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Racial Differences in the Impact of Social Support on Nocturnal Blood Pressure

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Abstract

Objective—To investigate whether black and white adults benefit similarly from perceived social support in relation to blood pressure (BP) dipping during sleep.

Methods—The Interpersonal Support Evaluation List (ISEL, 12-item version), which measures the perceived availability of several types of functional social support, was examined for interactive effects with race on dipping of mean arterial pressure (MAP), systolic blood pressure (SBP), and diastolic blood pressure (DBP) derived from 24-hour ambulatory blood pressure monitoring (ABPM). The sample consisted of 156 young to middle-aged adults (61 blacks, 95 whites; mean age = 35.7 years).

Results—Mean ISEL scores did not differ between racial groups. Controlling for age, body mass index (BMI), resting BP, and socioeconomic status (SES), the interaction of social support by race yielded associations with nighttime dipping in MAP and DBP ($p < .001$) as well as SBP ($p < .01$). As ISEL scores increased among white participants, the extent of dipping increased in MAP, SBP, and DBP ($p < .01$), explaining 10%, 10%, and 8% of the variance, respectively. Conversely, black participants exhibited associations between increasing ISEL scores and decreasing levels of dipping in MAP, SBP, and DBP ($p < .05$), accounting for 9%, 8%, and 8% of the variance, respectively.

Conclusion—As perceived social support increased, white adults received cardiovascular benefits as suggested by enhanced nocturnal dipping of BP, but black adults accrued risks as evidenced by blunted declines in BP during sleep.

Keywords

social support; nocturnal dipping; ambulatory blood pressure; racial differences

INTRODUCTION

Blacks in the US have disproportionately high rates of cardiovascular morbidity and mortality, especially at younger ages (1,2). Similarly, black adults demonstrate higher

nighttime blood pressure (BP) and experience less of the decrease in BP that usually occurs during sleep (i.e., nocturnal dipping) compared with white adults (3,4). BP decline during sleep seems to occur, in part, via reduced sympathetic nervous system activity and it may play a role in the regulation of daytime BP (5). Growing evidence suggests that blunted nighttime dipping in BP predicts increased morbidity and mortality among both hypertensive and normotensive individuals (6,7), with increased target organ damage (e.g., left ventricular hypertrophy, subclinical atherosclerosis, diabetic neuropathy, renal insufficiency) as well as increased risk for stroke and cardiac death (8–11). For example, a 9-year prospective study revealed that the risk of cardiovascular mortality in adults >40 years old increased by 20% for each 5% reduction in nocturnal dipping of systolic BP (SBP) or diastolic BP (DBP), regardless of normotensive or hypertensive status (12).

The pathophysiological origins of racial differences in BP dipping during sleep are not well understood. Although genetic factors likely influence nocturnal decline in BP, the extent of such influence on these black-white differences is unclear. Moreover, studies indicate no significant differences in nighttime BP decline between whites in the US and adults of African descent in other countries. This suggests the blunted BP dipping among blacks in the US likely has some nongenetic influences, such as psychosocial factors (4).

The substantial clinical and laboratory research that has investigated psychosocial vulnerability and resiliency in cardiovascular health (13,14) is complemented by a promising literature involving “real world” assessments of ambulatory BP (15–19). However, few ambulatory studies have examined psychosocial influences on nighttime BP dipping (6,20–23), with even less information available on possible racial differences in such associations (16,24).

A large body of evidence indicates that people with greater levels of structural and perceived functional social support often exhibit favorable cardiovascular outcomes (14,25–27), including lower ambulatory BP (15,17). Whereas structural support refers to the quantity of social relationships (e.g., number of members in a social network) rather than quality, functional support describes the perceived availability of specific types of support (e.g., emotional empathy, tangible aid, help in decision-making) from members of one’s social network (26). Little is known about how perceived functional support relates to sleep-related declines in BP and how this association might vary by race. Although functional support has been shown to be at similar levels in black and white adults (16), its associations with nocturnal dipping in each group might be influenced by racial differences in physiological (e.g., body mass index (BMI)) and psychosocial factors (e.g., socioeconomic status (SES), discrimination, socioenvironmental stressors) that have been associated with BP (25,28–32). The limited information available on social support and nocturnal dipping indicates an association between greater functional support and greater SBP dipping among samples of young adults (16) and older black adults (33), after adjustment for demographic and physiological covariates. However, research has not examined potential black-white differences in the impact of perceived support on BP dipping. Given the racial disparities in cardiovascular disease and nighttime BP, this study investigated whether blacks and whites benefit similarly from perceived availability of social support with regard to nocturnal BP dipping.

METHODS

Participants

The sample consisted of 156 employed (>30 hours/week), young to middle-aged black and white adults, who were recruited by community advertisements or referrals to participate in a larger cardiovascular study between 2001 and 2007. It included 61 black adults (37 women, 24 men) and 95 white adults (44 women, 51 men) with upper, middle, and lower SES. Although 14% of participants had mild primary hypertension, the sample was otherwise healthy and medication free, as determined by a physician's evaluation of medical histories and physical status. Excluded were persons with diagnoses of secondary hypertension, diabetes (or a fasting glucose of >120 mg/dl), morbid obesity (BMI ≥ 40 kg/m²), or any other major medical or psychiatric condition. Also excluded were those persons with known sleep disorders (e.g., narcolepsy), current drug or alcohol abuse, creatinine levels >1.4 mg/dl, proteinuria, hematuria, or renal bruit on examination. Women were ineligible if they were pregnant, postmenopausal, taking oral contraceptives, or diagnosed with premenopausal syndrome. Racial group membership was based on self-report. Informed consent was obtained in accordance with the Institutional Review Board of the University of California, San Diego.

Procedures

During two screening sessions, participants underwent a variety of tests, including an evaluation of medical status (physical examination/medical history to screen for exclusions), assessment of resting BP and BMI as well as completion of demographic and psychosocial questionnaires. After being equipped with an ambulatory BP monitoring (ABPM) device, participants wore the monitor for 24 hours during which they carried on normal activities at work and at home.

Measures

Interpersonal Support Evaluation List (ISEL)—The ISEL has been widely used to measure perceptions about the availability of multiple types of functional support from members of social networks (34,35). The shortened 12-item version of the ISEL includes “appraisal,” “belonging,” and “tangible” items that assess the degree to which respondents believe they have someone to confide in about personal problems, companions for activities, and sources of material assistance, respectively. Items are rated on a 4-point Likert scale ranging from “1” (definitely false) to “4” (definitely true) and summed (after appropriate reverse coding) to produce a total ISEL score ranging from 12 to 48, with higher scores indicating higher perceived support. It exhibits good internal consistency in ethnically diverse healthy and medical samples (Cronbach's $\alpha = 0.80\text{--}0.90$) [available at <http://www.psy.cmu.edu/~scohen/under> the “scales” section] and in the current sample (overall Cronbach's $\alpha = 0.86$; blacks = 0.84; whites = 0.86). Total ISEL scores were used in the primary analyses. However, the ISEL also was decomposed into its three subscales to aid in interpretation.

ABPM

ABPM was conducted for a 24-hour period to assess participants' "real world" BP throughout a workday and night's sleep at home. Using a cuff outlined in ink on the skin (to help participant maintain proper positioning of cuff), the participant's monitor (Model 90207, Spacelabs, Redmond, Washington) was programmed to measure BP at 15-minute intervals between 6 AM and 10 PM and at 30-minute intervals between 10 PM and 6 AM. ABPM artifacts were detected through standard Spacelab default and visual inspection: any BP reading differing by >35 mm Hg from one reading to the next reading was thus deleted. Measures of dipping for SBP, DBP, and mean arterial pressure (MAP) were each calculated as average wake level minus average sleep level. The "sleep" period was based on each participant's self-reported bedtime and awakening during the 24-hour monitoring. Nocturnal dipping defined in this manner produces BP measures with adequate reliability (36).

Demographic and Physiological Covariate Measures

In addition to age, the covariates included BMI, resting BP, and SES. BMI was derived from weight and height measured on a calibrated scale to the nearest 0.1 kg and 0.1 cm, respectively. Three measures of resting SBP and DBP were obtained after 5 minutes of seated rest with a Dinamap 1846x monitor (Critikon; Tampa, Florida) and then utilized to estimate three MAP readings. These three readings for SBP, DBP, and MAP were each averaged to compute resting levels for the respective BP parameter. SES was assessed with the widely used Hollingshead Two Factor Index of Social Position (37), which sums weighted values (1 to 7) applied to occupational and educational levels. It provides a continuous social index score ranging from 11 to 77, with lower scores representing higher SES. Social index corresponds to social class categories I–IV, which were collapsed as follows for characterization of the sample: I/II (upper); III (middle); and IV/V (lower). However, all analyses utilized the continuous social index measure for SES.

Statistical Analysis

The primary analyses were a series of hierarchical multiple regressions, which examined race, perceived social support (i.e., continuous ISEL total scores), and the social support by race interaction as predictors of three criterion variables: SBP, DBP, and MAP dipping (i.e., continuous measures of wake minus sleep levels of BP). Considering the statistical power available, covariates of age, BMI, resting BP, and SES were selected based on: a) prior research indicating these factors show associations with BP dipping (6,23,38) and b) the criteria of significant group differences and/or correlations with the key variables of interest. The following variables did not meet the criteria for inclusion in the primary analyses but were considered in exploratory analyses: gender, smoking, apnea-hypopnea index (i.e., apneas plus hypopneas per hour of sleep), and exercise (i.e., Leisure Time Exercise Questionnaire scores) (39).

To reduce skewness, square root transformed values for ISEL total, age, and BMI were used in all regression analyses. All other variables were analyzed in raw form. Regression residuals indicated that the DBP and MAP dipping measures of two cases were possible outliers (>3 standard deviations), but they do not seem to be the result of equipment

malfunction or data entry error. Analyses were performed both with and without these possible outliers included in the sample.

Regression analyses were conducted separately for each BP parameter, with the previously described covariates on Step 1, race on Step 2, ISEL total scores on Step 3, and finally, the ISEL by race interaction on Step 4. Interactive effects were further examined by a subsequent series of race-stratified regressions. These separate regressions on blacks and whites consisted of the aforementioned covariates entered on the first step and ISEL scores entered on the final step.

RESULTS

Table 1 shows sample and group characteristics as well as group differences. Mean ISEL scores did not differ by racial group. However, *t* tests show black participants were slightly older and had lower SES (p values $< .05$), higher BMI ($p < .001$), and higher mean SBP, DBP, and MAP during sleep (p values $< .001$) as well as less dipping in SBP, DBP, and MAP (p values $< .001$) compared with white counterparts.

Table 2 shows simple correlations among variables evaluated for the primary study. Of the covariates, SES showed the greatest number of simple correlations, such that higher SES was associated with higher social support ($p < .001$), white racial group ($p < .05$), and having greater dipping in SBP ($p < .01$), DBP, and MAP (p values $< .001$).

Regressions of ISEL, race, and ISEL by race on SBP, DBP, and MAP dipping were conducted both with the full sample and with removal of two cases previously described as potential outliers for DBP and MAP dipping. Removal of these cases did not alter the results. Thus, these cases were retained and the analyses summarized below are based on the full sample.

As detailed in Table 3, the initial regression models revealed that dipping levels of the three BP variables each showed a main effect of race (p values $< .001$) and ISEL scores (p values $< .01$). Moreover, Table 3 shows that ISEL scores interacted with race to predict dipping in MAP ($p < .001$), SBP and DBP (p values $< .01$) models adjusted for age, BMI, resting BP, and SES. To further clarify the ISEL by race effects on nocturnal BP dipping, a subsequent series of race-stratified multiple regressions are detailed in Table 4. Among white participants, perceived social support explained an additional 10%, 10%, and 8% of the variance in MAP, SBP, and DBP dipping (p values $< .01$), respectively, over and above the variance accounted for by age, BMI, resting BP, and SES. Moreover, the full regression models were significant for dipping in MAP ($F(5,89) = 4.23, p < .01, R^2 = .19$), SBP ($F(5,89) = 2.87, p < .05, R^2 < .14$), and DBP ($F(5,89) = 5.13, p < .001, R^2 = .22$) among whites.

Table 4 indicates that perceived social support also was predictive of MAP, SBP, and DBP dipping (p values $< .05$) among black participants and explained an additional 9%, 8%, and 8% of the variance, respectively, beyond the variance accounted for by covariates. The full regression models were significant for dipping levels of MAP ($F(5,55) = 3.02, p < .05, R^2$

= .22), SBP ($F(5,55) = 2.53, p < .05, R^2 = .19$), or DBP ($F(5,55) = 3.00, p < .05, R^2 = .21$) among blacks.

The β weights (standardized regression coefficients) shown in Table 4 indicate that racial groups showed associations in different directions. Figure 1 plots the regressions of race by social support (using raw ISEL scores) on nocturnal dipping. As social support increased, the amount of dipping in SBP, DBP, and MAP increased among whites but decreased among blacks.

To better understand the paradoxical findings among black participants, a series of separate exploratory regressions (analyses not shown) were conducted in which the model for MAP (which partially reflects SBP and DBP) dipping was altered to include the original set of covariates (i.e., age, BMI, resting BP, and SES) plus one of seven potential confounders. The covariates explored were gender, smoking, exercise, apnea-hypopnea index, and hypertension status as well as ethnic discrimination and socially desirable response bias. With black participants showing higher levels of perceived ethnic discrimination (mean = 3.5 versus 2.5, $p < .001$ on Scale of Ethnic Experience-Perceived Discrimination subscale) (40) and greater tendency to give socially desirable responses (mean = 19.5 versus 17.0, $p < .05$ on Marlowe Crowne Social Desirability Scale) (41) than white participants, these covariates were explored due to their potential influence on self-reported social support, stress levels, and BP (6,14,20). Data indicate these seven exploratory covariates had virtually no impact on the aforementioned results when separately added to the adjusted models for MAP dipping in blacks. Exploration of Pearson's correlations (data not shown) revealed that neither BP dipping nor social support were related to socioenvironmental factors of household crowding (i.e., people per rooms in home) (42) or neighborhood stressors (i.e., Neighborhood Problems Scale) (43) among a subsample of 44 black and whites (p values $> .05$).

To elucidate the underlying links between ISEL total scores and BP dipping, these measures were decomposed (Table 5) to detail how the functions of social support were related to waking versus sleeping BP. Stronger perceived availability of someone to confide in about difficulties (i.e., ISEL-Appraisal) was significant for simple correlations with decreased SBP dipping among blacks ($p < .05$) as well as increased dipping and decreased mean levels of all BP parameters during sleep among whites (p values $< .01$). Simple correlations also suggest that access to material assistance (i.e., ISEL-tangible) was associated with increased DBP during waking and sleeping hours in blacks (p values = .06–.07), but with decreased sleeping levels of SBP and MAP (p values $< .05$) and increased nocturnal dipping in SBP, MAP (p values $< .05$), and DBP ($p = .05$) in whites. Although availability of companions for activities (i.e., ISEL-Belonging) was significantly correlated with increased dipping of all BP parameters among whites, it showed no effects on dipping among blacks and no simple correlations with sleeping or waking BP in either racial group.

Given the relatively few correlations for black participants in Table 5, an exploratory regression was run separately for each of the ISEL subscales on MAP dipping in these participants (data not shown). The only model that reached significance indicated that

increasing ISEL-Appraisal scores predicted decreased MAP dipping in black adults, controlling for age, BMI, resting MAP, and SES ($p < .01$).

DISCUSSION

Research suggests that perceived functional support not only influences cardiovascular functioning when awake and actively engaging in the social environment but also during sleep (15–17). However, social support is a complex construct with multiple qualitative dimensions that could affect populations differently. We examined whether blacks and whites would show similarly enhanced reductions of BP during sleep in association with higher functional support. Increases in ISEL scores predicted levels of SBP, DBP, and MAP dipping that were enhanced among whites but diminished among blacks. Thus, results suggest that stronger perceived availability of functional support operated as a resiliency characteristic among white adults but conferred vulnerability on cardiovascular functioning among black adults.

These racial variations in the effects of social support on BP dipping are challenging to explain. Consistent with Ituarte et al. (16), black and white participants did not differ in their mean levels of perceived social support and the ISEL scale showed similarly high reliability across racial groups. Moreover, the exploratory regression models for MAP dipping in blacks revealed that adding separate adjustments for a variety of other factors (i.e., gender, smoking, sleep apnea, exercise, hypertension, ethnic discrimination, socially desirable response bias) to the primary set of covariates (age, BMI, resting BP, SES) had virtually no impact on the results. Despite the potential influence of chronic stress on sympathetic arousal and coping demands, our exploratory analyses found that socioenvironmental stressors (i.e., neighborhood problems, household crowding) were not associated with either BP dipping or social support. Whereas our exploratory analyses should be interpreted with caution due to reduced statistical power, these demographic, health, and socioenvironmental factors examined as covariates do not seem to account for the paradoxical relationship between greater perceived functional support and diminished BP dipping among blacks.

Table 5 decomposes the associations between BP dipping and ISEL scores into simple correlations of waking and sleeping BP with the ISEL's three dimensions of functional support: having someone to confide in about problems (i.e., appraisal); companions for activities (i.e., belonging); and sources of material assistance (i.e., tangible). These indicate that white participants showed beneficial associations between BP dipping and all three forms of functional support. Surprisingly, this seems to be driven by favorable effects on BP during sleep rather than when the participants were awake and interacting with others. Little is known about how support affects BP when one is awake versus asleep, but these data among whites suggest that it could be influential on BP regulatory systems as the body undergoes a variety of restorative processes during sleep.

On the other hand, black participants exhibited notably fewer simple correlations among these variables (Table 5). Data indicated that those who reported stronger perceptions that they have someone to turn to for material assistance and to confide in exhibited higher sleeping and waking levels of DBP and more blunted dipping in SBP, respectively. black

adults showed no simple correlations between BP measures and availability of companions for activities. This group may have shown relatively few associations in Table 5, because the relationships between social support and the BP measures among blacks are too complex to be sufficiently captured by simple correlations without adjustment for confounders. Particularly important was lower SES, which was correlated with lower functional support (Table 2). The regressions of ISEL total scores on BP dipping in blacks did not reach significance without controlling for differences in SES. Whereas SES was marginal in the regression model for DBP sleep-related decline in whites, lower SES was significantly related to reduced dipping in SBP, DBP, and MAP among blacks (Table 3). Exploratory regressions of ISEL subscales on MAP dipping in blacks suggested that our primary findings for this group are driven by an association between reduced BP dipping and increased availability of confidants to discuss problems, but only after controlling for SES.

The available data cannot explain why perceived functional support seemingly benefited white adults and adversely affected black adults. Whereas the literature largely focuses on the benefits of social ties, recognition is growing that a complex set of factors influence whether a particular individual is helped or hindered by these relationships (13). For example, social interactions with network members that involve negative outcomes, such as conflict, criticism, and excessive demands, can result in “social strain” (30). Higher social strain is found among those with lower SES (32), but little is known about how social strain might vary by race. Some evidence suggests that blacks may rely more heavily on family members for support than whites (28). Moreover, negative social interactions might occur more often with family members than with friends and adverse exchanges may be more common when needs for support overtax the resources of members of the social network (29). If interpersonal interactions were frequently stressful between black participants and people they relied on for support (e.g., discussing personal problems), their higher social strain may have negated the potential cardiovascular benefits of social support. Other aspects of support not measured in the current study also could be relevant, such as utilization of resources. Although perceived social support was similar among blacks and whites in this study and in the research of Ituarte et al. (16), some work suggested that blacks may be less likely than whites to actually seek and/or obtain support from available resources (31). Like social strain, insufficient utilization of needed social resources might contribute to elevated stress levels and the sympathetic arousal that influences BP. Overall, the paradoxical findings among blacks illustrate the need to consider more textured ways of examining the dimensions of social relationships in future research on links between social support and cardiovascular outcomes.

The current study differed from the investigation by Rodriguez and colleagues (33), who found that lower scores on a measure of emotional support and social network adequacy predicted nondipping (<10% nighttime decrease) of SBP among older black adults. In addition to utilizing a younger sample and a different measure of social support, the current work differed from that investigation by assessing BP dipping with continuous measures and using stricter exclusion criteria resulting in a healthier sample. However, the differences between the two studies also might reflect cohort variations. As Dressler noted (25), social and cultural changes in recent decades may contribute to generational differences in how social support is perceived and utilized, particularly among blacks (e.g., pre and post Civil

Rights era). These and other sociocultural factors (e.g., cultural values, community characteristics) might contribute to racial differences in associations between social support and cardiovascular processes. Future research should consider these influences and other psychosocial factors (e.g., attachment style, autonomy needs, dispositional hostility) to better elucidate how cardiovascular functioning is affected by the degree to which subjects appraise their social resources as functionally supportive. These appraisals occur in the context of a network of complex social relationships that may not only be adaptive in providing support but can also be detrimental (e.g., marital conflict) by increasing distress (14,22,27).

Several limitations of this study should be noted. Replication with a larger sample is needed, as it is possible that our findings occurred by chance. Although statistical power was sufficient for the primary analyses, it was reduced in the exploratory tests of other potential confounders. Nevertheless, the findings are fairly robust, with social support predicting nocturnal dipping of SBP, DBP, and MAP in both groups after adjustment for age, BMI, resting BP, and SES. Although gender was not a significant covariate in the exploratory regressions among black participants, additional research is needed to assess more directly how the associations between social support and BP dipping among blacks and whites might vary by gender. Other limitations could be due to the measures utilized in the study. For example, the measures of social support and SES that were used are both well established, but neither is able to capture every dimension that might be potentially relevant to BP dipping. Although several socioenvironmental stressors (e.g., discrimination, neighborhood problems, home crowding) were explored, the study might have been strengthened by directly assessing perceived stress levels, which could have influenced BP.

The current work on relatively healthy young to middle-aged black and white adults may have limited generalization to other populations. It is also possible that the inclusion of mildly hypertensive participants might have influenced the results. However, this seems unlikely because hypertensive participants were medication free; all primary regressions were adjusted for resting BP; and hypertension was controlled for in exploratory regressions among blacks. For dipping, we used continuous measures based on self-reports of sleep-wake periods to avoid the poor reproducibility of categorical dipping measures (e.g., dippers versus nondippers) and to capture the variations that are lost when a standard time frame is imposed to define sleep (36). Given the lack of an established optimal approach for defining BP dipping (7), it may be difficult to compare the current study to others using a different methodology. Finally, the cross-sectional, correlational nature of the study does not allow for temporal or causal determinations. Whereas it seems unlikely that the asymptomatic decline in BP during sleep would influence perceptions about available social resources, the current data are not sufficient to determine if perceived social support caused the observed variations in BP dipping.

In sum, black participants exhibited smaller declines in BP during sleep than white participants did. These racial differences were modest at lower levels of perceived functional support. However, as perceived support increased, blacks accrued risks as suggested by decreased dipping in BP, whereas their white counterparts received cardiovascular benefits as indicated by increased dipping. These findings are important in light of the poorer

cardiovascular outcomes among black adults and the prognostic implications of reduced BP dipping for cardiovascular disease. Further research is needed to clarify the determinants of who may or may not derive cardiovascular benefits from particular types of social support, which in turn could provide the groundwork to develop interventions targeting the physiological systems involved in BP regulation.

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Glossary

BP	blood pressure
ISEL	Interpersonal Support Evaluation List
MAP	mean arterial pressure
SBP	systolic blood pressure
DBP	diastolic blood pressure
BMI	body mass index
SES	socioeconomic status
ABPM	ambulatory blood pressure monitoring

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Figure 1.

Social support (raw ISEL scores) by race on A) SBP, B) DBP, and C) MAP dipping. Greater support predicted greater dipping in white adults, but less dipping in black adults. ISEL = Interpersonal Support Evaluation List; SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure.

TABLE 1

Sample Characteristics (Raw Scores) and Group Differences

	Total, <i>n</i> = 156 (52% Women)	Black Adults, <i>n</i> = 61 (61% Women)	White Adults, <i>n</i> = 95 (46% Women)
ISEL total	28.57 ± 5.79	28.16 ± 6.08	28.84 ± 5.61
Age (yrs) *	35.68 ± 8.36	37.47 ± 8.25	34.52 ± 8.27
BMI (kg/m ²) **	26.37 ± 4.73	28.49 ± 4.95	24.99 ± 4.04
SES: Social index *	38.25 ± 14.71	41.81 ± 14.37	35.94 ± 14.53
Upper social class: I, II (%)	27%	18%	32%
Middle social class: III (%)	39%	39%	39%
Lower social class: IV, V (%)	34%	43%	29%
Hypertensive (%) *	14%	21%	10%
Current smoker (%)	17%	19%	16%
LTEQ weekly exercise total	46.21 ± 38.67	39.40 ± 37.99	50.38 ± 38.71
Apnea-hypopnea index	6.66 ± 6.30	6.73 ± 6.19	6.61 ± 6.40
Resting SBP (mm Hg)	123.39 ± 14.52	125.39 ± 15.83	122.09 ± 13.52
Resting DBP (mm Hg)	73.07 ± 9.37	74.61 ± 9.98	72.08 ± 8.86
Resting MAP (mm Hg)	89.85 ± 10.10	91.53 ± 10.88	88.75 ± 9.46
ABPM day SBP (mm Hg)	119.67 ± 9.57	120.37 ± 11.85	119.21 ± 7.77
ABPM day DBP (mm Hg)	74.32 ± 8.27	74.66 ± 10.38	74.09 ± 6.59
ABPM day MAP (mm Hg)	89.43 ± 8.31	89.83 ± 10.76	89.18 ± 6.27
ABPM night SBP (mm Hg) **	106.97 ± 10.50	110.95 ± 12.25	104.38 ± 8.26
ABPM night DBP (mm Hg) **	61.68 ± 8.76	64.72 ± 9.90	59.70 ± 7.33
ABPM night MAP (mm Hg) **	76.89 ± 8.90	80.14 ± 10.51	74.77 ± 6.96
SBP day-night dipping (mm Hg) **	12.47 ± 7.14	9.19 ± 6.84	14.62 ± 6.53
DBP day-night dipping (mm Hg) **	12.55 ± 6.60	9.91 ± 6.14	14.28 ± 6.34
MAP day-night dipping (mm Hg) **	12.46 ± 6.43	9.65 ± 6.21	14.30 ± 5.91

Data shown as mean ± standard deviation, unless otherwise noted.

Racial group differences:

*
p < .05;**
p < .001.

ISEL = Interpersonal Support Evaluation List; BMI = body mass index; SES = socioeconomic status; SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure; ABPM = ambulatory blood pressure monitoring.

TABLE 2

Correlations (r) of Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. ISEL total	—	0.06	0.11	0.16*	0.15 [†]	-0.01	-0.09	-0.36**	-0.11	0.05	-0.02	0.03	-0.08	0.02	-0.11
2. Race		—	0.37**	0.33**	0.36**	-0.17*	-0.37**	-0.20*	-0.11	-0.13	-0.14	-0.15	-0.05	-0.01	0.14
3. SBP dipping			—	0.85**	0.91**	-0.09	-0.23*	-0.26*	0.01	-0.04	-0.02	0.05	-0.03	-0.07	-0.05
4. DBP dipping				—	0.97**	-0.17*	-0.28**	-0.35**	-0.04	-0.03	-0.03	0.02	-0.03	-0.03	-0.05
5. MAP dipping					—	-0.11	-0.25*	-0.32**	0.01	-0.02	-0.01	0.01	-0.03	-0.03	-0.03
6. Age						—	0.25*	0.09	0.17*	0.30**	0.26*	0.10	0.09	0.25*	0.09
7. BMI							—	0.13	0.30**	0.34**	0.35**	0.02	-0.02	0.23*	-0.22*
8. SES								—	0.04	-0.10	-0.04	0.04	0.35**	0.04	0.11
9. Resting SBP									—	0.66**	0.88**	0.38**	0.02	0.24*	0.04
10. Resting DBP										—	0.93**	0.27*	-0.04	0.20*	-0.01
11. Resting MAP											—	0.35**	-0.01	0.24*	0.01
12. Gender												—	-0.03	-0.23*	-0.21*
13. Smoking													—	0.03	0.06
14. Apnea-hypopnea														—	0.02
15. Exercise															—

*
 $p < .05$;**
 $p < .001$;[†]
 $p < .06$ (two-tailed). Lower SES is reflected by higher Hollingshead social index scores.

ISEL = Interpersonal Support Evaluation List; SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure; BMI = body mass index; SES = socioeconomic status.

TABLE 3

Regressions of Social Support $\times$ Race on Nocturnal BP Dipping ($n = 156$)

DV	Step	Predictor	R ²	F	B (SE)	β	p
SBP dipping (mm Hg)	1)	Covariates	0.11	4.80			
		a) Age			-0.24 (0.75)	-0.02	.75
		b) BMI			-1.41 (1.31)	-0.09	.29
		c) Resting SBP			0.04 (0.04)	0.09	.26
		d) SES			-0.08 (0.04)	-0.17	.03*
	2)	Race	0.08	13.79	6.86 (1.48)	0.94	<.001**
	3)	ISEL total	0.01	0.56	-6.58 (2.10)	-0.95	.002*
	4)	ISEL total $\times$ race	0.06	11.65	1.70 (0.50)	1.19	.001*
DBP dipping (mm Hg)	1)	Covariates	0.19	8.56			
		a) Age			-0.95 (0.69)	-0.10	.17
		b) BMI			-1.96 (1.20)	-0.13	.10
		c) Resting DBP			0.05 (0.06)	0.07	.37
		d) SES			-0.12 (0.03)	-0.26	.001*
	2)	Race	0.03	6.53	5.83 (1.34)	0.87	<.001**
	3)	ISEL total	0.01	0.55	-6.30 (1.89)	-0.99	.002*
	4)	ISEL total $\times$ race	0.06	13.08	1.62 (0.45)	1.24	.001*
MAP dipping (mm Hg)	1)	Covariates	0.15	6.76			
		a) Age			-0.56 (0.72)	-0.05	.53
		b) BMI			-3.00 (1.20)	-0.11	.18
		c) Resting MAP			0.06 (0.05)	0.09	.23
		d) SES			-0.10 (0.03)	-0.22	.007*
	2)	Race	0.06	10.52	6.03 (1.31)	0.92	<.001**
	3)	ISEL total	0.01	0.59	-6.07 (1.86)	-0.98	.001*
	4)	ISEL total $\times$ race	0.06	12.82	1.57 (0.44)	1.23	<.001**

Age, BMI, and ISEL scores were square root transformed for regression analyses.

* $p < .05$;

^{**} $p < .001$. Lower SES is reflected by higher Hollingshead social index scores.

DV = dependent variable; SE = standard error; SBP = systolic blood pressure; BMI = body mass index; SES = socioeconomic status; ISEL = Interpersonal Support Evaluation List; DBP = diastolic blood pressure.

TABLE 4
Hierarchical Regression Models by Race for Perceived Social Support as a Predictor of Nocturnal Dipping

DV	Step	Predictor	Black Adults (n = 61)					White Adults (n = 95)				
			R ²	F	B (SE)	β	p	R ²	F	B (SE)	β	p
SBP dipping (mm Hg)	1)	Covariates	0.11	1.75				0.04	1.00			
		a) Age			-0.99 (1.25)	-0.10	.43			0.42 (0.98)	0.05	.67
		b) BMI			-1.70 (2.00)	-0.11	.40			-1.11 (1.87)	-0.07	.55
		c) Resting SBP			0.01 (0.06)	0.03	.82			0.06 (0.05)	0.12	.28
		d) SES			-0.16 (0.07)	-0.32	.02*			-0.03 (0.05)	-0.07	.53
DBP dipping (mm Hg)	2)	ISEL total	0.08	5.14	-1.82 (0.81)	-0.29	.03*	0.10	10.00	2.20 (0.70)	0.33	.002**
	1)	Covariates	0.13	2.14				0.14	3.94			
		a) Age			-0.20 (1.12)	-0.02	.86			-1.10 (0.92)	-0.12	.23
		b) BMI			-0.50 (1.74)	-0.04	.78			-3.13 (1.84)	-0.19	.09
		c) Resting DBP			-0.01 (0.08)	-0.01	.94			0.10 (0.08)	0.14	.23
MAP dipping (mm Hg)		d) SES			-0.19 (0.06)	-0.43	.002**			-0.08 (0.04)	-0.19	.056
	2)	ISEL total	0.08	5.72	-1.67 (0.70)	-0.30	.02*	0.08	8.60	1.89 (0.64)	0.29	.004**
	1)	Covariates	0.13	2.10				0.09	2.35			
		a) Age			0.28 (1.13)	0.03	.80			-0.47 (0.86)	-0.06	.59
		b) BMI			-0.30 (1.76)	-0.02	.87			-2.40 (1.73)	-0.16	.17
MAP dipping (mm Hg)		c) Resting MAP			0.00 (0.07)	0.00	.98			0.10 (0.07)	0.17	.14
		d) SES			-0.20 (0.06)	-0.45	.001**			-0.05 (0.04)	-0.12	.22
	2)	ISEL total	0.09	5.92	-1.72 (0.71)	-0.31	.018*	0.10	10.74	2.00 (0.61)	0.33	.001**

Age, BMI, and ISEL scores were square root transformed for regression analyses.

* $p < .05$;

** $p < .01$. Lower SES is reflected by higher Hollingshead social index scores.

DV = dependent variable; SE = standard error; SBP = systolic blood pressure; BMI = body mass index; SES = socioeconomic status; ISEL = Interpersonal Support Evaluation List; DBP = diastolic blood pressure; MAP = mean arterial pressure.

TABLE 5

Pearson's Correlations (*r*) Between ISEL Dimensions of Social Support and Awake BP Versus Sleep BP

	ISEL Total		ISEL-Appraisal		ISEL-Belonging		ISEL-Tangible	
	Blacks	Whites	Blacks	Whites	Blacks	Whites	Blacks	Whites
1. SBP dip	-.19	.31**	-.26*	.35**	-.19	.24*	-.03	.21*
2. DBP dip	-.15	.34**	-.21	.37**	-.16	.30**	.00	.20 [†]
3. MAP dip	-.15	.35**	-.20	.39**	-.15	.30**	-.01	.21*
4. SBP wake	-.04	-.06	-.05	-.10	-.17	.05	.13	-.09
5. DBP wake	.02	.02	-.02	-.04	-.14	.11	.23 [†]	-.01
6. MAP wake	.00	-.03	-.03	-.09	-.14	.09	.19	-.06
7. SBP sleep	.07	-.28**	.10	-.35**	-.06	-.13	.13	-.23*
8. DBP sleep	.11	-.28**	.10	-.35**	-.06	-.16	.24 [†]	-.17
9. MAP sleep	.09	-.32**	.09	-.41**	-.06	-.17	.19	-.22*

* $p < .05$;

** $p < .01$;

[†] $p = .05$ to $.07$ (two-tailed).

ISEL = Interpersonal Support Evaluation List; SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure. ISEL subscales: appraisal (people to confide in), belonging (companions for activities), and tangible (sources of material aid).