through arterial relaxation and the reduction in the catecholamine synthesis (norepinephrine, dopamine, and epinephrine) [28]. The results from this study is indicative of the persistent racial/ethnic disparities in hypertension prevalence and the factors that predispose to hypertension. Unlike some small studies that examined hypertension and cardiovascular risk factors [29–32], this study is very representative of the US population which allows for valid and reliable inference.

Despite the strength of our study (large sample size and appropriate point estimation), there are some limitations. First, as a cross-sectional design, it is difficult to establish a temporal sequence, implying a clear direction on the causal pathway in the relationship between hypertension and race, as well as other explanatory variables. However, it is unlikely that temporal sequence is mismatched in the cause and effect relationship between race/ethnicity and hypertension, since race/ethnicity preceded the development of hypertension. Secondly, because we recoded variables that were originally collected as continuous (interval and ratio scale) into categorical level, we might have introduced misclassification bias into our findings. Thirdly, like in most

epidemiologic studies, these findings may be influenced by unmeasured and residual confounding [33]. Finally, because we used secondary data in our assessment of the effect of race/ethnicity on hypertension and possible explanatory factors, there are well established risk factors in hypertension, namely, sodium and caloric intake that were not fitted in to our explanatory models. The fitting of these dietary factors (micro- and macro-nutrients) and *dietary salt intake* may very well have provided some explanation to the persistent racial/ethnic disparities in hypertension prevalence.

In summary, this study has shown that non-Hispanic blacks are disproportionately affected by hypertension and that the Hispanics have the lowest prevalence of hypertension in this sample of noninstitutionalized US residents. Further, the racial/ethnic disparities in hypertension between non-Hispanic blacks and Hispanics persisted after controlling for confounders on the effect of race/ethnicity on hypertension prevalence. Thus, given the nature of our design (cross-sectional), this study recommends further prospective studies in order to examine the incidence of hypertension by race/ethnicity, while identifying and adjusting for potential confounders in the relationship between race/ethnicity and hypertension.

Acknowledgment

The authors thank the Center for Disease Control and Prevention (CDC), National Health Statistics (NHS) Center, for the availability of the National Health Interview Survey data.

References

- [1] M. J. Wrobel, J. J. Figge, and J. L. Izzo Jr., “Hypertension in diverse populations: a New York State Medicaid clinical guidance document,” *Journal of the American Society of Hypertension*, vol. 5, no. 4, pp. 208–229, 2011.
- [2] L. N. Borrell, B. S. Menendez, and S. P. Joseph, “Racial/ethnic disparities on self-reported hypertension in New York City: examining disparities among Hispanic subgroups,” *Ethnicity & Disease*, vol. 21, no. 4, pp. 429–436, 2011.
- [3] K. N. Kershaw, A. V. Diez Roux, S. A. Burgard, L. D. Lisabeth, M. S. Mujahid, and A. J. Schulz, “Metropolitan-level racial residential segregation and black-white disparities in hypertension,” *American Journal of Epidemiology*, vol. 174, no. 5, pp. 537–545, 2011.
- [4] R. Cooper and C. Rotimi, “Hypertension in blacks,” *American Journal of Hypertension*, vol. 10, no. 7 I, pp. 804–812, 1997.
- [5] N. R. Kressin, M. B. Orner, M. Manze, M. E. Glickman, and D. Berlowitz, “Understanding contributors to racial disparities in blood pressure control,” *Circulation*, vol. 3, no. 2, pp. 173–180, 2010.
- [6] J. M. Mellor and J. Milyo, “Exploring the relationships between income inequality, socioeconomic status and health: a self-guided tour?” *International Journal of Epidemiology*, vol. 31, no. 3, pp. 685–687, 2002.
- [7] K. L. Ong, B. M. Y. Cheung, Y. B. Man, C. P. Lau, and K. S. L. Lam, “Prevalence, awareness, treatment, and control of hypertension among United States adults 1999–2004,” *Hypertension*, vol. 49, no. 1, pp. 69–75, 2007.

- [8] J. Currie and M. Stabile, "Socioeconomic status and child health: why is the relationship stronger for older children?" *American Economic Review*, vol. 93, no. 5, pp. 1813–1823, 2003.
- [9] W. H. Frist, "Overcoming disparities in U.S. health care," *Health Affairs*, vol. 24, no. 2, pp. 445–451, 2005.
- [10] D. R. Williams and T. D. Rucker, "Understanding and addressing racial disparities in health care," *Health Care Financing Review*, vol. 21, no. 4, pp. 75–90, 2000.
- [11] S. L. Botman, T. F. Moore, and C. L. Moriarity, "Design and estimation for the National Health Interview Survey, 1995–2004," *Vital Health Statistics Series 2*, no. 130, pp. 1–31, 2000, CDC, National Center for Health Statistics.
- [12] J. A. Gazmararian, D. W. Baker, M. V. Williams et al., "Health literacy among Medicare enrollees in a managed care organization," *Journal of the American Medical Association*, vol. 281, no. 6, pp. 545–551, 1999.
- [13] D. L. Downie, D. Schmid, M. G. Plescia et al., "Racial disparities in blood pressure control and treatment differences in a Medicaid population, North Carolina, 2005–2006," *Preventing Chronic Disease*, vol. 8, no. 3, p. A55, 2011.
- [14] M. V. Williams, D. W. Baker, R. M. Parker, and J. R. Nurss, "Relationship of functional health literacy to patients' knowledge of their chronic disease: a study of patients with hypertension and diabetes," *Archives of Internal Medicine*, vol. 158, no. 2, pp. 166–172, 1998.
- [15] B. H. Brummett, M. A. Babyak, I. C. Siegler et al., "Systolic blood pressure, socioeconomic status, and biobehavioral risk factors in a nationally representative US young adult sample," *Hypertension*, vol. 58, no. 2, pp. 161–166, 2011.
- [16] N. E. Adler and J. M. Ostrove, "Socioeconomic status and health: what we know and what we don't," *Annals of the New York Academy of Sciences*, vol. 896, pp. 3–15, 1999.
- [17] K. Fiscella, P. Franks, M. R. Gold, and C. M. Clancy, "Inequality in quality: addressing socioeconomic, racial and ethnic disparities in health care," *Journal of the American Medical Association*, vol. 283, no. 19, pp. 2579–2584, 2000.
- [18] R. E. Hurley, H. H. Pham, and G. Claxton, "A widening rift in access and quality: growing evidence of economic disparities," *Health Affairs*, Web Exclusives, no. 2005, pp. W5-566–W5-576, 2005.
- [19] "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care," Institute of Medicine, 2002, <http://www.nap.edu/openbook/030908265X/html/80.html>.
- [20] J. P. Smith and R. Kington, "Race, socioeconomic status and health in late life," in *Racial and Ethnic Differences in the Health of Older Americans*, L. G. Martin and B. J. Soldo, Eds., pp. 106–162, National Academy Press, Washington, DC, USA, 1997.
- [21] L. I. Pearlin and J. S. Johnson, "Marital status, life-strains and depression," *American Sociological Review*, vol. 42, no. 5, pp. 704–715, 1977.
- [22] M. L. Thompson, J. E. Myers, and D. Kriebel, "Prevalence odds ratio or prevalence ratio in the analysis of cross sectional data: what is to be done?" *Occupational and Environmental Medicine*, vol. 55, no. 4, pp. 272–277, 1998.
- [23] Y. C. Klimentidis, A. Dulin-Keita, K. Casazza, A. L. Willig, D. B. Allison, and J. R. Fernandez, "Genetic admixture, social-behavioural factors and body composition are associated with blood pressure differently by racial-ethnic group among children," *Journal of Human Hypertension*, vol. 26, no. 2, pp. 98–107, 2011.
- [24] M. S. Mujahid, A. V. Diez Roux, R. C. Cooper, S. Shea, and D. R. Williams, "Neighborhood stressors and race/ethnic differences in hypertension prevalence (the Multi-Ethnic Study of Atherosclerosis)," *American Journal of Hypertension*, vol. 24, no. 2, pp. 187–193, 2011.
- [25] C. Russo, Z. Jin, S. Homma et al., "Race/ethnic disparities in left ventricular diastolic function in a triethnic community cohort," *American Heart Journal*, vol. 160, no. 1, pp. 152–158, 2010.
- [26] G. S. Berenson, W. Chen, P. Dasmahapatra et al., "Stimulus response of blood pressure in black and white young individuals helps explain racial divergence in adult cardiovascular disease: the Bogalusa Heart Study," *Journal of the American Society of Hypertension*, vol. 5, no. 4, pp. 230–238, 2011.
- [27] A. Selassie, C. S. Wagner, M. L. Laken, M. L. Ferguson, K. C. Ferdinand, and B. M. Egan, "Progression is accelerated from prehypertension to hypertension in blacks," *Hypertension*, vol. 58, no. 4, pp. 579–587, 2011.
- [28] C. N. Bell, R. J. Thorpe Jr., and T. A. Laveist, "Race/ethnicity and hypertension: the role of social support," *American Journal of Hypertension*, vol. 23, no. 5, pp. 534–540, 2010.
- [29] L. Franzini, J. C. Ribble, and A. M. Keddie, "Understanding the Hispanic paradox," *Ethnicity & Disease*, vol. 11, no. 3, pp. 496–518, 2001.
- [30] N. Redmond, H. J. Baer, and L. S. Hicks, "Health behaviors and racial disparity in blood pressure control in the national health and nutrition examination survey," *Hypertension*, vol. 57, no. 3, pp. 383–389, 2011.
- [31] E. Brondolo, E. E. Love, M. Pencille, A. Schoenthaler, and G. Ogedegbe, "Racism and hypertension: a review of the empirical evidence and implications for clinical practice," *American Journal of Hypertension*, vol. 24, no. 5, pp. 518–529, 2011.
- [32] J. Warren-Findlow and R. B. Seymour, "Prevalence rates of hypertension self-care activities among African Americans," *Journal of the National Medical Association*, vol. 103, no. 6, pp. 503–512, 2011.
- [33] L. Holmes Jr., W. Chan, Z. Jiang, and X. L. Du, "Effectiveness of androgen deprivation therapy in prolonging survival of older men treated for locoregional prostate cancer," *Prostate Cancer and Prostatic Diseases*, vol. 10, no. 4, pp. 388–395, 2007.

