Socioeconomic Status, Psychosocial Factors, Race and Nocturnal Blood Pressure Dipping in a Hispanic Cohort

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BACKGROUND
Little information is available about the relationship of socioeconomic status (SES) to blunted nocturnal ambulatory blood pressure (ABP) dipping among Hispanics and whether this relationship differs by race. We sought to characterize ABP nondipping and its determinants in a sample of Hispanics.

METHODS
We enrolled 180 Hispanic participants not on antihypertensive medications. SES was defined by years of educational attainment. All participants underwent 24-hour ABP monitoring. A decrease of <10% in the ratio between average awake and average asleep systolic BP was considered nondipping.

RESULTS
The mean age of the cohort was 67.1 ± 8.7, mean educational level was 9.4 ± 4.4 years, and 58.9% of the cohort was female. The cohort was comprised of 78.3% Caribbean Hispanics with the rest from Mexico and Central/South America; 41.4% self-identified as white Hispanic, 34.4% self-identified as black Hispanic, and 24.4% did not racially self-identify. The percentage of nondippers was 57.8%. Educational attainment (10.5 years vs. 8.6 years; *P* <0.01) was significantly higher among dippers than nondippers. In multivariable analyses, each 1-year increase in education was associated with a 9% reduction in the likelihood of being a nondipper (odds ratio [OR], 0.91; 95% confidence interval [CI], 0.84–0.98; *P* = 0.01). There were significantly greater odds of being a nondipper for black Hispanics than for white Hispanics (OR, 2.83, 95% CI, 1.29–6.23; *P* = 0.005). Higher SES was significantly protective of nondipping in white Hispanics but not black Hispanics.

CONCLUSIONS
These results document a substantial prevalence of nondipping in a cohort of predominantly normotensive Hispanics. Dipping status varied significantly by race. Lower SES is significantly associated with nondipping status, and race potentially impacts on this relation.

Keywords: ambulatory blood pressure monitoring; blood pressure; Hispanics; hypertension; psychosocial; race; socioeconomic status.

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Clinic blood pressure (BP) is not always representative of an individual's BP during everyday life. Twenty-four-hour ambulatory BP (ABP) monitoring is used to assess individuals' BP during normal daily activities. ABP normally shows diurnal fluctuation, with higher BP levels during the day and lower levels at night. Sustained adrenergic activity during sleep is associated with a blunting of the typical nocturnal BP reduction. Individuals whose BP remains high at night (nondippers) have more cardiovascular morbidity and mortality[1] than those with a normal diurnal pattern. Evidence regarding ABP in Hispanics is limited. Only 2 small studies, which suggest that Hispanics are more likely to be nondippers than non-Hispanic whites, exist.[2,3] However, determinants of ABP among Hispanics have been largely unexplored.

Lower socioeconomic status (SES) is associated with increased cardiovascular morbidity and mortality.[4,5] The reasons for this association are not completely understood. Sympathetic stimulation has been shown to vary with environmental exposures, such as low SES adversity.[6] It is likely that lower SES individuals are exposed to more frequent and severe stressors and thereby experience more frequent sympathetic activation. An altered autonomic tone associated with lower SES may be reflected as ABP nondipping[7–10] and be particularly important among Hispanics whom, according to the US Census, are more likely to be living in poverty than non-Hispanic whites.[11]

In addition, there is evidence that ABP nondipping may be related to adverse psychosocial factors, such as depressive symptoms and lack of social support.[12–14] However, there is little information available as to the role of psychosocial factors and SES as they relate to ABP measures among Hispanics. Furthermore, there is clear importance to

the role of race as it relates to ABP in non-Hispanic populations, with ABP nondipping being more prevalent among non-Hispanic blacks than among non-Hispanic whites.[15,16] The role of race among Hispanics as it relates to ABP has not been explored.

In this study, we further characterize ABP nondipping and its determinants in a sample of Hispanics. Our aim is to examine the association of SES and psychosocial factors with ABP nondipping. We hypothesize that lower SES, lower social support, and higher depressive symptoms are associated with greater ABP nondipping in this Hispanic cohort. As a secondary aim, we explore whether these associations vary by race.

METHODS

The Northern Manhattan Study (NOMAS) is a population-based prospective study ongoing since 1992, designed to evaluate the effects of medical, socioeconomic, and other risk factors on the incidence of cardiovascular disease and stroke in a multiethnic community cohort. The methods of recruitment and enrollment into NOMAS have been detailed elsewhere.[17] Briefly, participants were eligible if they met the following criteria: (i) had never been diagnosed with a stroke; (ii) were aged >39 years; and (iii) resided in northern Manhattan for at least 3 months in a household with a telephone. The study was approved by the Columbia University and University of Miami Institutional Review Boards. All participants gave informed consent.

Alcohol use, smoking, and body mass index (BMI) data were collected as part of NOMAS and are included as covariablees for this analysis. Alcohol use was determined by participant acknowledgement of any alcohol consumption in the previous 12 months. Smoking status was defined as ever smoked >100 cigarettes, cigars, and pipefulls in a lifetime. Height (in inches) and weight (in pounds) measurements were obtained by trained research staff with the use of calibrated scales. BMI was calculated as weight in kilograms divided by height squared in meters after transformation.

As part of this ancillary study, additional psychosocial variables, SES variables, and ABP measures were obtained on 180 Hispanic participants drawn from the NOMAS population-based sample between December 2006 and February 2011. Use of antihypertensive medication or presence of severe hypertension (based on the average of two resting BP measurements ≥220 mm Hg systolic or ≥110 mm Hg diastolic) were exclusion criteria. Most ABP measures were obtained concurrently with the Cardiovascular Abnormalities and Brain Lesions study, a separate ancillary study also based on the NOMAS cohort.[18] Race/ethnicity was based on self-identification through a series of interview questions modeled after the 2000 U.S. Census. All participants self-identified as Hispanic and were then asked to racially self-identify as black or white. It was explained that being Hispanic is an ethnicity not a race and that identifying as black Hispanic or white Hispanic is distinct from being non-Hispanic black or non-Hispanic white. Spanish versions of all questionnaires were available. All assessments were conducted by trained bilingual research staff in English or Spanish, depending on the primary language of the participant. This ancillary study was approved by the Columbia University Institutional Review Board. All participants gave informed consent to participate in the study.

ABP measures

ABP was assessed using Spacelabs Ultralite ABP monitors (Spacelabs Healthcare, Redmond, WA). The accuracy and reliability of the device have been described.[19,20] Before use, the devices were calibrated by a trained research assistant with a reference mercury sphygmomanometer with target agreement within ±5 mm Hg. An appropriately sized BP cuff was placed on the subject's nondominant arm, and the ABP monitor was programmed to automatically take a reading every 15 minutes during awake hours, and every 30 minutes during sleep. The average time-weighted awake and sleep systolic BP (SBP) and diastolic BP values were computed using participant diary-entered reports of sleep onset and wake-up times. ABP nondipping was defined as a decline in nocturnal systolic BP (SBP) of less than 10% relative to awake SBP,[21] which translates to a value >0.9 for the ratio of the mean sleep SBP to the mean awake SBP (ABP night/day ratio). Thus, individuals were assigned to 2 categories of ABP dipping pattern (dippers: ratio ≤0.90; non-dippers: ratio >0.90). This cutoff has been associated with various clinical outcomes in multiple studies.[21] Recordings were retrieved and analyzed with the aid of ABP report management system software (Spacelabs Systems).

SES and psychosocial measures

Information about educational level and income was obtained by questionnaire. Educational attainment as an SES marker strongly predicts generalized cardiovascular risk and mortality[22] and was assessed as the number of years of completed education. Family annual income was assessed from 5 categories (<\$5,000, \$5,000–\$15,999, \$16,000–\$34,999, \$35,000–\$74,999, ≥\$75,000). High education and high income status categories were defined as above the median cut-point of education (9.0 years) and income category (\$5,000–\$15,999).

Social support

The CARDIA Study Social Support Scale (CSSS) has been validated and used in previous studies.[23,24] The CSSS score was calculated using a weighted mean of instrumental support (4 items), network adequacy (4 items), emotional support (one item), and a social network index (2 items). The intent of a total CSSS score was to assess the overall amount of support available to the individual. Scores below the median cut-point total CSSS score of 2.9 were defined as low social support.

Depressive symptoms

The Center for Epidemiological Studies Depression (CES-D) self-report scale is designed to measure depressive

symptomatology.[25] The CES-D has 4 separate factors—depressed affect, somatic symptoms, positive affect, and interpersonal relations—thus encompassing the major components of depressive symptoms. Higher scores indicate a higher degree of depressive symptoms. A score of ≥16 has been used previously as the cut point for high depressive symptoms.[26,27]

Statistical analysis

Baseline characteristics of participants are presented for the overall population and compared according to dipping status using means ± SD for continuous variables and proportions for categorical variables. Differences between dippers and nondippers for each characteristic were assessed using the t test for continuous variables and the χ^2 test for categorical variables. Medians were used to define education, income, and social support where these are used as dichotomous independent variables. The ABP night/day ratio was used in the analysis as a continuous variable but was also dichotomized as described to determine ABP dipping status. Pearson correlation coefficients were used to estimate the degree of correlation between ABP night/day ratio and psychosocial and SES measures. Linear and logistic regression were used to assess the association of SES and psychosocial factors with ABP night/day ratio and ABP dipping status, respectively, both in univariable and multivariable models. To control for variables with established effects on ABP dipping, age, sex, BMI, and tobacco use were selected as covariables.[28] We conducted exploratory analyses as to whether race impacts the psychosocial and SES and ABP relationship using χ^2 models to examine the relative prevalence of ABP nondipping among the different race groups. This portion of the analysis was limited to participants who self-identified as black Hispanic or white Hispanic. We tested for an interaction of SES (using interaction terms for education and income separately) and race on ABP dipping status by introducing the interaction terms into an age- and sex-adjusted model. Statistical significance was determined at the α = 0.05 level using 2-sided tests. Statistical analyses were conducted using SAS 9.2 (SAS Institute, Cary, NC).

RESULTS

Most of the participants were elderly and female; more than half were smokers and consumed some level of alcohol. Seventy-eight percent of the sample consisted of Caribbean Hispanics (Dominican Republic, Puerto Rico, and Cuba), with the rest from Mexico and Central/South America. More than 75% of the cohort was able to self-identify race, with most participants self-identifying as white Hispanic. The cohort on average had a ninth-grade education and a mean annual income between $5,000 and $15,999. Few participants had depressive symptoms, as evidenced by a low mean CES-D score across the cohort. Almost 60% of the cohort reported high levels of social support. More than half of the cohort were nondippers. The cohort was normotensive on average, with <7% of the cohort being untreated hypertensives (Table 1).

Univariate determinants of ABP dipping status

Among the demographic characteristics, age and sex were the only consistent demographic determinants of ABP dipping status. Being male was actually protective of ABP nondipping (odds ratio [OR], 0.44; 95% confidence interval [CI], 0.24–0.80; $P < 0.01$). BMI, smoking, and alcohol use were not associated with ABP dipping status. Among the psychosocial components, CES-D or CSSS scores were not significantly different according to ABP dipping status (Table 2).

SES impact on ABP dipping

There was a moderate inverse correlation between years of education and ABP night/day ratio (Pearson $r = −0.27$; $P < 0.01$). Mean educational attainment and income level were significantly greater among dippers than among nondippers (Table 2). The percentage of subjects with high educational levels was 42% among nondippers and 59% among dippers ($P = 0.03$). Increasing income and education were each associated with lower ABP night/day ratio. Each increasing year of education or increasing category of income was associated with a 10% and 43% less likely chance of being a nondipper, respectively (Table 3). These relations persisted on multivariable analysis. After adjusting for age, sex, BMI, and tobacco use, higher-educated Hispanics had a significantly lower prevalence of nondipping than their less-educated counterparts (OR, 0.91; 95% CI, 0.84–0.98; $P = 0.01$) (Tables 4 and 5). Among those with low education, those with low income were more likely to be nondippers than those with high income (76.5% vs. 34.8%; $P = 0.0003$). Among those with high education, those with low income were no more likely to be nondippers than those with high income (56.6% vs. 38.9%; $P = 0.10$). Educational attainment was significantly associated with ABP nondipping status and day/night ratio among women but not men. Income level was significantly associated with nondipping status and ABP day/night ratio among men but not women (Table 5).

Impact of race on ABP nondipping

In this cohort of Hispanics, race was not associated with education, income, depressive symptoms, social support, alcohol, or smoking (Table 6). However, the prevalence of ABP nondipping varied significantly by race (69.4% among black Hispanics vs. 52.7% among white Hispanics; $P = 0.048$; Figure 1). There was a >2-fold odds of being a nondipper for black Hispanics vss white Hispanics after adjusting for age, sex, BMI, and tobacco use (OR, 2.83, 95% CI 1.29–6.23; $P = 0.005$). In sex-stratified models, race remained independently associated with nondipping status among men but not women. Educational levels were important in determining ABP nondipping among white Hispanics (71.4% vs. 35.9%; $P = 0.002$) but not among black Hispanics (70.6% vs. 67.9%; $P = 0.82$). Prevalence of ABP nondipping was high among black Hispanics regardless of educational level, whereas among white Hispanics ABP nondipping prevalence was high only among those with lower education (Figure 2a). Among

Table 1. Characteristics of subjects (n = 180)

Characteristic	Percentage or mean ± SD
Demographic variables	
Age, years	67.1±8.7
Female/male, %	58.9/41.1
Smoker	52.8%
Alcohol use	63.3%
Hispanic race	
White	41.1%
Black	34.4%
Other/no response	24.4%
SES and psychosocial variables	
Education, years	9.4±4.4
Income category	2.4±1.0
CES-D score	7.8±9.6
High depressive symptoms	18.0%
CSSS score	2.9±0.4
High social support	58.3%
BP components	
SBP, mm Hg	126.6±14.3
ABP night/day ratio	0.9±0.07
Nondippers	57.8%
SBP category distribution	
Normotensive	46.7%
Prehypertensive	46.7%
Hypertensive	6.7%

Abbreviations: ABP, ambulatory blood pressure; BP, blood pressure; CES-D, Center for Epidemiological Studies Depression; CSSS, CARDIA Study Social Support Scale; SBP, systolic blood pressure; SES, socioeconomic status.

participants with high income levels, black Hispanics had a higher prevalence of ABP nondipping than white Hispanics (61.1% vs. 27.6%; *P* = 0.02). All Hispanics with low income levels had a higher prevalence of ABP nondipping regardless of race (68.9% vs. 72.7%; *P* = 0.69) compared with Hispanics with high income levels (Figure 2b). For the outcome of ABP dipping status, we found a nonsignificant statistical interaction of race with education status (*P* = 0.054) and a statistically significant interaction of race with income (*P* = 0.01). In exploring SES as a potential mediator of the association of race with ABP nondipping, we did not see an association between race and education or income in this Hispanic cohort.

DISCUSSION

These data are the first to indicate that less education and less income are independently associated with more prevalent ABP nondipping in a mostly normotensive cohort of Hispanics. This study documents a 58% prevalence of ABP nondipping, which is substantial compared with studies that indicate a prevalence ranging 30%–40% among

normotensive and untreated hypertensive populations.[29,30] These results are the first to show that race is a significant determinant of ABP nondipping in a cohort of Hispanics. Black Hispanic are significantly more likely to be nondippers than white Hispanics. Furthermore, race in this cohort of Hispanics appears to significantly impact the relationship between SES and dipping.

There is a remarkable dearth of information about the prevalence and correlates of ABP nondipping among US Hispanics. Non-Hispanic blacks are more likely to be classified as nondippers than non-Hispanic whites.[15,16] Only 1 study of Mexican-Americans[2] and one small study of Caribbean Hispanics[3] suggested that Hispanics, like non-Hispanic blacks, are more likely to be nondippers than non-Hispanic whites. These studies were limited by the absence of the added dimensions of Hispanic race and SES and psychosocial factors to explore their potential relationship to ABP measures in Hispanics. Although the cause of the high prevalence of ABP nondipping in this Hispanic cohort is unclear, there is evidence among non-Hispanic blacks that the ABP nondipping pattern may be related more to adverse environmental and psychosocial factors than to genetic factors.[12,13,31] African blacks have greater nocturnal dipping than US non-Hispanic blacks, comparable with the dipping observed in US non-Hispanic whites.[32] Because US Hispanics share similar socioeconomic and environmental disadvantages with non-Hispanic blacks, this important line of thinking needs to be further studied.

In this study, ABP nondipping was independently related to SES factors, with higher education and higher income associated with a lower prevalence of nondipping in a Hispanic cohort. The reason for the effect of low SES on ABP dipping is not completely understood. It is possible that individuals with lower SES are more likely to be exposed to more frequent and severe stressors and thereby experience more frequent sympathetic activation. This chronic or even intermittent adrenergic stimulation, even in the absence of overt hypertension, may be reflected as blunted nocturnal ABP variability representing an altered sympathetic–parasympathetic balance.[8,9,33] A higher SES is associated with positive health outcomes regardless of disease,[34,35] and this effect likely derives not just from an improved health behavior profile but also secondary to decreased psychological and physiological effects of stress,[36] which involves lower exposure to stress compared with their low SES counterparts, as well as the availability of greater resources with which to cope with stress.

Studies have found that depressive disorders are related to incident cardiovascular morbidity and mortality.[37] Data show that low social support is associated with an increased likelihood of being a nondipper among non-Hispanic blacks.[24] However, our cohort of Hispanics had low levels of depressive symptoms and high levels of perceived social support, and these 2 psychosocial factors did not predict ABP dipping.

Our study reports an association between race and ABP nondipping in a Hispanics cohort. Hispanic race is infrequently reported or assessed and its impact on ABP dipping and SES and psychosocial factors is not known. Hispanics share a diverse ancestry, with varying admixture of Native American, European, and West African ancestry.[38,39] This is

Table 2. Characteristics by ambulatory blood pressure dipping status

	Dipper (n = 76)	Nondipper (n = 104)	*P* value
Demographic variables			
Age, years	65.4 ± 8.6	68.4 ± 8.6	0.02
BMI, kg/m^2	27.7 ± 3.9	27.7 ± 3.9	0.92
Male	52.6%	32.7%	0.007
Smoker	60.5%	47.1%	0.08
Alcohol use	64.5%	62.5%	0.79
SES and psychosocial variables			
Education, years	10.5 ± 4.3	8.6 ± 4.3	0.004
High education	59.2%	42.3%	0.03
Income category	2.6 ± 0.9	2.2 ± 1.1	<0.01
High income	48.7%	21.2%	0.0001
CES-D score	7.5 ± 8.9	8.1 ± 10.1	0.66
High depressive symptoms	14.7%	20.4%	0.33
CSSS score	2.8 ± 0.4	2.9 ± 0.4	0.10
High social support	42.1%	55.8%	0.07

Abbreviations: BMI, body mass index; CES-D, Center for Epidemiological Studies Depression; CSSS, CARDIA Study Social Support Scale; SES, socioeconomic status.

Table 3. Univariable predictors of ambulatory blood pressure nondipping

Variable	Regression coefficient	SE	*P* value
ABP nondipping status[a]			
Age, years	0.04	0.02	0.02
Male	−0.83	0.31	<0.01
Smoker	−0.54	0.31	0.08
Alcohol use	−0.09	0.31	0.79
BMI, kg/m^2	0.03	0.04	0.56
CES-D score	0.01	0.02	0.65
CSSS score	0.58	0.35	0.10
Income	−0.43	0.16	<0.01
Education, years	−0.10	0.04	<0.01
ABP night/day ratio[b]			
Age, years	0.002	0.0006	<0.001
Male	−0.02	0.01	0.05
Smoker	−0.01	0.01	0.21
Alcohol use	−0.002	0.01	0.82
CES-D score	0.00003	0.0005	0.95
CSSS score	0.02	0.01	0.12
Income	−0.01	0.005	<0.01
Education, years	−0.004	0.001	<0.001

Abbreviations: ABP, ambulatory blood pressure; BMI, body mass index; CES-D, Center for Epidemiological Studies Depression; CSSS, CARDIA Study Social Support Scale; SES, socioeconomic status.
[a]Outcome variable is nondipping status.
[b]Outcome variable is ABP night/day ratio.

Table 4. Multivariable predictors of ambulatory blood pressure nondipping

Variable	OR[a]	95% CIs	
High income	0.35	0.17–0.70	
High education	0.52	0.27–0.99	
Education, per year	0.90	0.84–0.97	
Income, per category	0.73	0.53–1.00	
CSSS score	1.86	0.87–3.96	
	Regression coefficient[b]	**SE**	**P value**
High income	−0.03	0.01	0.01
High education	−0.02	0.009	0.046
Income	−0.01	0.005	0.02
Education	−0.004	0.001	<0.01
CSSS score	0.02	0.01	0.19

All analyses were adjusted for age, sex, body mass index, and tobacco use.
Abbreviations: CI, confidence interval; CSSS, CARDIA Study Social Support Scale; OR, odds ratio.
[a]Outcome variable is non-dipping status.
[b]Outcome variable is ambulatory blood pressure night-day ratio.

Table 5. Multivariable predictors of ambulatory blood pressure nondipping stratified by sex

Variable	Men		Women	
	OR[a]	95% CIs	OR[a]	95% CIs
High income	0.23	0.08–0.65	0.42	0.15–1.18
High education	0.70	0.26–1.86	0.41	0.17–0.98
Education, per year	0.93	0.82–1.05	0.89	0.80–0.98
Income, per category	0.56	0.31–1.01	0.74	0.49–1.12
CSSS score	3.39	0.88–12.98	1.50	0.55–4.11
Black Hispanic vs. white Hispanic	3.71	1.10–12.57	1.41	0.55–3.62
	Regression coefficient[b]	**SE**	**P value**	**Regression coefficient[b]**	**SE**	**P value**
High income	−0.037	0.02	0.02	−0.018	0.02	0.24
High education	−0.01	0.02	0.53	−0.026	0.01	0.03
Income	−0.018	0.008	0.03	−0.01	0.006	0.10
Education	−0.004	0.002	0.05	−0.004	0.001	0.008
CSSS score	0.05	0.02	0.005	−0.002	0.01	0.91

All analyses were adjusted for age, body mass index, and tobacco use.
Abbreviations: CI, confidence interval; CSSS, CARDIA Study Social Support Scale; OR, odds ratio.
[a]Outcome variable is nondipping status.
[b]Outcome variable is ambulatory blood pressure night/day ratio.

the first study to note that black Hispanics are more prone to ABP nondipping than white Hispanics. Hispanics with greater African admixture may have more similarity in prevalence of ABP nondipping with non-Hispanic blacks than previously appreciated. Geographic ancestral origins may contribute to the differential distribution of ABP nondipping among black vs. white Hispanics. The association of lower SES with ABP nondipping in this Hispanic population seems driven by the correlation seen in white Hispanics, and the high prevalence of nondipping among black Hispanics does

not appear to be explained by SES or psychosocial factors. The role/association of African vs. European genetic ancestry specifically with regards to ABP, SES, or psychosocial factors remains to be explored. Furthermore, it is unclear whether race in the context of this study is reflecting a physiological variable or a social label. Perceived racism is a social environmental characteristic identified as a psychosocial stressor contributing to increased rates of hypertension among non-Hispanic blacks.[40,41] Among Hispanics, perceived racism may be related to both daytime and nocturnal ABP [42] and

Table 6. Characteristics of Hispanic subjects stratified by race

Variable	White Hispanic (n = 74)	Black Hispanic (n = 62)	Other/no response (n = 44)	P value[a]	P value[b]
Age, years	69.1 ± 9.3	64.4 ± 8.6	67.7 ± 6.7	<0.01	0.34
Male	43.2%	37.1%	43.2%	0.47	0.99
Alcohol use	66.2%	61.3%	61.4%	0.55	0.59
Smoker	55.4%	45.2%	59.1%	0.23	0.70
Education, years	10.0 ± 4.4	9.3 ± 4.3	8.7 ± 4.5	0.94	0.11
Income category	2.4 ± 0.8	2.4 ± 1.4	2.2 ± 0.8	0.99	0.20
CESD score	7.2 ± 8.7	7.55 ± 10.56	9.5 ± 10.7	0.94	0.21
High depressive symptoms	16.4%	16.4%	22.7%	0.99	0.40
CSSS score	2.9 ± 0.43	2.8 ± 0.43	2.8 ± 0.47	0.11	0.18
High social support	56.7%	43.6%	47.7%	0.13	0.34

[a]Comparing black Hispanic with white Hispanic.
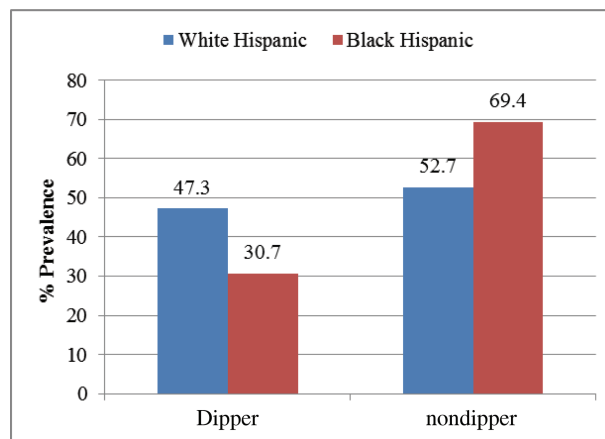[b]Comparing Other/no response with white Hispanic.

Figure 1. Proportion of participants according to ambulatory blood pressure nondipping status by race. The prevalence of nondipping depends on race. The proportion of white Hispanics was not different among dippers vs. nondippers; however, the proportion of black Hispanics more than doubles when going from dippers to nondippers.

also potentially impacted upon by race. These issues remain to be further defined.

A strength of our study is the standard and validated assessment of ABP on a Hispanic population. ABP was assessed using participant diary reports of sleep onset and wake-up times rather than arbitrary fixed-time intervals. This approach provides a more accurate assessment of ABP during sleep because waking times can vary considerably between participants. Although comprised of only 180 participants, the current study is still the largest study of diurnal ABP assessment in a Hispanic population. This is important because there is less published information about ABP dipping and other cardiovascular risk factors in this population. Another strength is the simultaneous assessment of several SES and psychosocial factors.

Several limitations must be noted. First, our study includes mostly Caribbean Hispanics, who represent only one subfraction of all Hispanics.[43] Thus our findings may not be generalizable to all Hispanics. Second, our assessment of race and ethnicity was through self-designation,

which carries limitations.[44,45] Hispanics are an admixed population, and the US concept of race being only white or black may be confusing.[46] There is discordance between understandings of race among Hispanics and the predominant US conceptualizations of this construct. Among Hispanics, the question of race is frequently confused with the question of ethnicity. Some Hispanics feel that being Hispanic is its own race and thus refuse to categorize along the US system; there is also a perception that for Hispanics to identify as black or white in the United States, he/she is attaching or aligning themselves with the US white or black community. We therefore spent considerable time with each participant to explain what was meant when we asked them to self-identify race. We did not address dietary factors or sleep quality; however the impact of these factors on ABP dipping is not clear.[9, 47–49] Lastly, a potential limitation is the exclusion of Hispanics who were not able to racially self-identify for a portion of the analysis. The prevalence of nondipping in this "Other/No Response" group was exactly 50%. In additional regression models that included "Other/
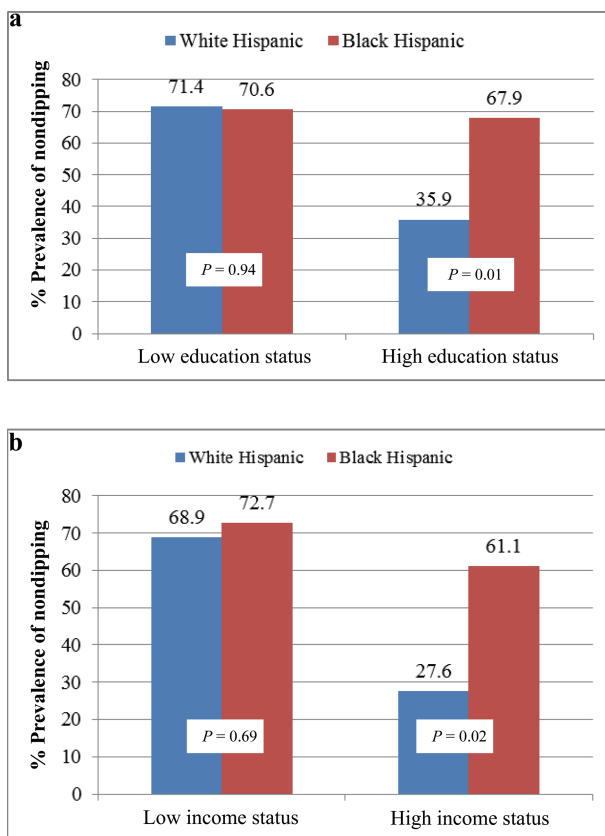
Figure 2. Differences in dipping status by race and education and race and income. (**a**) Prevalence of ambulatory blood pressure (ABP) nondipping was high among black Hispanics regardless of educational level, whereas among white Hispanics, ABP nondipping prevalence was high only among those with lower education. (**b**) Among participants with high income levels, being black Hispanic was associated with more prevalent ABP nondipping compared with white Hispanic. All Hispanics at low income levels regardless of race had a similar prevalence of ABP nondipping.

No Response" as a separate category, the odds of being a nondipper for black Hispanics (OR, 2.8; 95% CI, 1.3–6.2) compared with white Hispanics remained similar to what was seen in the original analysis. The "Other/No Response" group did not predict ABP dipping in this model.

In conclusion, our study contributes to the growing body of research on Hispanic cardiovascular health and extends the understanding of SES and race differences in ABP dipping. In a predominantly normotensive Hispanic cohort, we documented a substantial prevalence of ABP nondipping, particularly among black Hispanics and showed that lower SES is a predictor of dipping status. In this cohort of Hispanics, race potentially impacts the relation of SES with nocturnal ABP dipping. With regards to ABP, black and white Hispanics may have commonalities with their non-Hispanic counterparts that have previously been underappreciated. This implies that conclusions made about the health status of Hispanics should incorporate the assessment of race in this population.

DISCLOSURES

The authors declared no conflict of interest.

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