Research Article

AFRICAN AMERICANS AND HIGH BLOOD PRESSURE: The Role of Stereotype Threat

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Abstract—*We examined the effect of stereotype threat on blood pressure reactivity. Compared with European Americans, and African Americans under little or no stereotype threat, African Americans under stereotype threat exhibited larger increases in mean arterial blood pressure during an academic test, and performed more poorly on difficult test items. We discuss the significance of these findings for understanding the incidence of hypertension among African Americans.*

Many studies have demonstrated that African Americans have a higher incidence of high blood pressure, or hypertension, than European Americans (for reviews, see Anderson, 1989; Folkow, 1982; Obrist, 1981). Some researchers have argued that genetic factors explain the higher incidence (Rotimi, Cooper, Cao, Sundarum, & McGee, 1994). Others have argued that social environmental factors explain the higher incidence; specifically, they have claimed that African Americans experience stressful episodes more chronically than European Americans, which leads in turn to the observed racial differences in hypertension (Anderson, McNeilly, & Myers, 1993; Clark, Anderson, Clark, & Williams, 1999).

In the experiment we report here, we tested the latter notion by examining a specific type of stressor, stereotype threat, which may affect African Americans' hemodynamic reactivity. Steele and his colleagues (Aronson, Quinn, & Spencer, 1998; Spencer, Steele, & Quinn, 1999; Steele, 1997; Steele & Aronson, 1995; Steele, Spencer, & Aronson, in press) have presented a framework for understanding how stereotypes affect members of stereotyped groups. According to this framework, members of such groups experience stereotype threat when they are in situations in which other people may view them stereotypically in ways likely to increase performance pressures (i.e., stress). Research has shown that members of stereotyped groups (African Americans; Latinos; people of low socioeconomic status; women, in certain domains such as mathematics) perform more poorly on standardized tests, particularly on difficult items, than their nonstereotyped counterparts when stereotype threat is high. However, no such performance differences emerge when stereotype threat is low (Croizet & Claire, 1998; Spencer et al., 1999; Steele, 1997; Steele & Aronson, 1995). In the current experiment, we tested the hypothesis that increased blood pressure accompanies the stress or threat induced by stereotype threat among African Americans.

Three lines of evidence converge to suggest that being subject to repeated episodes of stress may play an important role in the higher incidence of hypertension among African Americans. First, family history of hypertension does not appear to predict greater cardiovascular reactivity among African Americans, unlike European Americans (Anderson et al., 1986; Clark et al., 1999; Falkner, Kushner, Khalsa, Canessa, & Katz, 1986; Johnson, 1989; Morrell, Myers, Shapiro, Goldstein, & Armstrong, 1989). Second, repressing anger and anger-provoking manipulations, particularly ones in which racism provokes the anger, do produce greater cardiovascular reactivity among African Americans compared with European Americans (Armstead, Lawler, Gorden, Cross, & Gibbons, 1989; Harburg, Blakelock, & Roper, 1979; Johnson, 1989; Johnson, Schork, & Spielberger, 1987). Third, John Henryism, or the tendency to work extremely hard while not giving up on difficult and demanding tasks, has been strongly associated with hypertension in African Americans but not in European Americans (James, Hartnett, & Kalsbeek, 1983; James, LaCroix, Kleinbaum, & Strogatz, 1984; James, Strogatz, Wing, & Ramsey, 1987).

Because African Americans face more situations in which they are stereotyped by others and consequently face a relatively high level of stereotype threat, a rare experience for European Americans, their comparatively high chronic blood pressure levels may stem, at least in part, from these multiple episodes of stereotype threat. Repeated episodes of acute blood pressure increases are thought to lead to chronically high blood pressure levels, or hypertension. Anderson et al. (1993) and Clark et al. (1999) have proposed mechanisms for this pathophysiological process.

To test this reasoning more directly, we examined mean arterial blood pressure (MAP) responses of African and European Americans in situations in which the saliency of stereotype threat for African Americans was varied. We hypothesized an interaction between stereotype threat and race such that when stereotype threat was relatively high, African Americans would have higher blood pressure levels than European Americans, but when stereotype threat was low, no racial differences would occur.

METHOD

Participants

Forty-one university students volunteered to participate in the study and received $20 for participation. The data of 2 participants were completely unusable because of mechanical difficulties with the physiological recording equipment, leaving 20 African-American and 19 European-American participants in the study.

Setting and Apparatus

The experiment took place in the recording chamber of a social psychophysiology laboratory. The chamber contained an unobtrusive video camera and intercom system for monitoring participants' well-being throughout the experiment, as well as video monitors and audio speakers for the presentation of instructions and stimuli. Participants were seated comfortably throughout the experiment.

Measures

The numbers of correct test items for the two tasks (described in the Procedure section) constituted the performance measure.

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We recorded MAP continuously using a Cortronics (Model 5000) automated blood pressure device and stored these data digitally on a laboratory computer. Larsen, Schneiderman, and Pasin (1986) argued that MAP is preferable to either systolic or diastolic blood pressure measurements, especially with regard to its relationship to hypertension.

Procedure

When participants arrived at the lab, they were met by a female research assistant of their own race. Before they entered the experimental chamber, the assistant explained that the study was about physiological responses to cognitive tasks.

Once the experimenter had calibrated the physiological equipment, participants heard audiotaped instructions simply to relax for a 5-min rest period. This period provided the baseline for subsequent MAP changes (i.e., MAP reactivity). Following the baseline period, participants received instructions (via videotape) for the stereotype-threat condition (i.e., the experimental manipulation) to which they had been randomly assigned. In the high-stereotype-threat condition, participants saw a European-American man who introduced himself as a professor from Stanford University. He briefly discussed the recent debate regarding the use of standardized tests (i.e., whether they are biased toward particular subcultural groups) and explained that researchers at Princeton University, Stanford, and the University of Michigan had developed a new test of intelligence that the participants would soon take. The participants were told they were taking the test to help the test developers achieve a nationally representative sample. In the low-stereotype-threat condition, participants saw an African American who also introduced himself as a professor from Stanford. He also noted the debate about the use of standardized tests. He went on to say that researchers at Tulane University, Howard University, and the University of Michigan had developed the test the participants would take, and that the test was the first step in an attempt to develop a culturally unbiased test. He further indicated that earlier studies using this test at other colleges and universities had found that the test was unbiased—that black and white college students had performed equally well—and that the test was currently being given as part of a project to demonstrate the fairness of the test.

After participants viewed the condition-relevant videotape, they listened to audiotaped instructions explaining the "verbal ability subtest" and saw several example problems and answers on a video monitor. The test was actually a version of the Remote Associates Test (RAT; McFarlin & Blascovich, 1984). Each item on the RAT consists of three words (e.g., "mouse, sharp, and blue"), and participants are instructed to generate a fourth word related to all three (in this case, the correct answer is "cheese"). So that participants' performance would be somewhat ambiguous, we used a mix of difficult, moderate, and easy RAT items (McFarlin & Blascovich, 1984). Participants were told they would see each item on the computer screen in front of them and would have 30 s to provide an answer. They performed two 10-item RAT tasks.

The timeline of the procedure was as follows. First, the experimenter attached the Cortronics blood pressure cuff to the participant's arm and initiated the automated self-calibration process of the system. Next, the experimenter left the recording chamber. Subsequently, the participant sat and relaxed for 5 min while baseline mean MAP values were recorded (Minutes 1–5). Participants then received the manipulation and instructions (Minute 6) and subsequently spent 5 min on the first RAT task (30 s per item; Minutes 7–11). They then received instructions to sit and rest (Minute 12), rested for another 5-min period (Minutes 13–17), received instructions for the second task (Minute 18), and subsequently spent another 5 min on the second RAT task (Minutes 19–23). Afterward, the experimenter met with the participant to go over a detailed debriefing (and probe for suspicion).

RESULTS

Performance on the RAT

We conducted a three-factor analysis of variance to test for performance differences using the number of correctly answered RAT items as the dependent measure. The two between-subjects factors were race (African or European American) and stereotype-threat condition (high or low). The within-subjects factor was level of item difficulty (high, moderate, or low). This analysis revealed only a main effect for item difficulty, $F(2, 74) = 50.77$, $p < .001$, with significantly poorer performance on the difficult items ($M = 1.17$ correct) than the moderate items ($M = 2.12$ correct), $F(2, 80) = 14.61$, $p < .001$, and significantly poorer performance on the moderate than the easy items ($M = 3.68$ correct), $F(2, 80) = 39.33$, $p < .001$.

Because previous stereotype-threat research has shown that performance detriments on standardized tests emerge only on difficult problems (Spencer et al., 1999; Steele, 1997; Steele et al., in press), we performed a priori contrasts comparing the performance of African Americans in the high-stereotype-threat condition with the performance of the other three groups (African Americans in the low-stereotype-threat condition, European Americans in both stereotype-threat conditions) on the difficult, moderate, and easy RAT items. As predicted, African Americans in the high-stereotype-threat condition performed significantly more poorly ($M = 0.73$) on the difficult items than the other three groups (Ms = 1.2 for African Americans in the low-stereotype-threat condition and 1.4 for European Americans in each stereotype-threat condition), $t(37) = 1.78$, $p < .05$; there were no significant differences on the moderate or easy items (ts < 1).

Physiological Responses

Baseline and reactivity scores

We calculated mean baseline MAP values across heart beat cycles for each of the last 3 min of the baseline period, the full 5 min of the first RAT task (Minutes 7–11), the intervening rest period (Minutes 13–17), and the second RAT task (Minutes 19–23).[1] We tested for group differences in baseline physiological responses by conducting a mixed model analysis of variance on the final 3 min of baseline MAP with minute of the experiment as the within-participants factor and race and stereotype-threat condition as the between-participants factors. No significant main effects or interactions emerged, Fs < 1.1. For the subsequent analyses, we computed MAP reactivity scores by subtracting each participant's mean baseline value from the MAP value for each minute of the two task periods and the intervening rest period.

1. We omitted Minutes 12 and 18 from all analyses as they represented transition minutes between the first task and rest and between rest and the second task, respectively. If data for these minutes are included in the analysis and all data are collapsed across postbaseline minutes, the results are unchanged from those reported.

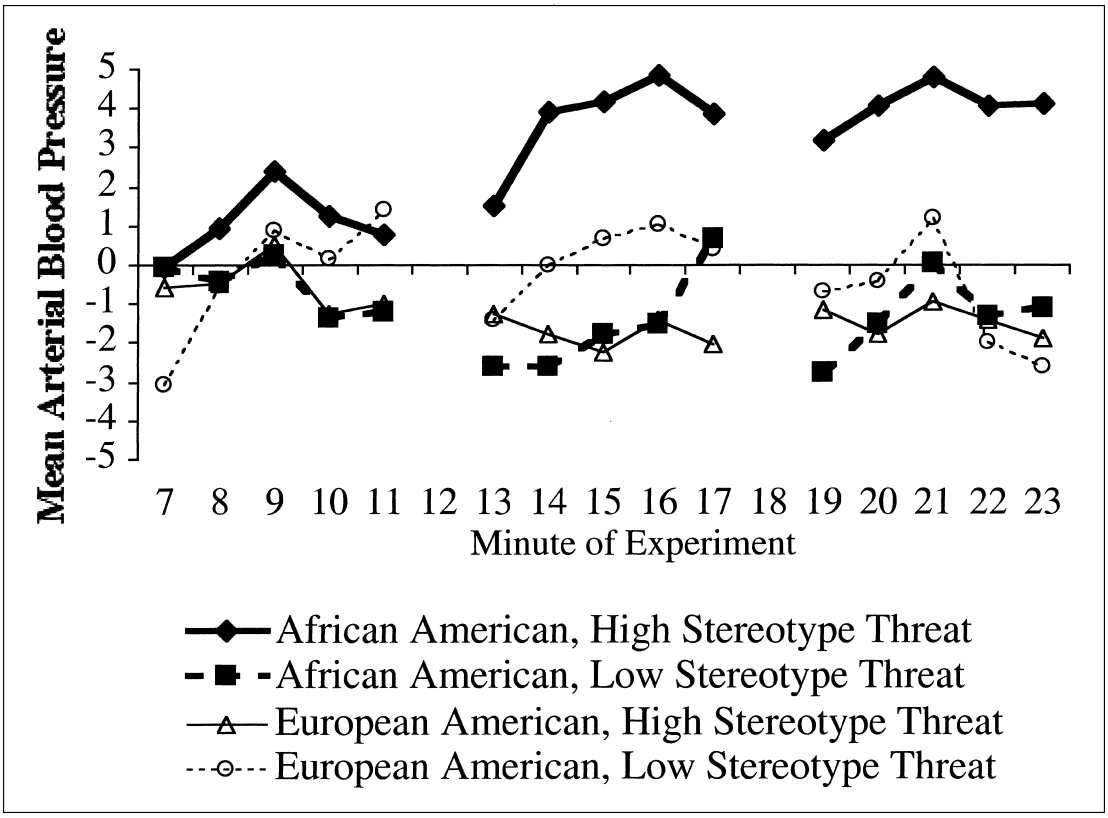

Fig. 1. Covariance-adjusted mean arterial blood pressure reactivity by race, stereotype-threat condition, and post-baseline minute.

Differences during the experimental phase

In order to identify significant race and stereotype-threat effects or interactions during the experimental (i.e., postbaseline) phase of the experiment, we conducted a fixed-effects analysis of covariance (ANCOVA) with race and stereotype threat as the between-participants factors, using the average MAP reactivity score across the 15 task and resting minutes of the experimental period (i.e., during the first task, during the intervening rest period, and during the second task). Baseline MAP scores were used as covariates to control further for relative baseline levels.[2] This analysis revealed no main effects for race or stereotype-threat condition (*p*s $> .26$). However, a significant race-by-stereotype-threat interaction occurred, $F(1, 31) = 6.15$, $p < .02$. As Figure 1[3] illustrates, greater MAP reactivity for African Americans in the high-stereotype-threat condition drove this interaction. MAP reactivity was significantly greater than zero only in this condition, $F(1, 35) = 16.18$, $p < .001$, and MAP reactivity was significantly greater for this condition than for the other three conditions, $F(1, 32) = 5.57$, $p < .03$, which did not differ significantly from each other.

In order to further examine the nature of the race-by-condition interaction, we divided the experimental phase into its three major components: first RAT task, intervening rest period, and second RAT task, performing a separate analysis for each one.

First RAT task

We analyzed MAP reactivity scores during the 5 min of the first task conducting a mixed-model ANCOVA with minute as a within-participants factor and race and stereotype-threat condition as the between-participants factors, using mean baseline MAP values as covariates to further control for baseline levels.[4] Neither the main effects for race and stereotype-threat condition nor the race-by-stereotype-threat-condition interaction was significant ($p > .5$). The main effect for time was significant, $F(4, 140) = 3.36$, $p < .02$, and the interaction of race, stereotype-threat condition, and time was significant, $F(4, 140) = 3.28$, $p < .04$. As the mean MAP reactivity scores for Minutes 7

2. We repeated all the analyses of MAP described in this report using overall performance score and performance on difficult items as covariates to rule out any possible confounds of performance with stereotype-threat condition and race. Neither performance score was a significant covariate in any of these analyses (all but one $F < 1$), and these covariates did not change the pattern or statistical significance of any of the results.

3. The means in Figure 1 and throughout the rest of this article are adjusted means controlling for baseline MAP.

4. The *F* ratios for the mixed-model designs throughout this article are reported using the Geisser-Greenhouse adjusted *F* test. This test adjusts for the fact that the circularity assumption may not be met in a repeated measures design. See Kirk (1982, p. 261) for a discussion of this procedure.

through 11 in Figure 1 indicate, African Americans in the high-stereotype-threat condition experienced the highest level of MAP for any condition or minute during Minute 9. Post hoc comparisons indicated that MAP reactivity was significantly greater than zero for African Americans in this condition, $F(1, 38) = 8.02$, $p < .01$, whereas reactivity in the other conditions did not differ from zero during this minute. Similarly, MAP reactivity was marginally greater for African Americans in the high-stereotype-threat condition than in the other three conditions during Minute 10, $F(1, 35) = 3.46$, $p = .07$. MAP reactivity for European Americans in the low-stereotype-threat condition was significantly less than zero during Minute 7, $F(1, 38) = 14.2$, $p < .001$, but only for this, the first minute of the first task.

Intervening rest period

Similarly, we analyzed MAP reactivity scores during the 5 min of the intervening rest period conducting a mixed-model ANCOVA with minute as a within-participants factor and race and stereotype-threat condition as the between-participants factors. Again, we used mean baseline MAP values as covariates. The main effects for race and stereotype-threat condition did not reach significance (ps $> .35$). However, the race-by-stereotype-threat-condition interaction did reach significance, $F(1, 32) = 4.16$, $p < .05$. In addition, the main effect for time was significant, $F(4, 132) = 3.22$, $p < .02$, but time did not interact significantly with the other variables. As Figure 1 illustrates, the significant interaction was due in part to substantially higher MAP levels in the African-American, high-stereotype-threat condition compared with all other conditions during Minutes 13 through 17. MAP reactivity was significantly greater than zero only in this condition, $F(1, 37) = 16.86$, $p < .001$, and MAP reactivity was significantly greater in this condition than in the other three conditions, $F(1, 34) = 9.82$, $p < .01$. Interestingly, MAP reactivity was marginally less than zero in the European-American, high-stereotype-threat condition, $F(1, 37) = 3.98$, $p = .051$.

Second RAT task

Finally, we analyzed MAP reactivity scores during the 5 min of the second RAT task, again conducting a mixed-model ANCOVA with minute as a within-participants factor and race and stereotype-threat condition as the between-participants factors, and using mean baseline MAP values as covariates to further control for baseline levels. Neither the main effects for race and condition nor the race-by-stereotype-threat-condition interaction reached significance (ps $> .18$). The main effect for time was significant, $F(4, 124) = 3.57$, $p < .01$, but time did not interact significantly with the other variables (ps $> .44$).

Because there were no interactions with time and because we could gain statistical power by including participants for whom there were missing data from some of the minutes in the mixed-model ANCOVA, we collapsed across time and ran a fixed-model ANCOVA with race and stereotype-threat condition as between-participants factors and baseline MAP values as covariates. The race-by-stereotype-threat-condition interaction was significant in this analysis, $F(1, 29) = 5.42$, $p < .05$. As the mean MAP reactivity scores for Minutes 19 through 23 in Figure 1 indicate, African Americans in the high-stereotype-threat condition experienced the largest increases in MAP. MAP reactivity was significantly greater than zero only in this condition, $F(1, 35) = 22.91$, $p < .001$, and MAP reactivity was significantly greater in this condition than in the other three conditions, $F(1, 32) = 6.44$, $p < .02$.

DISCUSSION

We found that African Americans open to stereotype threat on a cognitive task exhibited greater blood pressure increases than European Americans, and this relatively heightened blood pressure continued even during a 5-min rest period and through another task. In contrast, when stereotype threat was low, African Americans did not have greater blood pressure increases than European Americans. Furthermore, although African Americans predictably performed more poorly on difficult RAT items, performance effects cannot account for the blood pressure differences (as indicated by the fact that including performance as a covariate in the analyses did not change the results).

These results suggest that stereotype threat may play an important role in the incidence of hypertension among African Americans. It seems likely that African Americans encounter more situations in which they face stereotyping than European Americans. If one can generalize our findings to real-life situations, then increased exposure to situations that provoke stereotype threat might well result in African Americans experiencing many more situations (compared with European Americans) in which their blood pressure is elevated. Over time, these individual incidents might lead to more chronic changes that could lead to hypertension (see Anderson et al., 1993; Clark et al., 1999).

One should note, however, that the current results are merely suggestive, and their implications for hypertension are likely to be complicated for at least two reasons. First, in this study, we demonstrated only that African Americans open to high stereotype threat had increased blood pressure over the course of a 20-min period. The long-term consequences of such increases in blood pressure were not examined. In addition, the biological mechanisms by which these acute increases in blood pressure would lead to chronic hypertension (see Anderson et al., 1993; Clark et al., 1999) were not examined.

Second, we did not examine the generalizability of the results to other situations or other groups of participants. Here, we examined African-American college students taking an intellectual test. Other participant populations (perhaps those less concerned with their performance on an intellectual test) or these same participants on other tasks (perhaps tasks in which important identities are not at stake) may not experience increased blood pressure in response to stereotype threat. This possibility, which is consistent with previous work on stereotype threat (Spencer et al., 1999; Steele, 1997; Steele & Aronson, 1995; Steele et al., in press), means that the link between stereotype threat and hypertension may be more complicated than the current study suggests.

Despite these qualifications, we believe the results of this study provide an interesting account of how stress might play an important role in the relatively high incidence of hypertension in African Americans. If this account is correct, then simple stress among African Americans does not contribute to the development of hypertension in African Americans as much as does a particular type of stress—being in a situation in which one desires positive evaluation but faces the possibility of being evaluated stereotypically in a negative way. We believe the current results warrant further investigation of this idea.

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