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Unfair Treatment and Trait Anger in relation to Nighttime Ambulatory Blood Pressure in African American and White Adolescents

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Abstract

Objective—To determine if ambulatory blood pressure (ABP) at night relative to day among adolescents is influenced by unfair treatment and trait anger, and whether these associations are stronger in African Americans and adolescents from lower socioeconomic status (SES) families and neighborhoods.

Methods—A total of 189 healthy White and African American adolescents (ages 14 –16, *SD* = .62, 50% female) completed two days and one night of ABP monitoring and unfair treatment and trait anger questionnaires. SES was measured using: 1) parental education, and 2) a composite neighborhood SES score based on U.S. Census tract data for neighborhood poverty and education. The night/day ABP ratio was calculated by dividing the night ABP mean (readings from the self-reported bedtime of each participant through 5 a.m.) by the day ABP mean (8:30 a.m. until self-reported bedtime).

Results—Higher trait anger was associated with a higher night/day DBP ratio in the full sample, *B* = .003, *SE* = .001, *t* = 2.20, *p* = .03. A significant interaction effect for *Race* × *Unfair Treatment* on the night/day DBP ratio, *B* = .01, *SE* = .003, *t* = 3.17, *p* = .002, followed by post hoc tests indicated that greater unfair treatment was associated with a higher night/day DBP ratio among African Americans, *B* = .006, *SE* = .002, *t* = 2.56, *p* = .01. Further, among African American adolescents living in lower SES neighborhoods, greater unfair treatment predicted a higher night/day DBP ratio, *B* = .008, *SE* = .003, *t* = 3.15, *p* = .002, and higher trait anger scores predicted a higher night/day DBP ratio, *B* = .008, *SE* = .002, *t* = 3.19, *p* = .002.

Conclusions—Trait anger may be a factor leading to elevated nighttime DBP in both African Americans and Whites. Unfair treatment and trait anger are important predictors of elevated night/day ABP ratios among African American adolescents living in lower SES neighborhoods. These factors may contribute to the onset of hypertension in African Americans at a younger age.

Keywords

Ambulatory blood pressure monitoring; unfair treatment; attributions to racial/ethnic discrimination; socioeconomic status; trait anger; African American adolescents; White adolescents; hypertension

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Introduction

Ambulatory blood pressure (ABP) allows for the assessment of blood pressure (BP) throughout a 24-hour period. Individuals with a normal circadian rhythm of BP experience a decline in BP at night. However, some individuals show abnormal elevations in nighttime BP, relative to their daytime BP. Epidemiological data suggest that elevated nighttime ABP or a higher night/day ABP ratio is an independent predictor of cardiovascular disease (CVD) events (1,2).

African American adults are more frequently classified as nondippers, i.e. declining < 10% at night, than are Whites (3). These racial/ethnic differences in ABP patterns are apparent by late childhood. In a 15-year longitudinal study, Wang et al. (4) reported that by age 10, African American children already display higher nighttime ABP and a blunted nocturnal decline, when compared with White children. These racial/ethnic differences persisted after adjusting for the effects of a family history of essential hypertension and the John Henryism coping style.

Unfair Treatment, Racial Discrimination, and Ambulatory Blood Pressure

Unfair treatment and, more specifically, racial discrimination or perceived racism are chronic stressors for African Americans, which may contribute to racial/ethnic disparities in BP (5–7). However, empirical support for the relationship of discrimination and resting or clinic BP is weak (for review see 8;9–11). On the other hand, recent data based on ABP methodology does provide some evidence for the discrimination-BP association. In a sample of 40 African American college students, Hill et al. (12) found that greater perceived racism in the academic setting predicted higher daytime and nighttime diastolic ABP. Steffen et al. (13) reported that greater lifetime perceived racism predicted higher average daytime ABP (i.e., both systolic BP and diastolic BP; SBP and DBP) in a sample of 69 middle-aged African Americans with normal or mildly elevated BP. There was no association with nighttime ABP, but those who reported holding their anger in had increased nighttime DBP. Recently, in a sample of 62 middle-aged, drug free hypertensive White adults Linden et al. (14) found that the inability to diffuse anger (i.e., let go of angry affect) was associated with nondipper status. Brondolo et al. (5) reported that lifetime perceived racism did not predict daytime ABP in a sample of 245 African American and Latino adults. However, greater perceived racism did predict higher nighttime SBP and DBP. In the sample used in the current paper, Matthews et al. (15) reported that unfair treatment overall and attributions to racial/ethnic discrimination for any experiences of unfair treatment did not predict daytime ABP across the day in African American or White adolescents. However, African American adolescents did have greater increases in daytime ABP in response to co-occurring increases in negative mood (i.e., sum of anger, conflict, and not feeling calm) than did Whites (15). It is unknown whether experiencing anger frequently or the greater emotional reactivity of African American adolescents being associated with elevations in daytime ABP leads to disturbances in nighttime ABP. That paper did not examine nighttime ABP. A primary objective of the present paper is to evaluate the association of unfair treatment and reports of anger with nighttime ABP relative to daytime ABP in African American and White adolescents.

Socioeconomic Status and Ambulatory Blood Pressure

Cross-sectional (16–17) and longitudinal (18) studies have shown that lower family and neighborhood socioeconomic status (SES) is associated with higher daytime ABP in adolescents and adults. Further, recent longitudinal studies have demonstrated that childhood SES—as measured by parental education and occupation, and household income, influences ABP in adulthood, regardless of adult SES (19–20). In comparison to other racial/

ethnic groups, African Americans are more likely to live in lower SES neighborhoods (21). Individuals from lower SES backgrounds are exposed to more stressful circumstances, including blight, safety concerns, economic disinvestment in their neighborhoods, and family stressors (22–23), suggesting that lower SES and being African American would be particularly disadvantageous for ABP. A recent study of African American adolescents suggests that a common event in lower SES neighborhoods, i.e. exposure to violence, may heighten African Americans' risk for elevated nighttime ABP (24). A secondary aim of the present study is to test whether unfair treatment and anger leads to elevated night/day ABP among African American and White adolescents living in lower SES neighborhoods.

In sum, the present study tests the hypotheses that perceptions of unfair treatment and greater anger are associated with higher night/day ABP ratios in adolescents, and that these effects are stronger in African American adolescents who live in lower SES families or neighborhoods. Additionally, we sought to determine whether attributions to racial/ethnic discrimination for experiences of unfair treatment are associated with higher night/day ABP ratios among African American adolescents. The current study adds to our understanding of disparities in early hypertension onset in at least three ways. First, this study has the potential to shed light on psychosocial stressors that may help to explain the elevated nighttime ABP observed in African Americans (4). Given the early onset of hypertension in African Americans, this study can provide insight into psychosocial factors that may foreshadow persistently elevated BP. Second, most studies of discrimination, anger, and SES have independently examined these factors and almost exclusively in adult samples. Further, interactive associations among these factors and the influence on night/day ABP ratios in any sample, including adolescents, are unknown. The present study will allow us to determine whether the effect of unfair treatment and anger on nighttime ABP is influenced by living in a lower SES family or neighborhood. Third, this study will allow us to understand whether there are racial/ethnic variations in the associations of these factors with night/day ABP. With few exceptions (15), most research on the association of unfair treatment with ABP has focused primarily on African Americans.

Methods

Participants

Participants were drawn from a sample of 211 White and African American adolescents between the ages of 14 and 16. Of these adolescents, 198 (50% males; 50% African Americans) completed the psychosocial measures of unfair treatment and trait anger, and the two days and one night of ABP monitoring described below and constitute the sample for this analysis.

Procedure

Participants were recruited from mandatory health classes and freshman orientation sessions at two urban high schools. Data collection took place from summer 1999 through spring 2002. The University of Pittsburgh Institutional Review Board approved the protocol, and both the participants and a parent or legal guardian provided written informed consent. Parents completed a medical history regarding their son or daughter to ensure that the child did not have any cardiovascular disease, did not take any medications that affect cardiovascular function, and was within 80% of the ideal height and weight for age and gender group. Nine adolescents were obese, BMI ≥ 30, and were excluded from the current analyses. Thus, the final sample consisted of 189 participants.

Participants were tested over the course of several visits: two consecutive days of ABP data collection at school and one in the psychophysiology laboratory. Measures of unfair treatment, trait anger, and demographic factors were obtained at the laboratory visit.

Measures

Unfair Treatment—Unfair treatment was assessed with a modified 10-item version of the Detroit Area Study Everyday Unfair Treatment Scale (25). Respondents were asked about the frequency of their experiences with various forms of interpersonal unfair treatment in their daily lives without reference to specific reasons for unfair treatment (e.g., race or ethnicity).

Representative items range from relatively minor and subtle negative events, such as receiving poorer service than others in restaurants or stores, to more blatant and extreme negative events, such as being threatened or harassed. To reflect the potential experiences of this adolescent sample, one item which asked about being called names or insulted was reworded to read "You or your family were called names or insulted." The frequency of each type of mistreatment was assessed using a 4-point scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*). Total scores range from 10–40; the Cronbach's alpha was .78 in the present sample.

Attributions to Racial/Ethnic Discrimination—Participants who reported having experienced any unfair treatment (i.e., reported a response of > *never* to at least one of the 10 unfair treatment items) were asked to indicate whether race or ethnicity was a reason for any of their experiences. The categories of race and ethnicity were combined. This item was formatted as yes/no.

Trait Anger—Adolescents completed the 10-item Trait Anger scale of the State-Trait Personality Inventory (STPI; 26–27). This scale assesses the frequency with which emotions of anger are experienced. This scale uses a 4-point scale (1 = *almost never*, 2 = *sometimes*, 3 = *often*, 4 = *almost always*). Example items are, "I am quick-tempered" and "I feel infuriated when I do a job and get a poor evaluation." Scores range from 10 – 40; the Cronbach's alpha was .83 in the present sample.

Family and Neighborhood SES—Parental education was used as the family-level indicator of SES. In households where both parents were present, the higher educational attainment of the two parents was used. Education was categorized into three levels: ≤ high school diploma, an associate or college degree, and > college degree.

The neighborhood-level indicator of SES was calculated based on the following two indices drawn from the 2000 U.S. Census tracts corresponding to each participants' address: 1) percentage of households in the tract with incomes above the poverty threshold, and 2) percentage of households in the tract with ≥ high school education. The Pearson's correlation between these two measures was moderately high, $r(189) = .51$, $p < .0001$. For analyses, these two U.S. Census tract indices were standardized and averaged to create a neighborhood-level SES index, such that a higher score indicated higher SES. For ease of interpretation, the unstandardized neighborhood SES variable is used in Table 1.

Ambulatory Blood Pressure—ABP was assessed throughout two school days and the intervening night using the Accutracker Dx ambulatory monitor (Suntech Medical Instruments, Raleigh, NC), an instrument with documented reliability and validity (28). This monitor uses the auscultatory method of BP assessment. An appropriately sized cuff was

placed on the nondominant arm of participants, with the microphone over the inner side of the arm.

On the day of ABP monitoring, a research assistant met each scheduled participant at school prior to the beginning of the first class to train the participant in the use of the ABP monitoring device. Four sample BP readings were taken—two while the participant was seated and two while standing—to ensure correct microphone placement for accurate readings. If the monitor displayed any error codes, the microphone and cuff placement were adjusted until four consecutive readings free of error codes were completed.

ABP readings were taken every 30 minutes from 8:30 a.m. until 10 p.m., and every 60 minutes from 10 p.m. until 5 a.m. the following morning. Participants then returned to school that morning where a research assistant again met him or her and reconnected the ABP monitor. The participant wore the monitor for the remainder of the school day, and the monitor resumed readings every 30 minutes. The self-reported bedtime of each participant was used to determine the beginning of night ABP monitoring; the end of the nighttime interval was 5 a.m. for all participants the following morning. Nighttime ABP was the mean ABP during this interval. Daytime ABP was the mean for ABP readings taken from 8:30 a.m. until the self-reported bedtime of each participant. The night/day ABP ratio was calculated by dividing the night ABP mean by the day ABP mean.

The data were uploaded to a PC by using AccuWin software (Suntech Medical Instruments, Raleigh, NC). Each BP reading was reviewed to determine whether the reading was an artifactual reading, for example cuff not connected or an air leak. Values that were a priori considered out of range were: SBP ≥ 250 or ≤ 70; DBP ≥ 150 or ≤ 40, or pulse pressure ≤ 10. If any of these exclusion criteria were met, all data related to that particular BP reading were excluded.

We obtained an average of 37.69 (*SD* = 4.22, range = 11 – 43) readings during daytime ABP monitoring and an average of 6.38 (*SD* = 1.59, range = 3 – 11) readings during night ABP monitoring for each participant. The total number of daytime ABP readings that were obtained was 4,142; 334 of these were removed due to error readings. The total number of night ABP readings that were obtained was 663; 44 of these were removed due to error readings.

Analytic Plan—Initial preliminary analyses were conducted to assess the means (*SD*s) in the full sample, as well as race differences in the covariates, predictor variables, and ABP variables in the sample. *T*-tests and Chi-square analyses were used to assess SES differences by race. Substantial race differences in the indicators of SES (as reported in the Results section), especially for neighborhood SES were found in this sample. Therefore, in all analyses where SES indicators are either assessed as main predictor variables or in interactions for unfair treatment and trait anger on night/day ABP ratios, models were run separately for African American and White adolescents. To assess associations among the psychosocial (i.e., unfair treatment, attributions to racial/ethnic discrimination, and trait anger) and SES (i.e., neighborhood SES and parental education) variables, Pearson's or Spearman correlations were conducted.

Gender, race, and BMI served as covariates in analyses of the night/day ABP ratios. Due to the limited age range (14 to 16 years), age was not used as a covariate. To assess the main effects of the continuous psychosocial variables and neighborhood SES on night/day ABP ratios, Proc Reg (SAS Institute, Cary, NC) was used, whereas Proc GLM was used to assess the association of categorical parental education on night/day ABP ratios. To test for interaction terms, predictor variables were centered and interaction terms were created for

the predictor and moderating variables. To probe significant and marginal interactions, simple effects analyses were conducted using the method developed by Aiken and West (29). Using the centered SES variables, two regression slopes – one was 1 SD above and the other 1 SD below the mean – were calculated and tested in main effects analyses to determine whether they were significantly different from zero (30). Note that because the simple effects analyses report the betas and *p*-values from the post hoc tests, those differ from the overall betas and *p*-values reported for the analyses in which the interaction terms were tested.

Results

Race Differences in Predictor Variables and ABP

Table 1 displays demographic, psychosocial, and ABP characteristics for the full sample and by race. Half of the sample (50%) reported they had experienced unfair treatment at least sometime or often on at least one of the 10 items assessing unfair treatment. Also, as shown in Table 1 and as previously reported (15), white adolescents perceived more overall unfair treatment than African American adolescents, $t(187) = 2.29$, $p = .02$. Among the African American participants, 38 made attributions to racial/ethnic discrimination as a reason for at least one of the unfair treatment events they had experienced ($n = 94$); only 15 white participants made attributions to racial/ethnic discrimination as a reason for unfair treatment ($n = 95$), $X^2(1, N = 189) = 14.21$, $p = .0002$. On average, participants indicated they experienced feelings of anger sometimes. African American adolescents had higher daytime DBP than White adolescents, $t(187) = -2.34$, $p = .02$. There were no racial/ethnic differences in nighttime ABP or the night/day ABP ratios. There were significant differences in SES by race among the adolescents in the study. White adolescents ($n = 95$) lived in higher SES neighborhoods as measured by the composite index than African American adolescents ($n = 94$), $M = 71.77$, $SD = 11.95$ vs. $M = 59.53$, $SD = 10.99$, $t(187) = 7.33$, $p < .0001$ (see Table 1 for individual neighborhood characteristics). Parents of white adolescents ($n = 94$) had higher education than the parents of the African American adolescents ($n = 92$), $X^2(2, N = 186) = 21.33$, $p < .0001$.

Associations Among Predictor Variables

As shown in Table 2, neighborhood SES was positively correlated with parental education in both the white and African American adolescents. Post hoc analysis using the Fisher's *z* indicated that there was a significant difference between the correlations in the African American and white adolescents, $z = 3.05$, $p < .01$. The association of unfair treatment with trait anger demonstrated in the African American adolescents was not found in the white adolescents. An attribution to racial/ethnic discrimination as a reason for any of the unfair treatment was not associated with any of the other predictor variables, including unfair treatment. Among white adolescents, unfair treatment was not associated with any of the other predictor variables.

Influence of Psychosocial Variables on Night/Day ABP Ratios in the Full Sample

Trait Anger—As shown in Table 3, higher trait anger scores predicted higher night/day DBP ratios, but not higher SBP ratios. A marginal interaction effect for *Trait Anger* ×*Race* was found for the night/day SBP ratios, but post hoc analyses revealed no associations for either Whites or African Americans. The *Trait Anger* × *Race* interaction term on the night/day DBP ratio was not significant.

Unfair Treatment and Attributions to Race/Ethnicity—Unfair treatment and attributions to race/ethnic discrimination were not associated with the night/day ABP ratios as main effects (see Table 3). However, the *Race* × *Unfair Treatment* interactions were

significant for night/day DBP ratios, and marginally significant for night/day SBP ratios. Post hoc analyses indicated that greater unfair treatment was associated with higher night/day DBP ratios among African Americans, $B = .006$, $SE = .002$, $t = 2.56$, $p = .01$. A marginal, inverse effect was found among the White adolescents, $B = -.004$, $SE = .002$, $t = -1.81$, $p = .07$. Higher unfair treatment was associated with higher night/day SBP ratios among African American adolescents, $B = .005$, $SE = .003$, $t = 1.98$, $p = .05$, and no association among White adolescents, $B = -.001$, $SE = .003$, $t = -.42$, $p = .68$. The *Race* × *Attributions to Racial/Ethnic Discrimination* interaction term on night/day ABP ratios was also not significant.

Influence of Unfair Treatment and Trait Anger on Night/Day ABP Ratios in Lower SES Adolescents

Because of the race differences in SES, we analyzed the interactions between the psychosocial and SES variables separately for African Americans and Whites. Among White adolescents, there were no significant effects found for any psychosocial and SES interaction terms on the night/day ABP ratios.

As shown in Table 4, among African American adolescents, neighborhood SES influenced the association of unfair treatment on the night/day DBP ratios. Post hoc analyses indicated that among those living in lower SES neighborhoods, those who experienced more unfair treatment had a higher night/day DBP ratio, $B = .006$, $SE = .002$, $t = 2.48$, $p = .001$. This effect was not exhibited in those living in higher SES neighborhoods, $B = -.005$, $SE = .005$, $t = -.94$, $p = .35$. There was no effect found for the night/day SBP ratio.

Among African American adolescents, neighborhood SES also influenced the association of trait anger on the night/day ABP ratios. There was a significant effect for the *Trait Anger* × *SES* interaction term for the night/day DBP ratio, and a marginal effect for the *Trait Anger* × *SES* interaction term for the night/day SBP ratio. Post hoc analyses indicated that among adolescents living in lower SES neighborhoods, those who reported greater trait anger had a higher night/day DBP ratio, $B = .006$, $SE = .002$, $t = 3.02$, $p = .003$ and a higher night/day SBP ratio, $B = .004$, $SE = .002$, $t = 2.11$, $p = .04$. Significant effects were not found in African American adolescents living in higher SES neighborhoods, for the night/day DBP ratio $B = -.003$, $SE = .004$, $t = -.90$, $p = .37$, or for the night/day SBP ratio $B = -.003$, $SE = .004$, $t = -.79$, $p = .43$.

Among the African American adolescents, there were no significant effects for main or interaction effects with parental education.

Discussion

The primary aims of this study were to test whether unfair treatment and trait anger would be associated with a higher night/day ABP ratio among adolescents and whether these effects would be more pronounced among African American adolescents living in lower SES families and neighborhoods. A secondary hypothesis concerned whether attributions to racial/ethnic discrimination by African Americans would be related to higher night/day ABP ratios. Our findings provide partial support for these hypotheses. Higher trait anger scores were associated with higher night/day DBP ratios in the full sample. Among African Americans, greater unfair treatment and trait anger were both associated with higher night/day DBP ratios, especially for those living in lower SES neighborhoods. Attributions to racial/ethnic discrimination for experiences of unfair treatment were not associated with SES or ABP among African American adolescents.

The previous study conducted on this sample of adolescents by Matthews et al. (15), found that unfair treatment and attributions to racial/ethnic discrimination for any experiences of unfair treatment did not predict daytime ABP across the day in the African American or White adolescents. Since that time, nighttime ABP has emerged as a critical indicator of CVD risk (1,2) and, the two studies (5,12) conducted on the association between unfair treatment and ABP have demonstrated an effect on nighttime ABP in adults. Thus, we revisited this sample to determine whether unfair treatment influenced nighttime ABP in adolescents.

To our knowledge, this is the first study to assess the relationship of unfair treatment and trait anger to night/day ABP ratios in adolescents. It is also the first to provide empirical evidence that living in lower SES neighborhoods may exacerbate the effects of being exposed to unfair treatment contributing to higher night/day ABP ratios among African Americans. Although this relationship had been previously hypothesized (8), it had not been tested prior to the current study. These findings may have important ramifications for our understanding of the effects of anger on nighttime ABP among adolescents, and additionally, the effects of unfair treatment on ABP among racial/ethnic minorities.

The finding that greater anger was associated with higher night/day ABP among adolescents adds to previous findings in the literature (13, see 31 for review). It has been documented that anger is related to higher ABP (31). For instance, Steffen et al. (13) reported that anger inhibition was related to higher nighttime DBP and a smaller drop in DBP from day to night in a sample of African American adults. Most recently, Linden et al. (14) reported that anger-related affect was associated with less of a decline in nighttime SBP in a sample of middle-aged White hypertensives. Taken together, the current findings draw further attention to the role of anger and anger processing in nighttime ABP among African Americans and Whites.

Although we previously reported that racial/ethnic discrimination was not associated with daytime ABP in the present sample (15), the finding that attributions to racial/ethnic discrimination for experiences of unfair treatment were not associated with night/day ABP ratios among African Americans was, nonetheless, unexpected. The null effect may have been due to a methodological limitation. We explicitly asked participants whether or not they would attribute any of the unfair treatment they had experienced to race/ethnicity. An affirmative response indicates that the participant perceived that race/ethnicity may have influenced at least one of the 10 events that were assessed in the measure of unfair treatment. However, the intensity, frequency, or specific events which may have comprised their overall experiences with racial/ethnic discrimination were not measured. Other studies which have reported an association between perceived racism and ABP have focused on these specific characteristics of racial discrimination (5,12,13). For instance, in studies by Brondolo (5), Hill (12), and Steffen (13), the frequency of explicit, interpersonal interactions with racism were assessed. These experiences were examined across multiple settings, including the academic setting, workplace, and community, and also in varying forms such as threats and social exclusion. Thus, it is plausible that it is the frequency and context of one’s exposure to racial/discrimination that influences ABP, not the yes/no attribution.

The findings on the association of unfair treatment with night/day ABP ratios are consistent with those of Brondolo et al. (5) and Hill et al. (12) studies of adults. The current findings also extend a recent epidemiological study (32) that used a single-item to assess unfair treatment and found that unfairness predicted increased coronary events. However, these findings do raise the question - why was unfair treatment associated with nighttime ABP, but not daytime ABP (15) in this sample of adolescents? Drawing on the studies conducted since the earlier paper on this sample, at least two explanations can be offered.

First, Brondolo et al. (5) assert that maltreatment in interpersonal contexts during the day may lead to greater nighttime distress (5). In line with this notion, daytime contexts for adolescents include class attendance and other activities which may serve as sources of "natural distraction" (p. 54; 5) from unfair treatment. Reflection on negative daytime interactions may be delayed until later in the evening as a result of these daytime activities. The unfair treatment adolescents report may be due to the school context or it may stem from experiences in the neighborhood environment after school hours. In either case, other mediating processes such as rumination or overall greater psychological distress or negative emotions at the end of the day may explain the association of unfair treatment to higher night/day ABP ratios.

Second, it is also plausible that the cost of coping with stressful stimuli may not be evident until later when a depletion of future resources becomes evident. Consistent with this notion are experimental data showing that exposure to uncontrollable noise stress is associated with poorer performance on frustrating tasks after the cessation of noise, compared to yoked controls; during the stress exposure, there were no differences (33). Future research should examine whether it is the direct cognitive engagement of prior maltreatment that directly influences elevated night/day ABP ratios or whether this relationship is mediated by other processes (e.g., perseverative cognition) that may deplete coping resources, and in turn, influence higher nighttime ABP.

Why were similar associations not found in White adolescents, given that they reported as much if not more unfair treatment? Perhaps one indication comes from the substantial neighborhood SES differences found in African American and White participants. White adolescents lived in higher SES neighborhoods and had parents with higher education than their African American counterparts. It is plausible that the resources conferred through higher SES ameliorated the potential physiological effects associated with unfair treatment in African Americans. At the same time, research has demonstrated that the type of unfair treatment or racism (e.g., workplace, stigmatization, threat) that African Americans are exposed to varies as a function of their SES (34). It is plausible that exposure to unfair treatment that is characterized by stigmatization versus threat would be differentially related to ABP, and that this relationship would be influenced by SES. Thus, further research is needed to determine whether the pattern of effects observed among African American adolescents living in lower SES neighborhoods who report overall unfair treatment is similar when specific types of unfair treatment are considered.

What might explain the influence of neighborhood SES on African American adolescents? One possibility is that living in neighborhoods that yield more stressful characteristics may tax coping resources among African American adolescents. For instance, lower SES environments may have more safety related issues and may be more stressful in general (35). African American adolescents who have to contend with these concerns may become hypervigilant or be less able to manage experiences of unfair treatment. It is of interest to note that parental education did not affect the associations between unfair treatment or anger and night/day ABP ratios. Perhaps African American adolescents are influenced less by their families than by their neighborhood and school environments where many of their social interactions take place. Alternatively, it is plausible that the family unit may be limited in their ability to buffer the cumulative effect of stressors adolescents experience, which includes unfair treatment.

In the current study, actigraphy and polysomnography data were not obtained. Nighttime ABP was measured based on self-reported bedtime in this sample of adolescents. Therefore, we are unable to determine whether participants were actually asleep (versus in bed or trying to sleep) for the reported time and whether there were sleep disturbances that may have

influenced the findings. Recent research suggests that low sleep efficiency predicts elevated sleep ABP (36) and is associated with prehypertension in healthy adolescents (37). Additionally, recent reports in samples of African American adults indicate that perceived racism is associated with poor self-reported sleep quality (38–40). It is possible that our findings may reflect the association of unfair treatment to sleep quality, which, in turn, affects sleep ABP (39). Our future research will examine sleep ABP more explicitly through the use of self-report measures of bedtime and sleep quality and objective measures, i.e., actigraphy. Such measures will allow us to more explicitly assess the role of unfair treatment on sleep ABP.

SUMMARY

This study adds to previous literature demonstrating that anger influences nighttime ABP in African Americans and Whites. Additionally, this is the first study to show that unfair treatment and trait anger are associated with night/day ABP ratios in among African Americans from lower SES environments. Our findings on the association of unfair treatment are consistent with those obtained in several adult samples. Future studies should assess the effects of unfair treatment and other psychosocial stressors on nighttime ABP among adolescents, and explicitly examine the role of SES using multiple approaches. This study suggests that psychosocial factors that are a part of the lived social contexts may contribute to elevated nighttime ABP, and, may inform the disparate rates of elevated BP and hypertension that are found in young African American adults.

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Glossary

ABP	ambulatory blood pressure
SBP	systolic blood pressure
DBP	diastolic blood pressure
BMI	body mass index
CVD	cardiovascular disease
SES	socioeconomic status

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Table 1

Demographic, Psychosocial, and Blood Pressure Variations in the Full sample and by Race (N = 189)

	Full Sample		Whites (n = 95)		African Americans (n = 94)	
	M	**SD**	**M**	**SD**	**M**	**SD**
Demographic Variables						
Age	14.6	.62	14.6	.6	14.5	.6
BMI	22.2	3.2	21.9	2.9	22.6	3.3
Neighborhood SES[a]	-	-	-	-	-	-
% households > poverty level	83.5	11.7	88.7*	6.5	78.3	13.4
% households > H. S. degree	47.8	18.0	54.8*	20.3	40.8	11.7
Parental Education[b]	-	-	-	-	-	-
N (%)						
≤ High school	77 (41.4)	-	27 (28.7)*	-	50 (54.3)	-
Associates degree/some college	38 (20.4)	-	16 (17.0)	-	22 (23.9)	-
≥College	71(38.2)	-	51 (54.3)*	-	20 (21.7)	-
Psychosocial Variables						
Unfair Treatment	20.9	4.6	21.7*	4.6	20.1	4.5
Attribution to Racial/Ethnic Discrimination? Yes	53(28)	-	15 (16)	-	38 (40)*	-
N (%)						
Trait Anger	20.8	5.2	20.8	4.4	20.8	6.0
Ambulatory Blood Pressure						
Day ABP						
SBP	124.3	14.8	124.1	15.3	124.5	14.4
DBP	72.3	6.9	71.2	6.6	73.5*	7.1
Night ABP						
SBP	111.1	20.2	109.7	21.1	112.5	19.2
DBP	60.6	7.7	59.8	7.6	61.3	7.9
Night/Day ABP Ratio						
SBP Ratio	.89	.12	.88	.13	.90	.12
DBP Ratio	.84	.10	.84	.09	.84	.11

[a] Neighborhood SES was comprised of the averages for the mean % of households in the neighborhood living above poverty level and the mean % of households in the neighborhood with a high school degree or greater in the census tract in which the participant resided. These values are reported.

[b] Data on parental education were available for 186 participants.

* Whites versus African Americans, $p < .05$.

Table 2

Intercorrelations for Psychosocial and SES Measures by Race[a]

Measure	1	2	3	4	5
1. Neighborhood SES[b]	--	.26*	−.19	−.18	−.16
2. Parental Education[c]	.60*	--	−.06	−.05	.002
3. Unfair Treatment	.15	.06	--	.55*	.12
4. Trait Anger	−.17*	.06	.17	--	.13
5. Racial/Ethnic Discrimination Attribution (Yes/No)	−.06	.14	.15	.07	--

Note.

[a] Intercorrelations for African American adolescents (n = 94) are presented above the diagonal, and intercorrelations for White adolescents (n = 95) are presented below the diagonal.

[b] Neighborhood SES was comprised of the averages for the mean % of households in the neighborhood living above poverty level and the mean % of households in the neighborhood with a high school degree or greater in the census tract in which the participant resided. These values are reported.

[c] Data on parental education was only available for 186 participants.

*. All coefficients are significant at $p < .05$.

Pearson's correlation coefficients reported for all intercorrelations except correlations with the Racial/Ethnic Discrimination Attribution (Yes/No) where Spearman's correlation coefficient was reported.

Table 3

Beta Coefficients for Regression Analyses of Unfair Treatment and Trait Anger and Interaction Effects with Race on Night/Day ABP Ratios for Full Sample

	SBP		DBP	
	Night/Day Ratio	**p-value**	**Night/Day Ratio**	**p-value**
Main Effects				
Unfair Treatment	.002	.31	.001	.48
Trait Anger	.001	.47	.003	.03
Interaction Effects				
Unfair Treatment × *Race*	.007	.07	.010	.002
Trait Anger × *Race*	.006	.08	.004	.136

Note. All models are adjusted for sex and BMI. Race included as a covariate in main effects models.

Table 4

Beta Coefficients for Regression Analyses of Interaction effects for Neighborhood SES with Unfair Treatment and Trait Anger on Night/Day ABP Ratios for African American Adolescents

	SBP		DBP	
	Night/Day Ratio	**p-value**	**Night/Day Ratio**	**p-value**
Neighborhood SES × Unfair Treatment	−.001	.19	−.003	.02
Neighborhood SES × Trait Anger	−.002	.07	−.003	.02

Note. Models are adjusted for sex and BMI. Predictor variables are centered.