Unfair Treatment, Discrimination, and Ambulatory Blood Pressure in Black and White Adolescents

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The authors tested the hypotheses that unfair treatment and its attribution to race, physical appearance, and peer group were related to elevated ambulatory blood pressure (ABP). During 2 school days, 207 Black and White adolescents wore an ABP monitor and answered questions about mood, posture, location, and activity level at the time of the ABP assessment. At a separate session, in-clinic resting blood pressure and perceptions of unfair treatment were measured. Multilevel mixed models showed that unfair treatment and its attribution to race were not associated with ABP. However, adolescents who indicated that the primary reason for unfair treatment was their physical appearance had elevated ABP. Feeling unfairly treated because of physical appearance may impact blood pressure uniquely during the adolescent transition.

Keywords: ambulatory blood pressure, discrimination, adolescence, high blood pressure, ethnicity

Blacks are at high risk for the development of hypertension in adulthood, relative to Whites (Gillum, 1991). Among the behavioral factors that may contribute to the excess risk are obesity, physical inactivity, diet, chronic stress, and, in particular, discrimination due to race (Brondolo, Rieppi, Kelly, & Gerin, 2003). Although discrimination is clearly an adverse stressor and has been endured for centuries by people of color, it has seldom been the subject of epidemiological studies of blood pressure (BP). In their recent review of the six studies of perceived racism and BP, Brondolo et al. (2003) concluded that the relationships are not straightforward. Three studies found no main effects of perceived racism on BP (Broman, 1996; Dressler, 1996; S. A. James, LaCroix, Kleinbaum, & Strogartz, 1984), and two studies reported an inverse association, with lack of exposure to discrimination being associated with higher BP in some subgroups (Krieger, 1990; Krieger & Sidney, 1996). Brondolo et al. noted, however, that these pioneering studies had measurement limitations, which precluded definitive conclusions. For example, several studies used self-reported history of hypertension, and three studies focused on workplace discrimination, which, although important, misses discrimination outside of the work context (Dressler, 1996; K. James, Lovato, & Khoo, 1994; S. A. James et al., 1984).

Further, only one study asked explicitly about other sources of unfair treatment, that is, gender, which may also impact on BP (Krieger, 1990).

To our knowledge, there are no studies of unfair treatment, racial discrimination, and BP in adolescents. Adolescence is an important point in the life span because high BP and hypertension in adulthood have their origins in childhood and adolescence, with racial differences emerging in adolescence and young adulthood (Liu et al., 1989; Voors, Webber, & Berenson, 1979), and are related, as in adulthood, to obesity, physical inactivity, diet, and cardiovascular responses to acute social stress (Cho, Mueller, Meiningier, Liehr, & Chan, 2001; Matthews, Salomon, Brady, & Allen, 2003; Murphy, Alpert, & Walker, 1992; Treiber, Turner, Davis, & Strong, 1997). Given the increasing prevalence of obesity and physical inactivity in youth (Ogden, Flegal, Carroll, & Johnson, 2002), high BP is also likely to be an increasingly important public health problem in adolescents.

Adolescence is a time of change and heightened conflict (Laursen & Collins, 1994), with children establishing strong peer relationships, relying less on parents, and finding a sense of identity within the youth culture. Thus, it may be a time when perceptions of unfair treatment may be particularly salient and multifactorial. That is, adolescents may attribute the unfair treatment to a number of sources related to the adolescent transition, including one’s physical appearance and identity of the peer group. In the context of risk for elevated BP, discrimination due to factors related to the adolescent transition may be particularly likely to induce stress-related changes in BP.

Should perceptions of unfair treatment related to adolescent development be an important predictor of BP, it should be most apparent in BP levels obtained during school days, when adolescents are exposed to their peer environment. Ambulatory blood pressure (ABP) assessments are useful diagnostically because they

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provide an overall estimate of exposure to high BP, are more strongly related to comorbidity associated with hypertension than are clinic measures (Pickering & Kario, 2001), and can distinguish those who have white coat hypertension (normal ABP but high clinic pressure) and those who have masked hypertension (high ABP but normal clinic pressure; Pickering, Davidson, Gerin, & Schwartz, 2002). A recent report suggested that life history of perceived racism is related to daytime ambulatory systolic blood pressure (SBP) and diastolic blood pressure (DBP) among employed African American men and women, suggesting that ABP may be a more sensitive indicator of BP elevations in response to unfair treatment than is clinic or casual BP (Steffen, McNeilly, Anderson, & Sherwood, 2003).

The objectives of the present study were to test the hypotheses that unfair treatment, in general, and attributions of unfair treatment due to race, physical appearance, and peer group identity, in particular, are related to ABP during the school day. Subsidiary objectives were to evaluate whether those who score high on unfair treatment are more reactive to conflict and changes in mood states during the day than those who score relatively low, and to examine whether Black and White adolescents differ in their reports of unfair treatment and reasons for it.

Method

Participants

The study consisted of 217 adolescents between the ages of 14 and 16 who participated in at least a portion of the study protocol. They were from two urban high schools. The school district central administration and principal of each school approved participation. Of these adolescents, 52 male and 54 female Blacks and 53 male and 53 female Whites completed the psychosocial measures of unfair treatment described below, and all but 1 male and 2 female Blacks and 1 male and 1 female Whites completed the ABP assessment. Both high schools serve diverse populations, with one high school serving a more economically disadvantaged student body (40.2% vs. 21.8%), that is, having a greater proportion of students from low-income families as defined by the State of Pennsylvania’s Department of Education. The school with the more disadvantaged student body also had fewer White (50.5% vs. 69.0%) and more Black (48.7% vs. 28.1%) students. Participants were recruited from mandatory health classes and freshman orientation sessions for an adolescent health project aimed at stress and the development of risk factors for cardiovascular disease. The University of Pittsburgh Institutional Review Board approved the protocol, and 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 was free of any cardiovascular disease, not taking medication affecting the cardiovascular function, and within 80% of ideal height and weight for his or her age and gender group. Three adolescents were considerably obese when they presented at the laboratory despite parental report of meeting the weight requirements and did not participate further.

Measurement of Unfair Treatment

Embedded in the psychosocial questionnaires presented by a computer were 10 items that assessed how frequently the participants had experienced a variety of forms of interpersonal mistreatment (Williams, Yu, Jackson, & Anderson, 1997). Examples of items are “You are treated with less respect than other people” and “You are threatened or harassed.” The items were presented in general terms, without making any reference to race, prejudice, or discrimination. Participants were asked to rate the frequency with which they experienced each type of mistreatment on a 4-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often). The reliability of the unfair treatment scale was adequate: alpha coefficients were .79, .79, and .78 for all participants, Whites only, and Blacks only, respectively. Total scores are positively related to self-reports of ill health, particularly among Blacks (Williams et al., 1997), and to carotid intima media thickness among Black middle-aged women (Troxel, Matthews, Bromberger, & Sutton-Tyrrell, 2003). The participants were asked to indicate the reasons for their experiences of unfair treatment on a checklist that included race, ethnicity, gender, age, income level, language, religion, body weight, other physical appearance, style of dress, who they hang out with, and other. Finally, they were asked to indicate the biggest reason for the experiences, hereafter labeled primary reason. Because of small numbers, categories of race and ethnicity and body weight and other physical appearance were combined.

Measurement of ABP

ABP and heart rate (HR) were obtained by using the Accutracker Dx ambulatory monitor (Suntech Medical Instruments, Raleigh, NC). This monitor uses the auscultatory method of BP assessment and is very similar in design to the Accutracker II, which has been validated according to Association for the Advancement of Medical Instrumentation and British Hypertension Society standards (Taylor, Chidley, Goodwin, Broeders, & Kirby, 1993). BP values obtained by the Accutracker Dx closely track those obtained by the Accutracker II and the measures obtained during clinic visits, with the Accutracker DX underestimating manual readings (Goodie & Kamarck, 1994). In a validity study carried out in the laboratory (N = 12), values from the Accutracker DX and manual readings (simultaneously measured on different arms) correlated during rest (SBP, r = .97, p < .001; DBP, r = -.76, p < .003) and during a math task (SBP, r = .94, p < .001; DBP, r = .70, p < .01), with the Accutracker DX underestimating manual resting SBP and DBP and task DBP. An appropriately sized cuff was placed on the nondominant arm of participants, with the microphone over the inner side of the arm. The Accutracker DX was programmed to take measures every 30 min during waking hours and every 60 min from 10 p.m. until 7 a.m. Measures were taken beginning at 8:30 a.m. of the first day, continuing until 1:30 p.m. of the second day. The data were uploaded to a PC by using AccuWin software (Suntech Medical Instruments, Raleigh, NC).

Assessment of BP Covariates, Moods, and Events

Participants completed 10 questions at each BP assessment during waking hours. (We could not ask for more because of the competing demands of school.) Respondents answered questions regarding their location when the BP cuff inflated (school, home, car/bus, other); their posture (lying down, sitting down, on their feet); their physical activity in the past 10 min (none, mild, moderate, heavy); their consumption in the past 10 min (none, food, caffeine, smoking); the people they had talked to in the past 10 min (school personnel, friends, parents, other relatives, other, no one); the extent of conflict or disagreement and pleasant interaction in the past 10 min; and whether they felt calm/relaxed, angry/upset, and involved/interested at the time of cuff inflation. All responses were recorded on a 5-point scale (YES!, Yes; yes; no; No; NO!). The diary data were collected via Palm Organizers. The organizers and software allowed us to collect responses, record the time of the responses, and store the information directly in database software for later retrieval.

Body Mass Index (BMI)

In the laboratory, participants’ heights were measured with a fixed steel tape while they were in a standing position, and their weights were
measured with a beam scale. The ratio of weight to height-squared (kg/m²) was calculated for each participant as a measure of obesity.

Procedure

The research team presented an overview of the study to students attending mandatory health classes or freshman orientation sessions and asked whether they were interested in obtaining further information about the project. Interested participants were sent a letter that provided an overview of the study for the student and parents or guardian. Then the research team contacted the student and responsible adult to ask whether they had any questions, and parents were asked about the children’s eligibility criteria, their own cardiovascular health history, and family socioeconomic status. Eligible students were then scheduled for two sessions: one involving two consecutive days of data collection at school and home and another in the psychophysiology laboratory. Prior to any testing, informed consent was obtained.

Research assistants 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 and the handheld computer diary. Four sample BPws were taken—two while the participant was seated and two while he or she was 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. The participant completed a diary entry on the handheld computer for practice. The monitor was programmed to take readings every 30 min during the day until 10 p.m., after which the monitor obtained readings every 60 min. Participants were instructed to complete a diary entry after every daytime reading.

Participants wore the monitor for the remainder of the school day and night and were instructed to remove it after awakening the following morning (after 5 a.m.) for their morning shower. Participants then returned to school the following morning where a research assistant again met each participant at school and reconnected the ABP monitor. The participant wore the monitor, which resumed readings every 30 min, for the remainder of the second school day. At the end of each day (approximately 10 p.m. the first day and 1:30 p.m. the second day), participants were asked to complete an overall assessment of their experiences during that day, including any medications they used, whether the day was typical, the best thing that happened that day and how pleasant it was on a 6-point scale, the most stressful thing that happened that day and how distressing it was on a 6-point scale, troublesome things that happened that day, and whether anyone that day provided help with a problem or argued with them.

Another session consisted of psychosocial questionnaires; measurements of health behaviors, height, and weight; an echocardiographic and carotid ultrasound examination; and a cardiovascular reactivity protocol, which included three resting BPws taken in the seated position after 10 min of rest. This session was almost always completed second. An automated BP device, IBS Model 700A (IBS Corporation, Waltham, MA), was used for these measures. These data are being reported elsewhere. Participants received payment for participation.

Data Reduction

Cardiovascular measures. The primary analyses of the BP measures were restricted to Day 1 daytime readings, with 29 observations. Of the Day 1 daytime readings, 4.8% (296 of 6,148) were lost as a result of either monitor cuff error (e.g., cuff not connected, air leak) or out-of-range values (DBP < 38 mmHg or > 145 mmHg; SBP < 58 mmHg or > 250 mmHg; or pulse pressure, that is, the arithmetic difference between SBP and DBP, < 10 mmHg). It should be noted that if any of these exclusion criteria were met, all data for a particular point in time were excluded. An average participant produced 27.7 (SD = 3.8) out of 29 valid BP readings, the data overall consisting of 95% (5,852 of 6,148) of valid BP readings. Day 2 daytime measures numbered a maximum of 12 observations. Similar criteria were used to edit the Day 2 BP data, with the average participant producing 9.7 (SD = 1.3) out of 12 valid BP readings, or 81%.

Diary of physical and mental activity. Four participants did not have Day 1 diary data because of equipment malfunction or failure to follow instructions. Including those 4, ratings were completed for 85% of the diary ratings, with the average participant producing 24.7 (SD = 4.0) out of 29 valid diary ratings. Taken together, 80% (4,897 of 6,148) of the BP measurements and all of the diary observations were simultaneously available for the analyses of Day 1 readings. For Day 2, an average participant produced 9.7 (SD = 1.3) out of a possible 12 diary ratings. Taken together, 74% (1,881 of 2,544) of the BP measurements and all of the diary observations were simultaneously available for the analyses of Day 2 readings.

Statistical Analyses

We used multilevel random coefficients regression analysis (PROC MIXED, SAS Institute) to test the hypotheses that participants who reported unfair treatment or who reported that the primary reasons for unfair treatment were race, gender, age, or physical appearance showed elevated BP levels and greater BP responses to changes in interpersonal interaction and mood compared with their counterparts. These hypotheses would be confirmed by significant main effects for the unfair treatment measures and by interaction terms for unfair treatment status (between-persons predictor) with the within-factors of interpersonal interaction and mood measured by diary simultaneous with BP readings across the monitoring day. Random-effects modeling allows for different intercepts and slopes of all within-participant variables across participants. The first-order auto-regressive error structure was specified to allow for auto-correlation among the sequentially assessed ambulatory readings from the same individuals as preliminary analyses comparing three types of error structures (auto-regressive, compound symmetry, and spatial power) showed that the model based on the auto-regressive error structure had the best fit. All models included three between-participants variables—race, sex, and BMI—and the interaction of race and sex. For within-participant variables, location, position, physical activity, and consumption of food, beverages, and so forth served as covariates. Categorical variables were dummy coded so that the following served as the referent: Black, female, school, lying down, no physical activity, and consuming nothing. Mood, conflict, and pleasant interaction were person centered; that is, each observation of an individual was subtracted from the individual’s mean across all observations. Mis-treatment scores and primary reasons for mistreatment were entered into separate models. Effect sizes were the parameter estimates divided by the mean of the group’s model-based standard deviations, which took into account the multiple observations for each participant.

Results

Participant Characteristics and Perceptions of Unfair Treatment

Table 1 shows the characteristics of the study participants. On average, they were 14.5 years of age and had parents with some college. Black adolescents had parents with less education than had White adolescents. BMIs were equivalent among the four race–gender groups and were within the normal weight range, although 6% had a BMI of ≥30. Average daytime SBP was greater among male adolescents than female adolescents. Daytime DBP was greater among Blacks than Whites, especially females, and HR was higher among female adolescents than male adolescents. Similar patterns were found for clinic-resting BP and HR.
To race/ethnicity by Blacks, and to age by Whites, only, the primary reasons were race, physical appearance, friends, income, language, and religion infrequently endorsed. For Blacks least 12% were age, physical appearance, and friends, with gender,relative of group, the primary reasons for mistreatment reported by at

sons for the unfair treatment than did Whites, female adolescents, respectively, but Blacks endorsed more reasons for the unfair treatment. Mean unfair treatment scores were higher among Whites,

Table 2 shows the mean unfair treatment scores and the primary reasons for the mistreatment. Mean unfair treatment scores were higher among Whites, F(1, 208) = 5.11, p < .03, and male adolescents, F(1, 208) = 4.38, p < .04, than among Blacks and female adolescents, respectively, but Blacks endorsed more reasons for the unfair treatment than did Whites, F(1, 208) = 8.80, p < .003.

Primary reasons for unfair treatment were more often attributed to race/ethnicity by Blacks, χ²(1, N = 188) = 11.49, p < .0007, and to age by Whites, χ²(1, N = 188) = 8.99, p < .004. Irrespective of group, the primary reasons for mistreatment reported by at least 12% were age, physical appearance, and friends, with gender, income, language, and religion infrequently endorsed. For Blacks only, the primary reasons were race, physical appearance, friends, and age, whereas for Whites only, they were age and physical appearance. Participants enrolled in the two high schools did not vary in unfair treatment scores or the primary reasons for unfair treatment, with the exception of the primary reason being race/ethnicity. The school that had a larger percentage of Blacks had participants that endorsed that reason proportionately more often (18.6% vs. 7.7%, p < .05).

Because of the association of ethnicity and parental education, we also examined the association of parental education and family income with unfair treatment scores. Parental education was lower among adolescents who reported the primary reason for unfair treatment being physical appearance (13.3 vs. 14.3 years, p < .004) and higher among adolescents who reported the primary reason being age (14.8 vs. 13.8 years, p < .03). No differences were obtained for parental education or income for adolescents classified by the primary reason being race or friends. Family

Table 2
Perceived Unfair Treatment Scores According to Race and Gender

<table>
<thead>
<tr>
<th>Unfair treatment scores</th>
<th>Black (n %)</th>
<th>White (n %)</th>
<th>Total (n %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD mistreatment scores</td>
<td>21.2 ± 5.2</td>
<td>19.5 ± 4.1</td>
<td>22.2 ± 4.9</td>
</tr>
<tr>
<td>Mean ± SD total no. of reasons</td>
<td>3.7 ± 2.2</td>
<td>3.7 ± 1.8</td>
<td>2.6 ± 1.9</td>
</tr>
<tr>
<td>Primary reason for mistreatment: n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>11 (21.2)</td>
<td>11 (20.4)</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>Gender</td>
<td>1 (1.9)</td>
<td>1 (1.9)</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>Age</td>
<td>8 (15.4)</td>
<td>8 (14.8)</td>
<td>17 (30.2)</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>4 (7.7)</td>
<td>14 (25.9)</td>
<td>8 (15.1)</td>
</tr>
<tr>
<td>Friends</td>
<td>9 (17.3)</td>
<td>9 (16.7)</td>
<td>6 (11.3)</td>
</tr>
<tr>
<td>Clothes</td>
<td>8 (15.4)</td>
<td>3 (5.6)</td>
<td>5 (9.4)</td>
</tr>
<tr>
<td>Income</td>
<td>2 (3.9)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Language</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>Religion</td>
<td>2 (3.9)</td>
<td>1 (1.9)</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (1.9)</td>
<td>2 (3.7)</td>
<td>6 (11.3)</td>
</tr>
<tr>
<td>Not specified</td>
<td>6 (11.5)</td>
<td>5 (9.3)</td>
<td>7 (15.1)</td>
</tr>
</tbody>
</table>
income was higher among adolescents who reported the primary reason being age \((p < .004)\).

**Predictors of ABP**

Table 3 shows the parameter estimates from the multilevel model for the covariates, except for mood and interpersonal interactions. Males had higher average SBP. SBP varied by location, posture, physical activity, and food intake, such that SBP was higher when participants were at home and other locations relative to school; sitting or standing relative to reclining; taking more strenuous activity; and eating food or drinking caffeinated beverages; or smoking. Relative to Whites, especially females, Blacks had higher average DBP. DBP varied by location, posture, physical activity, and food intake, such that DBP was higher when participants were in the car or bus but lower when participants were at home relative to school; and higher when participants were sitting or standing relative to reclining; engaged in mild exercise relative to none; and eating food, drinking caffeinated beverages, and so forth. Ratings of decreasing calmness (parameter estimate \(= -.43, p < .07\)) and increasing anger (parameter estimate \(= .43, p < .10\)) tended to be associated with increasing DBP. The ratings of interest–involvement were not related to changes in BP.

Next we evaluated whether total unfair treatment scores or those primary reasons that had a prevalence of at least 12% were important predictors of ABP above and beyond the standard co-variates. In addition, because race/ethnicity and age were important primary reasons for Blacks and Whites, respectively, we also evaluated those factors as primary reasons as interactions with race both in the full sample and in Blacks and Whites taken separately. Finally, we evaluated whether racism endorsed as one of the reasons for unfair treatment was related to BP.

**Table 3**

Parameter Estimates for Multilevel Modeling of Day 1 ABP According to Physical Appearance as Primary Reason for Unfair Treatment

<table>
<thead>
<tr>
<th>Variable</th>
<th>SBP</th>
<th></th>
<th>DBP</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>(p)</td>
<td>Estimate</td>
<td>(p)</td>
</tr>
<tr>
<td>Race: White vs. Black</td>
<td>-2.73</td>
<td>.36</td>
<td>-4.94</td>
<td>.0004</td>
</tr>
<tr>
<td>Sex: Male vs. female</td>
<td>7.49</td>
<td>.01</td>
<td>-1.54</td>
<td>.27</td>
</tr>
<tr>
<td>Race (\times) Sex</td>
<td>0.10</td>
<td>.98</td>
<td>3.73</td>
<td>.05</td>
</tr>
<tr>
<td>Location (vs. school)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>4.53</td>
<td>&lt; .0001</td>
<td>-2.63</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>Other</td>
<td>4.35</td>
<td>&lt; .0001</td>
<td>0.90</td>
<td>.09</td>
</tr>
<tr>
<td>Position (vs. reclining)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting</td>
<td>2.75</td>
<td>&lt; .0007</td>
<td>5.33</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>Standing</td>
<td>9.00</td>
<td>&lt; .0001</td>
<td>10.58</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>Physical activity (vs. none)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>2.97</td>
<td>&lt; .0001</td>
<td>1.10</td>
<td>.01</td>
</tr>
<tr>
<td>Moderate or greater</td>
<td>6.15</td>
<td>&lt; .0001</td>
<td>1.43</td>
<td>.07</td>
</tr>
<tr>
<td>Intake of food, caffeine vs. none</td>
<td>1.85</td>
<td>&lt; .0007</td>
<td>0.93</td>
<td>.02</td>
</tr>
<tr>
<td>BMI</td>
<td>-0.10</td>
<td>.73</td>
<td>-0.30</td>
<td>.02</td>
</tr>
<tr>
<td>Physical appearance as primary reason vs. no</td>
<td>7.57</td>
<td>.0092</td>
<td>3.71</td>
<td>.0045</td>
</tr>
</tbody>
</table>

_Note._ ABP = ambulatory blood pressure; SBP = systolic blood pressure; DBP = diastolic blood pressure; BMI = body mass index.

Total unfair treatment scores were not significant predictors of either SBP \((p = .96)\) or DBP \((p = .36)\). Race as a primary reason for unfair treatment was not a significant predictor of either SBP \((p > .89)\) or DBP \((p > .77)\) in the full model for Day 1. It was not related in analyses stratified by race or testing for an interaction between race and race/ethnicity as the primary reason. Endorsing race as one of the reasons for unfair treatment was not related to Day 1 BP \((p > .17)\) in the full sample or in Blacks only \((p > .42)\). (Note that 26 Black males, 18 Black females, 8 White males, and 7 White females endorsed race/ethnicity as a reason.) Analyses of Day 2 BP also showed no relationships when analyzed separately or with days as a nested variable (i.e., the first 12 readings of both days).

The only primary reason for unfair treatment that was a significant predictor of Day 1 BP in the full sample was physical appearance. Those who indicated that physical appearance was the primary reason for their mistreatment had higher overall Day 1 SBP \((estimate = 7.57, p < .01)\) and DBP \((estimate = 3.71, p < .005)\) levels than did those who did not indicate that as their primary reason. The effect sizes are 3.79 for SBP and 4.10 for DBP in units of average model-based standard deviations. This analysis excluded 24 participants who did not indicate a primary reason, usually because of a low mistreatment score. Of these 24 participants, 4 included physical appearance as one of the reasons for unfair treatment on their checklists. When these 4 were considered as having endorsed physical appearance as a primary reason and the other 20 were placed in the category of not endorsing physical appearance as a primary reason, the results were similar \((SBP estimate = 5.50, p < .04; DBP estimate = 2.97, p < .02)\).

Note that the above results were not due to the participants being heavier, as BMI was statistically controlled in all analyses. To evaluate whether the effect for physical appearance was unique to the measurements taken on the school day, we repeated the full model for physical appearance as the primary reason using the resting BP obtained in the clinic on a separate day as a covariate; the results remained the same. As for Day 1, those who reported that physical appearance was the primary reason for their unfair treatment had elevated ambulatory Day 2 SBP \((estimate = 7.28, p < .008)\) and DBP \((estimate = 3.93, p < .007)\) levels in the multivariate model, with effect sizes of 2.05 standard deviations and 1.82 standard deviations, respectively. School as a covariate in the model did not alter the results, and there were no interactions of ethnic group with the physical appearance as the primary reason. Finally, educational attainment of the parents was introduced into the model, and the effect of physical appearance remained significant for SBP \((parameter estimate = 7.40, p < .02)\) and DBP \((parameter estimate = 3.57, p < .007)\). Thus, the elevated ABP for the participants who perceived physical appearance as the primary reason for discrimination was apparent both days; was not a consequence of being heavier, having elevated resting BP levels in the clinic, or coming from less educated families; and was apparent in both Blacks and Whites.

Next we evaluated whether those who had high mistreatment scores or who endorsed age, physical appearance, friends, and race (Blacks only) as primary reasons for mistreatment were more likely to have elevated BP when they experienced changes in mood or quality of interaction. The models were repeated with the mood, conflict, and pleasant interaction entered in separate models as main effects and in interactions with the unfair treatment vari-
End-of-the-Day Diary Reports

We evaluated whether adolescents who reported high levels of unfair treatment or attributed the unfair treatment to race, age, physical appearance, or other factors differed in their overall experiences during that day, as summarized by their end-of-the-day diary reports. Total unfair treatment scores were not related to the end-of-the-day reports. However, those who endorsed their peer group as the primary reason for unfair treatment indicated more often that troublesome things happened that day in the categories a lot of work at school, a lot of work at home, and a lot of demands made by family than did their counterparts (ps < .05). Those who reported that the primary reason for their unfair treatment was physical appearance did indicate that their day was less typical and that they less often reported that troublesome things happened that day in the category a lot of demands made by family than did their counterparts (ps < .05). Thus, their days were more benign than usual, not more troublesome. Whites rated the worst thing that happened to them that day as more distressing than did Blacks (Ms = 3.54 vs. 3.95, respectively, p < .05), and Whites reported more often of having arguments or tension with others (odds ratio [OR] = 1.77, p = .053). Female adolescents reported more often of having any arguments or tension with others (OR = 0.57, p = .06) and that troublesome things happened that day in the category a lot of demands made by family (OR = 0.50, p < .05) than did male adolescents.

Discussion

The primary purpose of this study was to evaluate whether adolescents who reported high levels of mistreatment or mistreatment due to race and factors related to the adolescent transition experienced elevated ABP during a school day. High levels of mistreatment or mistreatment attributed primarily to race were not related to elevated BP in this sample. Previous literature has not shown that racism is directly related to resting BP or hypertensive status but rather that associations vary by occupational status and method of coping with racism (Brondolo et al., 2003). Our findings suggest that among adolescents, individual differences in perceived racism are not a strong correlate of high ABP.

We do not interpret our null finding to mean that racial discrimination is not harmful to BP regulation. Psychophysiological research does suggest that racist comments or challenges that are threatening lead to acute elevations in BP (Clark, 2000; Guyl, Matthews, & Bromberger, 2001). ABP in one study was associated with perceived racism (Steffen et al., 2003), and our own results suggest that adolescents who experience high levels of mistreatment increase in ABP when they experience decreasing calmness. Discrimination may have uniform and negative effects on the minority population that cannot be observed within the population but can be observed between groups. Further, a long history of discrimination can lead to successful ways of coping with the stress of discrimination in the minority community that can mitigate its impact on BP. The adverse effects of discrimination may also be indirect, in terms of limiting academic achievement and opportunities for advancement, resulting in lower socioeconomic status and its consequent health-damaging effects on BP regulation (Adler et al., 1994). Finally, the integrated nature of the school environment and the families training their minority children to operate successfully within that environment may play a protective role.

In contrast to perceptions of mistreatment due to race, perceptions of mistreatment due to factors related to the adolescent transition were associated with elevated ABP. In particular, those who reported being unfairly treated primarily because of physical appearance were more likely to have elevated ambulatory SBP and DBP throughout the school day. The association between unfair treatment being due primarily to physical appearance and BP remained significant when statistical controls were introduced for BMI, gender, race, location, posture, physical activity, and mood. The same association was observed during the second day of data collection and when statistical adjustments were made for in-clinic pressure and parental education. Thus, the association is quite robust.

Our findings can be understood within a more general social dominance perspective of intergroup conflict (Sidanius & Pratto, 1999). This perspective begins with the premise that all human societies tend to be structured into group-based social hierarchies, which, at the minimum, contain one dominant and one subordinate group. Whereas the dominant group members enjoy positive social value by virtue of their group membership, the subordinate group members possess negative social value in terms of power, status, and even negative sanctions. These group distinctions are often culturally constructed and arbitrary and result in group conflict and oppression of the subordinate group (Sidanius & Pratto, 1999). Psychophysiological studies show that interacting with a dominant partner can augment BP responses (Brown, Smith, & Benjamin, 1998; Newton, Bane, Flores, & Greenfield, 1999) and that the effects of a higher status partner may be vascularity mediated (Mendes, Blascovich, Major, & Seery, 2001). Within the culture of a high school, and arguably within American society at large, physical appearance is an important dimension on which group-based hierarchies are formed. Within a social dominance framework, the culture in an urban, integrated high school may deem physical appearance a more potent group-based hierarchy than ethnicity. As such, it is not surprising that those who perceive unfair treatment to be based on being unattractive experienced increased BP both at school and at home.

Not important to BP elevations was another factor related to the adolescent transition, that is, one’s peer group. Why might attributions of unfair treatment to one’s physical appearance be associated with elevated BP whereas attributions to one’s peer group were not? One explanation is the locus of causality. Feeling unfairly treated because of one’s own physical appearance may lead to a heightened sense of self-awareness, feelings of discomfort at the thought of being evaluated on the basis of appearance, and interpersonal awkwardness with peers. On the other hand, ascribing unfair treatment to one’s peer group shares the responsibility for unfair treatment with the group, may not lead to the same level of personal discomfort, and may in fact reinforce a sense of belonging.
Perhaps theoretical and empirical research generated on discrimination and mental health applies to BP regulation. Crocker and Major (1989) and their colleagues have argued that perceived discrimination does not always have a negative influence on self-esteem because the individuals who experience perceived discrimination may attribute negative qualities to the person engaging in unfair treatment toward them, they may compare themselves positively with members of their own group as opposed to those of the majority group, and they may selectively devalue attributes on which their group fares poorly and value those attributes on which their group excels. Furthermore, the extent of controllability of the reason for discrimination may play a role. For example, race is not a controllable attribute, and Blacks may ascribe responsibility for mistreatment to another’s racism and not to their own behavior. On the other hand, being heavy or having unattractive physical appearance is perceived as controllable and for which the individual bears some responsibility (Crocker, Cornwell, & Major, 1993). This reasoning is post hoc but does suggest testable hypotheses for future research on the reasons for associations between attributions of unfair treatment and BP regulation.

A secondary purpose of the investigation was to describe the influences of race and gender on a sense of mistreatment and the reasons for that mistreatment in adolescence. We were surprised to learn that a general sense of unfair treatment was reported not by Blacks but Whites, especially males. Consistent with these findings are the reports from the end-of-the-day diaries where Whites reported more distress due to the worst thing that happened that day and more conflicts during the day than did Blacks. The primary reasons for unfair treatment varied by race, with Blacks indicating that race, physical appearance, friends, and age were the most important factors and Whites indicating that age and physical appearance were the key factors. Gender was seldom listed, with only 5 adolescents endorsing that as a primary factor. In previous work that used the same scale to measure unfair treatment in middle-aged women in Pittsburgh, Blacks reported more unfair treatment than did Whites, with the primary reason being race (Troxel et al., 2003). It is possible that the differences in these findings are due to developmental factors, such that attributions of unfair treatment among Blacks require an understanding and commitment to their ethnic identity or further exposure to discrimination and mistreatment through young adulthood and into midlife.

In support of this explanation, research on the development of ethnic identity suggests that a strong identification with one’s ethnic group may not occur until later adolescence. For example, in a study of 8th graders, only one third of Blacks had thought about and discussed their ethnic identity (Phinney & Tarver, 1988). Among 10th graders, half of the minority students had not explored their ethnicity at all, and only a fourth had explored and were committed to their ethnic identity (Phinney, 1989). Finally, in a longitudinal study of ethnic identity in adolescence, significant increases in ethnic identity occurred from ages 16 to 19 (Phinney & Chiavira, 1992). If ethnic identity is an important precursor to being affected by perceived ethnic discrimination, then the effects may emerge later in the life course, like occurred in the Steffen et al. (2003) study.

Primary study limitations are the nature of the sample, in that students were selected from two urban, integrated schools in the northeastern part of the United States that served student bodies that were also economically diverse. Thus, the findings cannot be generalized to other types of schools. Second, the study is cross-sectional in nature. The sample is healthy, so the range of ABP is limited. Finally, the measure of discrimination did not measure extent of exposure to racism, although it measured the extent of exposure to unfair treatment from all causes. On the other hand, we have used state-of-the-art measures of ABP and analytic techniques. We had excellent participation rates and high quality data. Finally, the study is the first to examine the role of unfair treatment in adolescent BP and the first to use ABP as the outcome with appropriate covariates that impact on BP regulation.

In sum, this study found that unfair treatment and attributions of unfair treatment to racism are not associated with elevated ABP in adolescents, suggesting that perceived racism does not play a role in the early development of hypertension risk. However, although these findings are specific to students who are enrolled in ethnically diverse schools, the findings are consistent with data in other population-based studies that used clinic measures of BP or self-reported hypertension as the outcome. Unfair treatment attributed to physical appearance does seem to lead to elevated BP across several school days and cannot be attributed to a variety of the usual determinants of BP, including weight, race, gender, posture, consumption, physical activity, and mood states. The development of a sense of unfair treatment, the reasons for it, in the context of ethnic identity, and the impact on risk for hypertension must be understood in the context of the life course of the individual.

References


