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Concerns about Appearing Prejudiced Get Under the Skin: Stress Responses to Interracial Contact in the Moment and across Time

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Abstract

Many White Americans are concerned about appearing prejudiced. How these concerns affect responses during actual interracial interactions, however, remains understudied. The present work examines stress responses to interracial contact—both in the moment, during interracial interactions (Study 1), and over time as individuals have repeated interracial contact (Study 2). Results of Study 1 revealed that concerns about appearing prejudiced were associated with heightened stress responses during interracial encounters (Study 1). White participants concerned about appearing prejudiced exhibited significant increases in cortisol “stress hormone” levels as well as increases in anxious behavior during interracial but not same-race contact. Participants relatively unconcerned about appearing prejudiced did not exhibit these stress responses. Study 2 examined stress responses to interracial contact over an entire academic year. Results revealed that White participants exhibited shifts in cortisol diurnal rhythms on days after interracial contact. Moreover, participants’ cortisol rhythms across the academic year, from fall to spring, were related to their concerns about appearing prejudiced and their interracial contact experiences. Taken together, these data offer the first evidence that chronic concerns about appearing prejudiced are related to short- and longer-term stress responses to interracial contact. Implications for life in diverse spaces are discussed.

Keywords

prejudice concerns; intergroup relations; physiological stress

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Diversity can be tremendously rewarding. Exposure to racial diversity has many positive outcomes, including improved racial attitudes (Astin 1993, Shook & Fazio, 2008), better leadership development (Antonio, 2001), and more complex thinking about the social world (Antonio et al., 2004; Sommers, 2006; Sommers, Warp, & Mahoney, 2008). In the words of former President Bill Clinton, diversity can be a "Godsend" for those who can "live together, learn together, work together" (1997). Not everyone fits this description, however. Many Americans are uncomfortable with diversity and prefer to live in non-diverse neighborhoods (Putnam, 2007). In fact, many individuals—especially those concerned about appearing prejudiced—find interracial contact stressful and avoid it when possible (Plant, 2004; Plant & Devine, 2003). As diversity continues to increase, however, interracial contact will become unavoidable. In the present work, we thus examine consequences of White individuals' chronic concerns about appearing prejudiced on their behavioral and physiological responses to interracial interactions, both in the moment and across time.

Concerns about Appearing Prejudiced

Interracial contact is often stressful (Crocker, Major, & Steele, 1998; Stephan & Stephan, 2000; Shelton & Richeson, 2006; Trawalter, Richeson, & Shelton, 2009), perhaps especially so for individuals concerned about appearing prejudiced (Plant & Devine, 1998; Plant, 2004; Shelton, 2003; Vorauer, 2006). These individuals fear that prejudiced behavior on their part will lead to social censure or, worse, rejection. Their desire to respond in non-prejudiced ways is rooted primarily in external motivations not to be evaluated negatively by others, rather than internal motivations not to be prejudiced. In other words, interracial contact may be especially stressful for those high in external (vs. internal) motivation to respond without prejudice. Research has shown that Whites who are high on external motivation to respond without prejudice (EM) report feeling anxious about interracial encounters and are more likely to avoid such contact (Plant, 2004; Plant & Devine, 1998, 2003). Furthermore, external motivation to appear non-prejudiced has been shown to affect Whites' spontaneous evaluations of Blacks (Amodio, Harmon-Jones, & Devine, 2003; Richeson & Trawalter, 2008). For example, Richeson and Trawalter (2008) have found that high-EM Whites automatically appraise Blacks as a threat to be avoided (see also Bean et al., 2011). Taken together, this research suggests that high-EM individuals are likely to experience distress during real interracial encounters.

A growing literature in psychophysiology likewise suggests that interracial contact can be distressing (Amodio, 2009; Blascovich, Mendes, Hunter, Lickel, Kowai-Bell, 2001; Littleford, O'Dougherty, & Sayoc-Pario, 2005; Mendes, Blascovich, Lickel, & Hunder, 2002; Mendes, Major, McCoy, & Blascovich, 2008; Mendoza-Denton et al., 2008; Page-Gould, Mendes, & Major, 2010; Page-Gould, Mendes, & Majory, 2010; Page-Gould, Mendoza-Denton, & Tropp, 2008). It remains unknown, however, whether concerns about appearing prejudiced moderate physiological stress responses to interracial contact. This gap in the literature is surprising given meta-analytic evidence that the human stress system is particularly sensitive to the threat of negative social evaluation (Dickerson, 2008; Dickerson & Kemeny, 2004). Specifically, research has found that intensely self-evaluative situations, such as interviews, activate the HPA axis, a major branch of the human stress system (Epel, Lapidus, McEwen, & Brownell, 2001; Foley & Kirschbaum, 2010; Kirschbaum, Pirke, & Hellhammer, 1993; Kudielka, Hellhammer, & Kirschbaum, 2007; Mendes et al., 2007). Some of this research has even revealed that negative self-focused social emotions, such as guilt and shame, are better predictors of HPA axis activity and immunological health outcomes than are more general negative affective states, such as distress (Dickerson, Gruenewald, & Kemeny, 2004; Dickerson, Kemeny, Aziz, Kim, & Fahey, 2004; Kemeny, Gruenewald, & Dickerson, 2004). In the present work, we thus investigate whether concerns about appearing prejudiced elicit physiological stress responses to interracial contact.

The Present Work

The present research considers how concerns about appearing prejudiced (i.e., external motivation to respond without prejudice, referred to as EM) shape stress responses to interracial contact in the moment—during interracial encounters—and across time. We focus squarely on external rather than internal motivation to respond without prejudice given evidence that the HPA axis is sensitive to socio-evaluative threats—threats of being evaluated negatively by others. Specifically, we investigate the following hypotheses:

Hypothesis 1

Relative to low-EM individuals, high-EM individuals will experience more stress during interracial contact but not same-race contact. This momentary stress will be evident in (A) behavior and (B) physiological responses.

Hypothesis 2

Relative to low-EM individuals, high-EM individuals will experience more stress over time the more interracial contact they have. This chronic stress will be evident in physiological stress system function; it will be associated with changes in physiological rhythms over time.

Study 1: Individuals Concerned about Appearing Prejudiced Exhibit Heightened Stress Responses during Interracial Contact

In Study 1, we examined whether individuals' concerns about appearing prejudiced are associated with heightened stress responses during interracial contact. We assessed stress responses in two ways. First, we assessed nonverbal anxiety as an indirect measure of stress. We drew on previous work documenting the behavioral manifestations of social anxiety in general and in intergroup anxiety in particular (Dovidio et al., 1997; Jurich & Jurich, 1974; Levine & Feldman, 1997; Olson & Fazio, 2007; Mendes et al., 2007; Trawalter & Richeson, 2008; Trawalter et al., 2009). This work has found that anxiety is associated with certain nonverbal behaviors including averted eye gaze, blinking, facial rigidity, and closed body posture. Because nonverbal behavior is notoriously difficult to control (DePaulo, 1992; Dovidio et al., 2002; Ekman & Friesen, 1969), behavioral anxiety provides an apt measure of individuals' spontaneous stress responses. In the present work, we thus examined participants' nonverbal behavior and changes in nonverbal behavior to assess stress and coping—that is, efforts to decrease stress (Trawalter, Richeson, & Shelton, 2009). We hypothesized that high-EM participants would exhibit more behavioral anxiety during interracial than same-race interactions, relative to low-EM participants. In addition, we thought high-EM participants might have a harder time reducing their stress during interracial interactions. That is, we thought high-EM participants might cope with their stress less effectively. By coding participants' nonverbal behavior at the very beginning and middle of interactions, we were able to explore this possibility.

Second, we measured physiological reactivity as a direct measure of stress. The human stress system comprises two major branches: the sympathetic-adrenal-medullary (SAM) system and the hypothalamic-pituitary-adrenal (HPA) axis. Theoretical and empirical work suggests that these two branches respond to different stressors and serve different, albeit complementary, roles (Cacioppo et al., 1998; Chrousos & Gold, 1992; Henry, 1992; Kemeny, 2003; Sapolsky, Romero, & Munck, 2000). In response to stressors of all kinds, within seconds, the SAM system is activated. Its activation results in the immediate release of epinephrine, also known as adrenaline. This "adrenaline rush" increases heart rate, lung function, and mobilizes resources such as glucose. It enables the "fight or flight" response.

Under some conditions, the hypothalamic-pituitary-adrenal (HPA) axis is also activated. HPA axis activation instigates a cascade of neuroendocrinological events resulting in the release of cortisol (a principal "stress hormone") into the blood stream. This cortisol response sustains and modifies SAM system activity and modulates the activity of other physiological systems. For example, cortisol facilitates glucose mobilization into the bloodstream, providing extra energy for individuals to cope with the stressor. Of particular relevance to the present work, highly stressful social situations—particularly those that trigger concerns about being evaluated negatively—have been found to activate the HPA axis (Dickerson & Kemeny, 2004; Foley & Kirschbaum, 2010). To foreshadow then, we expected that interracial contact would activate the HPA axis in high-EM but not low-EM White individuals.

To test this prediction, we measured cortisol levels in saliva. Cortisol increases are detectable in saliva 15-20 minutes after the onset of a stressor (Dickerson & Kemeny, 2004; Kirschbaum & Hellhammer, 1994). In other words, increases in salivary cortisol levels reflect stress experienced 15-20 minutes prior. We predicted, therefore, that high-EM Whites would reveal increased cortisol levels 15-20 minutes after the start of an interracial interaction.

Study 1 Methods

Participants

Forty White undergraduate students (26 women) participated in this study. They were paid $25 for their participation.

Materials

External motivation to respond without prejudice (EM) scale—The Motivation to Respond without Prejudice Scale (Plant & Devine, 1998) measures individuals' prejudice concerns stemming from external as well as internal motivations. An external motivation (EM) item is: "I try to act non-prejudiced toward Black people because of pressure from others." An internal motivation (IM) item is: "I am personally motivated by my beliefs to be non-prejudiced toward Black people." Participants made their responses on a 9-point scale, ranging from 1 (Not at all) to 9 (Very much).

Health questionnaire—The health questionnaire included questions about participants' daily caffeine, nicotine, and alcohol consumption—variables known to affect cortisol levels (see Adam & Kumari, 2009; Dickerson & Kemeny, 2004; Kirschbaum & Hellhammer, 1989 for reviews). Participants reported little to no nicotine and alcohol consumption the day of their respective study session. Caffeine consumption, however, was high and variable, and thus we controlled for this variable.

Procedure

Participants were asked not to drink, eat, or exercise two hours prior to their study session. Study sessions were scheduled between 12 noon and 6 P.M., Monday through Friday. When participants came to the lab, after reading and signing the informed consent form, they were told, "In this study, we are interested in the physiology of social behavior. Therefore, we will collect saliva samples, before and after an interaction in which you will be asked to answer questions about yourself. These questions will be typical 'get to know you' kinds of questions; the kinds of questions you might ask and answer when you first meet someone new." Participants were then informed that they would be videotaped during the interaction so that we could map their behavior onto their physiology. Next, participants provided a saliva sample by spitting through a small straw into a 2 mL vial (Sampling Time 1). After

collecting this baseline sample, the experimenter turned on the video camera and left the room to get the research assistant; participants were thus aware that the research assistant was not a naïve participant. The research assistant was one of three Black (two females) and three White (two females) research assistants. The research assistant's race comprised our experimental manipulation of interracial or same-race contact. Research assistants were blind to hypotheses.

Then, participants interacted with the research assistant for 10 minutes. Specifically, they answered questions regarding their summer vacation, a typical school day, and their future goals; that is, questions one might ask in a mundane social interaction. These interactions were videotaped and participants' behavior in these tapes was coded for signs of nonverbal anxiety (i.e., stress). Once the interaction was over, the research assistant left the room and the White female experimenter returned. At this time, the experimenter turned off the camera and participants provided a second saliva sample (Sampling Time 2). Participants then completed the post-interaction survey. Ten minutes after Sampling Time 2, participants provided another saliva sample (Sampling Time 3). Note that this third sample was taken 20 minutes after the interaction began. We would expect to see significant cortisol increases from baseline (Sampling Time 1) to this sample (Sampling Time 3) if interactions activated participants' HPA axis. If participants had not finished the survey (most had), they completed the survey after providing the third sample. Participants then completed a filler task in which they traced coloring book pictures. After 10 more minutes, participants provided a final sample of saliva (Sampling Time 4). Immediately after the study session, saliva samples were stored in a −20 C freezer. At the end of the study, samples were shipped on dry ice to Dresden Lab Service, where they were assayed for cortisol[1]. The inter- and intra-assay coefficients of variation for these assays were less than 10% and thus satisfactory.

Nonverbal Coding

The videotapes of the study sessions showed participants sitting in a chair in front of a white wall. The research assistant was not visible. From these tapes, we extracted 30-sec clips from the beginning and middle of each interaction for a total of 78 clips. Due to a video-camera malfunction, one participants' study session was not recorded. We replaced these 2 missing observations with grand means. Two independent coders, blind to experimental condition, rated the behavior exhibited by the participant in each video clip without audio. Specifically, coders rated behaviors associated with stress and social anxiety (similar to Trawalter, 2006; Trawalter & Richeson, 2008). They rated the extent to which participants closed their body posture, leaned away from the research assistant, averted their eye gaze, exhibited facial rigidity, seemed frozen, gestured (reverse coded), and smiled (reverse coded). Coders also rated the extent to which participants seemed avoidant and engaged (reverse coded) given research showing that high-EM individuals avoid and make great efforts to avoid interracial contact (Plant, 2003). All of these ratings were made on 9-point scales with anchors at 1 (Not at all) to 9 (Very much). In addition, coders counted eye blinks (as in Dodivido et al., 2002; McConnell & Leibold, 2001). These counts were transformed to a 9-point scale and averaged with the other ratings. Inter-rater reliabilities averaged across ratings were good ($R = .84$). Ratings for each nonverbal behavior, averaged across the 2 coders, were averaged to form a behavioral composite of anxious-avoidant behavior. This composite demonstrated adequate internal reliability ($\alpha = .71$).

[1]Samples were also assayed for alpha-amylase, a marker of SAM system activity. Sample 2 and 4 were obtained to examine changes in alpha-amylase. All participants, on average, exhibited increases in alpha-amylase from Time 1 to Time 2, $B = .31$, $t(39) = 2.95$, $p = .006$, and decreases back to baseline from Time 2 to Time 4, $B = -.31$, $t(39) = -2.06$, $p = .05$, regardless of condition, EM, and/or their interaction, all $ps > .25$. Thus, videotaped interactions with a stranger were somewhat stressful for all participants, regardless of the research assistant's race.

Study 1 Results

Preliminary Analyses

Data transformations—Cortisol values are reported in μg/dl units. Values were positively skewed and, therefore, log-transformed.

External motivation to respond without prejudice scores (EM)—The distribution of EM scores was variable. Scores ranged from 1 to 8.2 (out of 9) with a mean of 5.22 and a standard deviation of 1.55. Furthermore, EM scores did not differ by condition, $|t| < 1$. In other words, EM did not act as a dependent variable, suggesting that the variability in EM reflected individual differences, not situational demands. Consistent with previous research (Plant & Devine, 1998), EM and IM scores were not correlated, $r(39) = .05$, $p = .74$. It is worth noting that IM scores were much higher ($M = 7.00$) and with a shorter range, from 3.8 to 8.8.

Behavioral Stress Responses

To examine whether high-EM individuals revealed more behavioral stress reactions during interracial compared with same-race interactions (i.e., Hypothesis 1A), we used a general linear model (GLM) to model participants' nonverbal anxiety as a function of condition (interracial or same-race), EM (standardized), and time in the interaction (beginning or middle). The latter variable was modeled as a within-participant variable. This model revealed a significant main effect of condition, $F(1, 36) = 5.30$, $p = .03$, such that participants' behavior revealed more stress during interracial than same-race interactions. This model also revealed a main effect of time, $F(1, 36) = 5.98$, $p = .02$, such that participants' behavior revealed less stress at the middle than beginning of interactions. In other words, participants were able to reduce (or at least mask) their stress over the course of the interaction. This main effect, however, was qualified by two-way interactions between condition and time, $F(1, 36) = 4.95$, $p = .03$, and between EM and time, $F(1, 36) = 6.84$, $p = .02$, which were qualified by the predicted three-way interaction between condition, EM, and time, $F(1, 36) = 6.03$, $p = .02$. To make sense of these interactions, we examined the univariate analyses for Time 1 and Time 2 behavior. These analyses revealed that condition, EM, and their interaction did not predict nonverbal behavior at Time 1, all $|t|s < 1.40$, all $ps > .15$. At Time 2, there was a main effect of condition, $F(1, 36) = 2.96$ $p = .006$, such that participants' behavior revealed more stress during interracial than same-race contact. This effect was qualified by the two-way interaction between condition and EM, $F(1, 36) = 2.20$, $p = .03$. Simple slopes tests revealed that the behavior of participants one standard deviation below the EM mean did not differ across condition, $|t| < 1$. However, the behavior of participants one standard deviation above the EM mean did, $t(36) = 3.61$, $p = .001$; their behavior revealed more stress during interracial than same-race contact. Likewise, EM did not predict participants' nonverbal behavior during same-race contact, $|t| < 1$. EM did, however, predict their behavior during interracial contact, $t(36) = 2.01$, $p = .05$. The higher participants were in EM, the more stress their behavior revealed during interracial interactions. In fact, the behavior of participants one standard deviation above the EM mean revealed *increasing* stress from Time 1 to Time 2; the point estimate for this increase in behavioral stress was significantly larger than zero, $B = .58$, $SE = .15$, $t(36) = 3.73$, $p = .001$. Thus, it seems participants high in EM, those who were concerned about appearing prejudiced, were quite stressed during interracial interactions and, unlike other participants more generally, they were unable to decrease or mask their stress over the course of these interactions.

Physiological Stress Responses

To test whether high-EM individuals experienced more physiological stress during interracial compared with same-race interactions (i.e., Hypothesis 1B), we first computed cortisol reactivity scores as in previous work (e.g., Mendes et al., 2007, Page-Gould et al., 2008). That is, we subtracted cortisol levels at Time 1 (pre-interaction baseline) from cortisol levels at Time 3, 20 minutes post-interaction [2]. We then used a general linear model (GLM) to model reactivity scores as a function of condition (same-race or interracial), EM levels (standardized), and their interaction. We included caffeine and gender as covariates. As predicted, the condition by EM interaction was significant, $t(34) = 2.25$, $p = .03$. Simple slopes tests revealed that participants one standard deviation below the EM mean did not differ across condition, $|t| < 1$, but participants one standard deviation above the EM mean did, $B = .14$, $t(34) = 2.33$, $p = .03$. High-EM participants showed greater cortisol increases during interracial than same-race interactions. Moreover, participants of same-race contact did not differ as a function of EM, $|t| < 1$, but participants of interracial contact did, $B = .12$, $t(34) = 2.33$, $p = .03$; they showed greater cortisol increases if they were one standard deviation above the EM mean relative to those who were one standard deviation below the EM mean. Indeed, these high-EM participants were the only group of participants to exhibit significant cortisol increases from Time 1 to Time 3. Their estimated cortisol increase differed significantly from zero, $B = .18$, $SE = .07$, $t(34) = 2.56$, $p = .03$. In sum, concerns about appearing prejudiced were associated with cortisol reactivity—that is, physiological stress responses—during interracial contact [3].

Study 1 Discussion

Study 1 revealed that concerns about appearing prejudiced affected behavior during interracial but not same-race interactions. These behavioral findings suggest that intergroup anxiety can "leak" into behavior, consistent with previous work (e.g., Dovidio et al., 1997; 2002; Fazio et al. 1995; McConnell & Leibold, 2001; Trawalter & Richeson, 2008). Extending previous work, the present behavioral findings also suggest that individuals concerned about appearing prejudiced are not particularly adept at coping with their intergroup anxiety. High-EM participants' stress, as measured by their behavioral anxiety, actually increased over the course of interracial interactions; they were unable (or, perhaps, unwilling) to reduce or mask their anxiety. These findings highlight the importance of studying real interactions as they unfold. Intergroup anxiety is not static. It cannot be fully captured in one moment in time, before or during an interaction. Rather, intergroup anxiety shifts during interactions as individuals cope, effectively or not, with their anxiety (Trawalter et al., 2009).

Additionally, high-EM participants in the present work exhibited increases in cortisol levels in response to interracial contact. Low-EM participants did not exhibit this pattern of activity. In fact, their cortisol reactivity levels were no different from those revealed by low-EM participants of same-race contact. These findings suggest that interracial contact can be distressing for those who are concerned about appearing prejudiced.

The findings of Study 1 are thus consistent with a vast literature on interracial and intergroup contact, which finds that interracial contact can be stressful (Blascovich et al., 2001; Crocker, Major, & Steele, 1998; Mendes et al., 2002, 2008; Stephan & Stephan, 2000; for a review, see Trawalter et al., 2009), especially for some White individuals—for

[2]Recall that salivary cortisol levels reflect stress occurring 20 minutes prior. Thus, Sampling Time 3 is the appropriate sample for this analysis. Cortisol levels at Sampling Time 1 did not differ significantly by condition, EM, or their interaction.

[3]Concerns about *being* prejudiced (i.e., IM) did not have similar effects; condition, IM, and their interaction were not significant predictors of cortisol reactivity, all $|ts| < 1$. Our sample was not large enough to examine condition X EM X IM interactions.

example, those who have little interracial contact experience (Blascovich et al., 2001; Page-Gould et al., 2010) and those who have negative implicit racial attitudes (Mendes et al., 2007). The present study extends this work by showing that interracial contact can be especially stressful for individuals who are concerned primarily about *appearing* prejudiced. This is an important finding given the prevalence of concerns about appearing prejudiced (Apfelbaum, Sommers, & Norton, 2008; Plant & Devine, 1998; Shelton & Richeson, 2006; Vorauer, 2006). It is also important given that efforts to increase sensitivity to race-related issues (through diversity training, for example) can backfire and increase concerns about appearing prejudiced (Paluck, 2006; see also Apfelbaum, Sommers, & Norton, 2008). Our data suggest that increasing concerns about appearing prejudiced may not improve intergroup experiences.

Our findings are also consistent with more recent theoretical and empirical work on the HPA axis. This research has shown that the HPA axis in humans is especially sensitive to socio-evaluative threat—the threat of being evaluated negatively by others (Kemeny, 2003; Dickerson & Kemeny, 2004). Of note, much of the research on socio-evaluative threats and the HPA axis has used fairly heavy-handed paradigms such as the Trier Social Stress Test (TSST) to induce social stress (Foley & Kirschbaum, 2010; Kirschbaum, Pirke, & Hellhammer, 1993; see Mendes et al., 2007 for the TSST in a same-race vs. interracial context). The TSST requires participants to give an oral presentation and then perform mental arithmetic aloud in front of a panel of stern judges while being videotapes. If they make a mistake, the judges say “NO” (as if to a dog) and participants must start over. It is perhaps not surprising that this kind of social evaluative task triggers HPA axis activation. What is surprising about the present findings, however, is that high-EM participants exhibited HPA axis reactivity during relatively benign interracial interactions—interactions that did not involve discussing either race-related or otherwise controversial topics. Moreover, the cortisol increases exhibited by high-EM participants in response to interracial contact were sizable. These increases, on average, were comparable to those exhibited by participants subjected to a cold pressor test in which the hand is immersed in ice water for one minute (e.g., Cahill, Gorski, & Le, 2003). In other words, White participants concerned about appearing prejudiced—those high in EM—had pronounced stress responses to interracial contact, the kind of stress responses that are not likely to be adaptive in diverse social settings. In Study 2, we then consider the longer-term consequences, if any, of these responses.

Study 2: Individuals Concerned about Appearing Prejudiced Exhibit Signs of Chronic Stress over Time as a Function of Interracial Contact

Study 1 revealed that interracial contact is a stressor for students concerned about appearing prejudiced that is potent enough to activate the HPA axis. High-EM participants’ behavioral anxiety and cortisol levels significantly increased during interracial but not same-race contact in the moment. These findings beg the question, is interracial contact a *chronic* stressor for individuals living in an ethnically diverse environment? That is, might these momentary encounters have implications for chronic differences in stress-system functioning? One might argue that concerns about appearing prejudiced may be less salient outside of the laboratory, away from watchful experimenters and video-cameras. Even if concerns about appearing prejudiced are salient, students may be adept at coping with these concerns outside of the laboratory, during more familiar encounters. Students live on a relatively diverse campus, attend classes with peers from diverse racial/ethnic backgrounds, and gather in social spaces where they often cannot avoid interracial contact. Presumably, they are familiar with some interracial contact and have at least some practice with managing prejudice concerns. It is therefore possible that the stress of interracial contact is not a chronic one for students living on a relatively diverse campus. Nonetheless, given

Study 1 findings, we thought it was important to investigate whether students concerned about appearing prejudiced do, in fact, experience chronic stress as a function of interracial contact. Study 2 begins to examine the relationship between students' concerns about appearing prejudiced (EM) and *in vivo* stress responses to everyday interracial contact. It also examines whether these stress responses have longer-term consequences for stress-system functioning.

In Study 2 then, we examined individuals' physiological stress responses to naturalistic interracial contact over time. Again, we assessed individuals' cortisol levels. Instead of measuring cortisol reactivity in response to a single encounter (as in Study 1), however, we measured cortisol rhythms across time. Under normal conditions, cortisol levels show a strong diurnal (daily) rhythm. Cortisol levels are typically high upon waking, increase sharply 30-45 minutes after waking (referred to as the Cortisol Awakening Response or CAR), and then decline steeply across the day (Adam, 2006; Adam & Kumari, 2009; Kirschbaum & Hellhammer, 1989; Pruessner et al., 1997). Note, then, that high cortisol levels are not always bad. In general, high levels of cortisol in the morning are normal and associated with positive health outcomes whereas high levels in the evening are abnormal and associated with problematic health outcomes (Adam & Kumari, 2009).

In response to and anticipation of stress, cortisol's typical diurnal rhythm can shift. For instance, social stress on one day can result in larger CARs on the following day. According to the "boost hypothesis," these larger CARs reflect the body's attempt to mobilize resources—to provide a "boost" of energy to meet the anticipated demands of a new day (Adam, Hawkley, Kudielka, & Cacioppo, 2006; see also Miller, Chen, & Zhou, 2007 for a meta-analysis). Consistent with the "boost hypothesis," research has found that people tend to have larger CARs on a given day if they felt lonely the previous day (Adam et al., 2006; Doane et al., 2010). In light of this research, Study 2 considered whether Whites concerned about appearing prejudiced (i.e., those high in EM) exhibit larger CARs on days after interracial contact, given that such contact may be a significant source of social stress for them (see Study 1).

In addition to shifts in the CAR, frequent and/or chronic social stress can also disrupt other aspects of cortisol's typical diurnal rhythm. Specifically, chronic stress has been associated with flatter cortisol slopes across the day (i.e., relatively low morning values and/or relatively higher evening values) that, in turn, have been linked to negative health outcomes, ranging from increased negative affectivity to depression, burn out, and slower recovery from disease (Adam & Gunnar, 2001; Chrousos & Gold, 1998; De Kloet, Joels, & Holsboer, 2005; Doane & Adam, 2010; Gunnar & Vazquez, 2001; McEwen, 1998; Miller, Chen, & Zhou, 2007; Sapolsky, Romero, & Munck, 2000; Sephton, Sapolsky, Kraemer, & Spiegel, 2000). Consequently, Study 2 also considered the possibility that concerns about appearing prejudiced are associated with changes in individuals' cortisol rhythm over time. Specifically, we examined whether students' cortisol slopes become flatter over time as a function of their prejudice concerns and interracial contact over the course of their first year in college. As in Study 1, we focused on EM, as EM concerns were those theorized to activate the HPA axis and, indeed, were those associated with cortisol reactivity in Study 1.

Study 2, accordingly, sought to extend the findings of Study 1 in three important ways. First, we tracked changes in students' *cortisol diurnal rhythms* over the course of their first year in college rather than *cortisol reactivity* during an acute interracial encounter. Second, we examined the effects of naturally-occurring, real-life interactions, to see whether interactions outside of a controlled laboratory setting are associated with HPA axis function. Third, we considered the effects of a broader array of interracial interactions, including Black-White interactions (as in Study 1) as well as Hispanic-White, Asian-White, and other interracial

contact. Taken together, Study 2 allowed us to shift our focus from the implications of EM for acute stress responses during Black-White interactions (Study 1) to the potential effects of EM and interracial contact experiences on students' everyday physiological functioning. It allowed us to test whether high-EM individuals experience more stress the more interracial contact they have, and whether this more chronic stress is evident in physiological stress system function over time. We predicted that relative to low-EM individuals, high-EM individuals will experience more stress over time the more interracial contact they have. This chronic stress will be evident in their next-day CARs and changes in diurnal slopes across the year (Hypothesis 2) such that high-EM individuals will have larger CARs on days following interracial contact and flatter slopes across the year the more interracial contact they have.

Study 2 Methods

Participants

Forty White first-year college students (28 women) were recruited to participate in this study. We recruited first-year students because, for many of them, the transition to college offers their first "immersion experiences" with diversity (Tatum, 1997). Participants were paid $160 for their participation over the year. Three participants dropped out of the study. Two cited lack of time as the reason for dropping out and the third left the university during the spring term. The final sample consisted of 37 participants (26 women).

Materials

Pre-study questionnaire—Before completing diaries and saliva samples, participants filled out a number of surveys and scales including demographics, the Attitude toward Blacks scale (Brigham, 1993) as an explicit measure of racial attitudes, and the external and internal [4] motivation to respond without prejudice scales (EM and IM; Plant & Devine, 1998). See Table 1 for descriptive statistics for the final sample. Note that participants scored very low on the Attitudes toward Blacks scale. Participants also provided basic demographic information including race/ethnicity, gender, and social class; namely, parental education (from 1-less than high school to 5-post-graduate degree) and household income.

Daily diary—Each evening of the study, participants completed a diary entry online. The diary entry consisted of several questions regarding their sleep, mood, caffeine and alcohol use, daily physical exercise, etc. This information was collected as potential covariates, since they are all variables known to affect cortisol rhythms [5] (e.g., Adam et al., 2006; Adam & Kumari, 2009; Kirschbaum & Hellhammer, 1989, 1994). Diaries also consisted of questions regarding participants' social interactions. Specifically, participants were asked to list the initials of 5 individuals with whom they had the most meaningful interactions that day (we let participants define "meaningful" for themselves). Then, they were asked to estimate the length and rate the quality of these interactions [6]. Finally, at the end of the daily diary entry, participants were asked to provide demographic information about each interaction partner. They were asked to report the interaction partners' gender, age, race/

[4]In a separate sample of 72 White participants, we have found that concerns about appearing prejudiced toward Black people are highly correlated with concerns about appearing prejudiced toward racial minorities more generally, $r = .90$, $p < .001$. Thus, EM scores, although specific to responses toward Blacks, are likely to be relevant for interracial contact beyond Black-White interactions.

[5]We did not collect information about menstrual cycle. It is unlikely that the effects of menstrual cycle on cortisol rhythms could account for our results, however.

[6]Specifically, they rated the extent to which the interactions were positive, stressful, and the extent to which they were concerned about their partners' enjoyment of the interaction and their concerns about being judged. They also indicated their relationship with the person (e.g., friend, sibling). There were no differences on any of these explicit ratings of interactions as a function of interaction type (same-race v. interracial) and/or EM. That being said, interracial interactions were significantly shorter than same-race interactions, $t = -2.05$, $p = .05$.

ethnicity, and year in school (first-year, second-year, etc.). We used participants' answers to the race/ethnicity question to quantify their same-race and interracial contact each day. In response to the race/ethnicity question, participants reported interactions with Black, Asian, and Hispanic students. They also reported interactions with Jewish, French, African, foreign, and Muslim students (among other outgroups). Clearly, students' conception of race/ethnicity was very fluid. For our purposes, any interaction with a partner not described as White, Caucasian, or European-American was considered an interracial interaction. See Table 2 for descriptive statistics of participants' same-race and interracial interactions.

Saliva sampling kits—Participants were asked to provide three saliva samples each day for five days (one school week) in the fall and then again in the spring. We chose the second week of each of these two terms to avoid the mid-term and final examination periods—periods of high academic stress for students. Saliva kits contained enough straws, vials, and labels for the week of sampling. Participants provided saliva samples by expelling their saliva through a small straw and into a plastic vial. They labeled each vial with the sampling date and time. Participants stored their samples in their dorm room fridge until they returned them to the lab. This is standard procedure; in fact, research has shown that saliva remains stable for days, even weeks, and even without refrigeration (Groschl, Wagner, Rauh, & Dorr, 2001; Kirschbaum & Hellhammer, 2000; Nicolson, 2008). Once returned to the lab, saliva samples were stored in a −20 C freezer. At the end of the study, samples were shipped on dry ice to a lab at the University of Trier, where they were assayed for cortisol. The inter- and intra-assay coefficients of variation for these assays were less than 10% and thus satisfactory.

Post-study questionnaire—The post-study questionnaire contained the same surveys as the pre-study questionnaire, allowing for pre- and post-study comparisons. In addition, participants were asked to report their GPA.

Procedure

One week before the fall term started, students were recruited via fliers, listservs, and in-class announcements. That week and the first week of class, September 22-October 3, participants were scheduled for individual lab sessions during which they completed the pre-study questionnaire. During their lab session, they also received their saliva kits and were given detailed instructions for the saliva sampling. The second week of the term, Monday through Friday, October 6-10, they were asked to provide three saliva samples each day—immediately upon waking, 30 minutes after waking, and when they went to bed (i.e., bedtime). This sampling schedule allowed us to estimate individuals' daily diurnal rhythms. Specifically, the wake-up and evening samples allowed us to compute a diurnal cortisol slope for each participant on each day of the study. The first and second samples, taken at waking and 30 minutes after waking, allowed us to compute a Cortisol Awakening Response (CAR) for each participant, for each day of the study (see Adam, Hawkley, Kudielka, & Cacioppo, 2006, and Cohen, Schwartz, Epel, Kirschbaum, Sidney, & Seeman, 2006 for a similar approach to specifying the CAR). On each evening of that week, participants also completed the daily diary. At the end of the week, participants returned their saliva samples to the lab. The second week of the winter term, Monday through Friday, January 12-16, participants again completed daily diaries each evening, as in the fall term. The second week of the spring term, Monday through Friday, April 6-10, participants provided three daily saliva samples (as in the fall term) and, once again, completed the daily diaries (as in the fall and winter terms). They returned these saliva samples to the lab at the end of the week. Finally, at the end of the academic year, weeks after the last diary, participants completed the post-study questionnaire.

Study 2 Results

Preliminary Analyses

Attrition and compliance—Recall that participants were asked to participate for their first year in college. Given how stressful this year can be, we were concerned about attrition and compliance—we feared that students might drop out of the study and/or skip nightly diaries and saliva samples because our methods were too demanding. Attrition, however, was quite low. Only three participants (i.e., 6%) dropped out of the study. Compliance, furthermore, was high. On average, participants reported about 60 interactions (81% of the possible 75) and submitted over 26 saliva samples (88% of the possible 30).

Data transformations—As in Study 1, cortisol values were positively skewed and, therefore, log-transformed.

EM scores—As in Study 1, the distribution of EM scores was variable. Scores ranged from 1.20 to 8.20 (out of 9) with a mean of 5.07 and a standard deviation of 1.70. Participants' EM levels did not, on average, change from the beginning of the fall quarter to the end of spring quarter, $t(36) = -.03$, $p = .97$. EM scores were not correlated with internal motivation to respond without prejudice (IM) scores, $r = .07$, $p = .68$, and only moderately (albeit non-significantly) correlated with our measure of racial attitudes, the ATB, $r = .21$, $p = .21$. In other words, EM seemed to be independent from internal motivation to respond without prejudice (i.e., the desire not to *be* prejudiced) and negative racial attitudes.

Interracial contact—To examine students' interracial contact experiences, we used the five interactions they reported each day as a reflection of their diversity experiences that day. As can be seen in Table 2, students had a vast majority of their daily interactions with other White individuals. Indeed, students reported significantly more interactions with Whites than with racial/ethnic outgroup members, $F(4, 132) = 140.58$, $p < .001$. These data replicate previous work showing that White students at predominantly White colleges have significantly more interactions with other White students than with racial minority students (Floyd & Shinew, 1999; Mallett, Akimoto, & Oishi, 2011; Nezlek, 2007). Somewhat surprisingly, EM did not predict the number of interracial (or same-race) interactions students reported, Fs < 1 (cf., Plant, 2004). Reports of same-race and interracial contact did not vary by academic term, Fs < 1.

Next-day Cortisol Awakening Responses (CAR)

First, to test whether high-EM individuals' experiences with interracial contact elicit stress evident in stress system function (Hypothesis 2), we examined whether interracial interactions affected day to day changes in students' CARs, with higher CAR values occurring on days following interracial contact. We examined this possibility using the fall and spring data, the two terms for which we collected cortisol data. More specifically, we used fall and spring diary data, from Monday to Thursday, to predict fall and spring cortisol data, from Tuesday to Friday. These data allowed us to examine the lagged effect of prior-day interactions on next-day cortisol rhythms. One participants' extremely irregular cortisol data were dropped from analyses [7]. To investigate whether diurnal rhythms shifted on days following interracial contact, we used HLM to construct a three-level model of the form:

$$\text{(Level 1) CORTISOL} = \pi_0 + \pi_1\,(\text{CAR}) + \pi_2\,(\text{TIME SINCE WAKING}) + e$$

$$\text{(Level 2)}\ \pi_i = \beta_{i0} + \beta_{i1}\,(\textit{YESTERDAY'S}\ \text{IRp}) + r_0$$

[7]This participant's cortisol levels were highly invariable. He had a non-negative slope and no CAR for all days. We suspect he did not comply with instructions but rather took all of his saliva samples at one time.

$$\text{(Level 3)}\ \beta_{ij} = \gamma_{ij0} + \gamma_{ij1}\,(\text{MALE}) + \gamma_{ij2}\,(\text{EM}) + u_{ij}$$

This model accounts for the nesting of saliva samples within days, nested within participants. Note also that, because it models changes in cortisol rhythm from day to day, it accounts for the previous day's cortisol rhythm. At Level 1, the within-day/saliva sampling level, we modeled the diurnal cortisol rhythm. Specifically, we modeled the two parameters that characterize this rhythm: the Cortisol Awakening Response (CAR) and the cortisol slope across the day (see Adam et al., 2006; Doane & Adam, 2010; and Saxbe, Repetti, & Nishina, 2008 for similar analytic approaches). At Level 1 then, we entered a dummy variable for Sample 2 (0=Sample 1 or 3, 1=Sample 2) to model the CAR. We also modeled the cortisol slope across the day by entering the time at which each of the 3 daily saliva samples was taken. These times varied widely, both between and within participants. These sampling times were centered so that the first saliva sample on any given day, taken immediately after waking up, was always taken at "0 hours" after waking; the second sample that day was taken approximately .5 hours after waking (depending on participants' compliance with sampling protocol); and, the third sample that day was taken approximately 16 hours after waking (students' average waking day lasted 16 hours with substantial variation). Accordingly, π_0 represents wake-up cortisol values, π_1 represents the size of the CAR, and π_2 represents cortisol levels' rate of change per hour; i.e., participants' cortisol slope across the waking day. At Level 2, at the day level, we entered the interracial/inter-ethnic contact from the *previous* day; specifically, we entered the proportion of the previous day's interactions that were interracial/inter-ethnic (*YESTERDAY'S* IRp, centered). In this way, we were able to model the effect of *yesterday's* interracial interactions on *today's* rhythms. Note that, to model the lagged effect of *yesterday's* interracial interactions on *today's* rhythm, we had to use diary data from Monday to Thursday to predict cortisol rhythms from Tuesday to Friday during the fall and spring terms. At Level 3, at the person level, we entered EM levels (centered) and participants' gender (0=female, 1=male).

Unsurprisingly, given our healthy college student sample, results revealed that participants, on average, had strong, healthy cortisol diurnal rhythms. Specifically, consistent with the typical cortisol diurnal rhythm (Weitzman et al., 1971; Lacerda et al., 1973; Van Cauter, 1990; Schmidt-Reinwald et al., 1999) and as depicted in Figure 3, participants' cortisol levels were high in the morning, increased sharply soon thereafter, reflecting the CAR, $G = .17$, $t(33) = 7.10$, $p < .0001$, and then decreased across the day, $G = -.04$, $t(33) = -19.98$, $p < .0001$. Of more substantive interest to the present work, however, results also revealed that participants' previous-day interracial contact was associated with the size of the CAR, $G = .14$, $t(33) = 2.23$, $p = .03$. Specifically, individuals who reported a greater proportion of interracial encounters on one day tended to have greater CARs the following day [8]. This result held after controlling for *today's* alcohol use (at Level 2), and/or *today's* caffeine use (at Level 2), variables known to affect cortisol rhythms. The effect of *yesterday's* interracial contact on *today's* CARs became marginal, $G = .10$, $t(33) = 1.72$, $p = .09$, however, when controlling for *today's* wake time, another variable known to affect cortisol rhythm, and *today's* total number of social interactions.

Finally, contrary to predictions, EM levels did not moderate the relationship between previous day's interracial contact and today's CAR, $G = .06$, $t(33) = 1.13$, $p = .27$, though the effect was in the predicted direction (i.e., greater CARs following days with more interracial contact for individuals higher in EM). Thus, we do not have strong evidence that

[8] It is interesting to note that the size of the CAR on any given day did not predict the amount of interracial contact *that* day, $|t| < 1$. In other words, it is not the case that people with more interracial contact had larger CARs. The relationship between interracial contact and CARs was dynamic; *today's* interracial contact predicted *tomorrow's* but not *today's* CAR.

interracial contact affect next-day CARs for those higher in EM. Rather, it seems interracial contact affected all participants' next-day CARs, on average.

Changes in Cortisol Slopes across the Year

As another test of the relationship between EM, interracial contact, and physiological stress responses over time (Hypothesis 2), we investigated shifts in participants' cortisol daily diurnal rhythms from fall to spring. We predicted that, relative to low-EM participants, high-EM participants who reported frequent interracial contact would also exhibit a flattening of their daily cortisol slopes from the fall to spring term. In other words, we predicted that interracial contact across the year would not predict cortisol slopes in the fall but would in the spring for those high in EM and, for those individuals, their slopes would be flatter in the spring. To test this prediction, we examined changes in participants' cortisol slopes from fall to spring as a function of EM and participants' interracial contact across the year (based on their reports in the fall, winter, and spring diaries). In other words, for this analysis, we used cortisol data from all days, Monday to Friday, during the fall and spring terms, and all diary data, Monday to Friday, during the fall, winter, and spring terms. Three participants did not provide a sufficient number of saliva samples to properly estimate cortisol slopes in the spring (i.e., they provided only one sample on any given day, making it impossible to compute a slope parameter on that day), thus, they were excluded from analyses. Including these participants, however, did not meaningfully alter the parameter estimates. We then constructed a 3-level model using HLM:

$$\text{(Level 1) CORTISOL} = \pi_0 + \pi_1\,(\text{CAR}) + \pi_2\,(\text{TIME SINCE WAKING}) + e$$

$$\text{(Level 2)}\ \pi_i = \beta_{i0} + \beta_{i1}\,(\text{SPRING}) + \beta_{i2}\,(\text{WAKE TIME}) + r_0$$

$$\text{(Level 3)}\ \beta_{ij} = \gamma_{ij0} + \gamma_{ij1}\,(\text{MALE}) + \gamma_{ij2}\,(\text{EM}) + \gamma_{ij3}\,(\text{IRp}) + \gamma_{ij4}\,(\text{IRp*EM}) + \gamma_{ij5}\,(\text{TOTAL SOCIAL}) + \gamma_{ij6}\,(\text{TOTAL SOCIAL*EM}) + u_{ij}$$

Again, this model accounts for the nesting of saliva samples in days, nested in participants[9]. At Level 1, the within-day/saliva sampling level, we modeled the cortisol rhythm across the day just as before. That is, we entered a dummy variable for the second morning sample (0=Sample 1 and 3, 1=Sample 2) to model the CAR. We also entered "time since waking" to model the slope. At Level 2, at the day level, we entered academic term (0=fall, 1=spring) to assess change in cortisol rhythms from fall to spring. We also added wake time given its effect in the previous analysis. At Level 3, we entered EM level (standardized), the proportion of interracial contact across the year (IRp, centered), and the interaction between the two (centered). We also entered gender as a Level 3 covariate. In addition, we entered the total number of social interactions over the year and the interaction between the total number of social interactions over the year and EM levels, given their tempering effects in the previous model. Note that the previous model (for the next-day CAR) controlled for the interaction between EM levels and total number of interactions due to the nesting of the data. We thus control for this interaction in the present model too.

This model, again, revealed the typical (healthy) cortisol diurnal rhythm. Specifically, participants' cortisol levels were high in the morning, increased sharply soon thereafter reflecting the CAR, $G = .20$, $t(26) = 7.03$, $p < .0001$, and then decreased across the day, $G = -.04$, $t(26) = -18.47$, $p < .0001$. The fact that these parameter estimates are nearly identical to the ones above (for the analysis of the next-day CARs) is not surprising; the analysis is based on the same data, adding the Monday cortisol data excluded in the previous analysis.

[9]Computing average fall and spring cortisol slopes and using a GLM (instead of HLM) yielded similar findings. In spite of our relatively small sample, we use HLM to control for day-level and person-level variables, which we could not do in a GLM. Note that these HLM analyses were performed on 850+ cortisol samples.

Results also revealed that students who reported more interactions in general exhibited steeper slopes, $G = -.0005$, $t(25) = -2.50$, $p = .02$, consistent with previous work showing that social connectedness is associated with healthier cortisol rhythms and HPA axis functioning (Adam & Gunnar, 2001; Adam et al., 2006; Rosal, Yunsheng, & Reed, 2004; Vedhara, Tumistra, Miles, Sanderman, & Ranchor, 2006). Moreover, results revealed an unexpected gender-by-term effect: relative to female participants' cortisol slopes, male participants' slopes were marginally steeper in the fall term, $G = -.01$, $t(28) = -1.92$, $p = .07$, but became flatter in the spring, $G = .02$, $t(28) = 3.32$, $p = .03$.

Consistent with predictions, however, there was an interaction between EM, interracial contact, and term. As can be seen in Figure 4, results revealed that EM, interracial contact, and the interaction were not associated with cortisol slopes in the fall, all $|ts| < 1$; however, more interracial contact was associated with a flattening of cortisol slopes among high-EM participants from fall to spring and, conversely, a steepening of cortisol slopes among low-EM participants from fall to spring, $G = .06$, $t(25) = 2.38$, $p = 0.03$. Separate analyses on the spring slopes of low- and high-EM participants confirmed that high-EM participants exhibited steeper spring slopes the less interracial contact they had during the year, $G = .03$, $t(12) = 3.28$, $p = .01$, whereas low-EM participants had marginally steeper spring slopes the more interracial contact they had during the year, $G = -.02$, $t(13) = -2.09$, $p = .06$. These results held even after controlling for SES and/or GPA, two potential third variables and sources of stress at an elite university.

Study 2 Discussion

Study 2 extended the results of Study 1 by investigating more naturalistic and longer-term physiological stress responses to interracial contact, more broadly defined. Consistent with our predictions, results revealed that more interracial contact on one day was associated with larger CARs the following day and, for high-EM students, more interracial contact during the first year of college was associated with flatter cortisol slopes by the end of the academic year, a pattern that has been associated with chronic stress exposure and negative health outcomes (Adam & Kumari, 2009). Somewhat unexpectedly, results also revealed that interracial contact was associated with steeper slopes for individuals who are relatively unconcerned about appearing prejudiced—those lower in external motivation to avoid prejudice. We take this as evidence that, under some circumstances and for some people, diversity can be beneficial. Low-EM students seemed to thrive, at least physiologically, the more interracial (and same-race) contact they had. This finding is consistent with the notion that interracial contact *per se* is not stressful (see also Mendes et al., 2007). Rather, it is the concerns that people bring to these interactions—and the cognitive and emotional responses that these concerns elicit—that make interracial contact stressful. This finding highlights the need for interventions aimed at improving people's ability to cope with their concerns about appearing prejudiced.

General Discussion

The present work examines the potential implications of chronic concerns about appearing prejudiced in diverse settings. Study 1 revealed that high-EM participants exhibited heightened stress responses to interracial but not same-contact relative to their low-EM peers. Whereas low-EM individuals' behavioral anxiety decreased across the course of interactions, high-EM individuals' behavioral anxiety actually increased during interracial interactions. High-EM participants also exhibited cortisol reactivity in response to interracial but not same-race interactions. These responses were relatively large, suggesting that even benign interracial encounters are often distressing for those concerned about appearing prejudiced. Given that many White individuals are concerned about appearing prejudiced,

especially when they move into a new environment such as a diverse college campus, these findings are disquieting.

Indeed, Study 2 revealed that concerns about appearing prejudiced and interracial contact predict changes in physiological stress system function over time (i.e., days and months). Specifically, White students exhibited larger CARs on days after interracial contact. Some researchers have argued that larger CARs provide a physiological "boost" of energy to help individuals meet the anticipated demands of a new day (Adam et al., 2006). It is possible that interracial contact led students to anticipate more social challenges the following day and, consequently, they mobilized resources in the form of larger CARs to meet those challenges. Moreover, concerns about appearing prejudiced and interracial contact jointly predicted changes in cortisol slopes from fall to spring. In the fall, students' cortisol slopes did not differ as a function of interracial contact, EM, and/or their interaction. The transition to college may have been uniformly stressful for all first-year students and resulted in relatively similar slopes among our participants, regardless of other situational differences (interracial contact) and individual differences (EM). By the spring term, students highly concerned about appearing prejudiced had flatter slopes the more interracial contact they had. Taken together, these findings suggest that concerns about appearing prejudiced are associated with distress in interracial contexts. This distress manifests itself physiologically (Studies 1 and 2) and behaviorally (Study 1).

The present work honors a long tradition of theory and research recognizing intergroup anxiety as a major barrier to achieving positive intergroup relations. The physiological and behavioral findings of Study 1 provide further evidence that intergroup anxiety can be problematic not only for the self but for one's outgroup interaction partner (Plant, 2004; Shelton, 2003; Trawalter & Richeson, 2008). In response to interracial contact, White participants concerned about appearing prejudiced exhibited significant increases in cortisol levels and behavioral anxiety. These responses are likely to be consequential. Behavioral anxiety—closed body posture, averted eye gaze, facial rigidity, and the like—can make interracial contact awkward and even negative (Dovidio, Hebl, Richeson, & Shelton, 2006; Trawalter & Shapiro, 2010). In fact, racial/ethnic minorities often interpret these behaviors as a sign of Whites' racial prejudice (Dovidio, Kawakami, & Gaertner, 2002; Richeson & Shelton, 2005). The fact that participants concerned about appearing prejudiced did not cope with or even mask their anxiety during interracial interactions but, instead, behaved anxiously (and increasingly so) does not bode well.

The present work also speaks to research on biopsychosocial models of stress, which posit that social stressors "get under the skin" and affect stress and related systems (e.g., Cohen, Tyrrell, & Smith, 1991; Kemeny, 2003; Kemeny & Dickerson, 2004; McEwen, 1998; Sapolsky, 1999, 2004). In Study 1, EM levels were associated with cortisol reactivity during interracial contact. In Study 2, EM levels and interracial contact jointly predicted cortisol diurnal rhythms over time. These studies, taken together, are the first demonstration that prejudice concerns can have short- and long-term stress-related consequences for White individuals. Given the prevalence of these concerns, the present findings urge us to consider ways to cope more adaptively with concerns about appearing prejudiced, the stress of interracial contact, and racial diversity more generally.

Although we made no formal predictions about individuals relatively *un*concerned about appearing prejudiced, our data suggest that these individuals fared well in diverse contexts. Low-EM students did not exhibit HPA axis reactivity to interracial contact (Study 1) and exhibited steeper, healthier cortisol slopes at the end of their first academic year in college the more interracial contact they had (Study 2). Clearly, diversity can be rewarding, even healthy, as we noted in the introduction. The present work finds that it is those who are

relatively unconcerned about appearing prejudiced (and relatively low in racial bias) who may reap its benefits.

From an intervention perspective then, one question that naturally arises from this work is how can White individuals effectively cope with their concerns about appearing prejudiced? We know from previous work that these concerns are pervasive (Apfelbaum, Sommers, & Norton, 2008; Dunton & Fazio, 1997; Plant & Devine, 1998; Shelton, 2003; Shelton & Richeson, 2006; Vorauer, 2006). The intergroup literature offers some hints. Focusing on one's interaction partner or the interaction rather than the self (Crocker & Garcia, 2009; Goff, Steele, & Davies, 2008; Murphy, Richeson, & Molden, 2011; Vorauer & Turpie, 2004), having a script (Avery, Richeson, Hebl, & Ambady, 2009; Richeson & Trawalter, 2005), remembering past interpersonal successes (Mallett & Wilson, 2010; Page-Gould et al., 2010; Shapiro et al., 2010), and approaching contact as an opportunity to have a positive intercultural exchange (Trawalter & Richeson, 2006) all seem to reduce evaluative concerns and increase positive engagement during interracial contact. Future work will need to examine whether these strategies can help individuals thrive, physiologically and psychologically, in diverse environments. Such work will also clarify the causal role of concerns about appearing prejudiced on long-term stress responses and health in diverse social contexts.

Limitations & Future Directions

As we just noted, future work will need to manipulate evaluative concerns about appearing prejudiced to ascertain that these concerns are causally related to HPA axis function over time. Given the timing of our study (i.e., measurement of EM the first week of school and cortisol rhythm changes from fall to spring), the possibility of reversed causation is not viable. Still, a third unmeasured variable could be at play. Our results held when controlling for socioeconomic status and academic success (i.e., GPA), two potential third variables and sources of stress, but these two variables are far from exhaustive. Though not the focus of our present investigation, it is interesting to note that concerns about *being* prejudiced and explicit racial attitudes were not significantly correlated with concerns about *appearing* prejudiced. These other race-related variables did not predict the pattern of responses reported herein (perhaps because students were highly motivated to be non-prejudiced and reported positive racial attitudes) and thus these variables cannot account for our results. Still, the possibility that prejudice concerns did not *cause* HPA axis reactivity during, and shifts in diurnal rhythms in response to, interracial contact does not change the simple interpretation of our data. Concerns about appearing prejudiced and interracial contact are jointly associated with different patterns of HPA axis reactivity and changes in diurnal cortisol rhythms.

Future work will also need to examine psychological processes that mediate the relationship between prejudice concerns and physiological responses. Our relatively small sample size did not allow us to examine such potential mediating processes. Collecting more information about students' behavioral and emotional responses to daily interracial encounters will likely be telling. It is possible that students concerned about appearing prejudiced not only experienced more stress but coped less effectively with this stress. Coping with the stress of interracial contact can take many forms (Trawalter et al., 2009). Some coping responses (e.g., engaging vs. freezing) may be better at reducing stress and promoting positive outcomes. Some may require more resources than others, and hence be more depleting. The examination of coping responses in addition to stress reactions may provide a fuller understanding of when and how concerns about appearing prejudiced affect individuals. Finally, future research might consider how chronic interpersonal concerns, such as concerns about appearing prejudiced, affect students' sense of place and belonging when they move to environments that are more culturally/racially diverse than what they have

been used to. Such concerns may hinder students' adjustment to college life and, ultimately, undermine the many known benefits of diversity.

Of course, it will also be important for future work to replicate the present findings with both larger and more diverse samples of individuals, in different contexts, and especially samples that include racial minority participants, in order to speak to the generalizability of our results. Our sample came from a liberal campus population and, not surprisingly, all participants had very low scores on an explicit measure of racial attitudes. It is conceivable that concerns about appearing prejudiced are especially counter-productive for those who are low in racial bias— who need not be so concerned about appearing prejudiced as much as those who are high in racial bias (see Vorauer & Turpie, 2004 for an example of such a phenomenon). In other words, future work will need to consider how implicit and explicit racial attitudes as well as internal motivation to respond without prejudice moderate the effects of external motivation to respond without prejudice reported herein. It will be important to see whether racial group membership matters as well—do minority group members' concerns about appearing prejudiced and/or their concerns about being the target of prejudice give rise to the kind of longer-term, stress-related responses reported herein? Finally, future work will need to investigate interracial contact in more diverse social contexts. A majority of students' interracial interactions, we assume, took place in the psychological safety of the classroom, dorms, and campus meeting spaces. How interracial contact in less psychologically safe spaces affects stress responses and HPA axis function remains an open question.

Concluding Thoughts

Many White Americans have ambivalent attitudes about diversity. On the one hand, they recognize the benefits of diversity. College students, for instance, want and value diversity in the classroom (Haidt, Rosenberg, & Hom, 2003). On the other hand, many individuals have prejudice-related concerns and avoid intergroup contact (Plant, 2004; Vorauer, 2006). They prefer to live in non-diverse neighborhoods (Putnam, 2007). This ambivalence is not without reason. Research has shown that diversity can be both beneficial and costly. Diversity can lead to better racial attitudes and more complex thinking about the social world, but it can also make building trust among neighbors more difficult and reduce social capital in communities (e.g., Sommers, 2006; Putnam, 2007). The data presented herein are consistent with these divergent outcomes. For some students, those relatively unconcerned about appearing prejudiced, diversity was associated with relatively healthy and adaptive stress responses. For other students, those concerned about appearing prejudiced, diversity was associated with relatively maladaptive stress responses. Finding ways to help all individuals thrive in diverse contexts is paramount given increases in the diversity of U.S. society. The present work suggests that alleviating individuals' concerns about appearing prejudiced and/or helping them learn to cope with such concerns may help them positively engage in interracial contact and live better, healthier lives.

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Highlights

- We examined how concerns about appearing prejudiced affect stress responses to interracial contact in the moment and across time
- Concerns about appearing prejudiced were associated with stress responses to Black-White interracial interactions in the laboratory (Study 1) and real-life minority-White interactions, more generally (Study 2)
- These stress responses were evident in behavior during interracial contact (Study 1), physiological stress response during interracial contact (Study 1), and changes in stress-system functioning over time (Study 2)
- Individuals relatively unconcerned about appearing prejudiced did not exhibit stress responses to interracial contact in the moment or across time; in fact, they seemed to thrive.
- We take these findings as evidence that concerns about appearing prejudiced are no adaptive for life in diverse spaces.

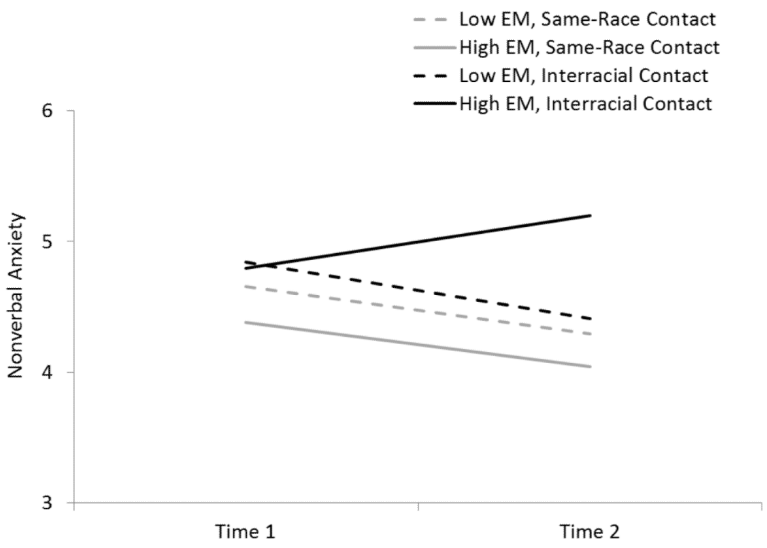

Figure 1.
Nonverbal behavior as a function of contact type (same-race v. interracial) and EM scores (one standard deviation above and below the mean)

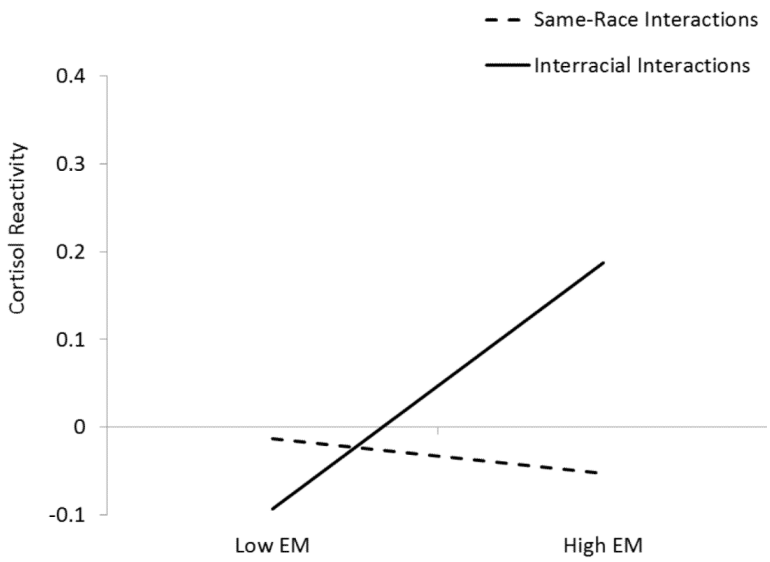

Figure 2.
Cortisol reactivity as a function of contact type (same-race v. interracial) and EM scores (one standard deviation above and below the mean)

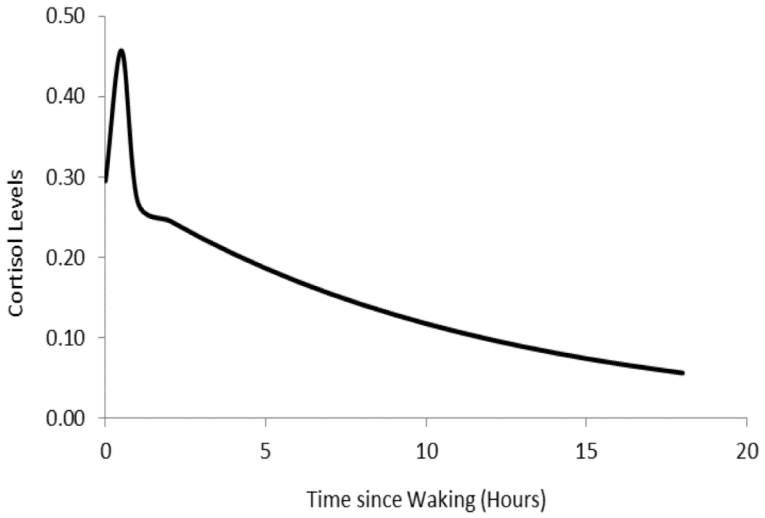

Figure 3.
Average cortisol diurnal rhythm (back-transformed to μg/dl)

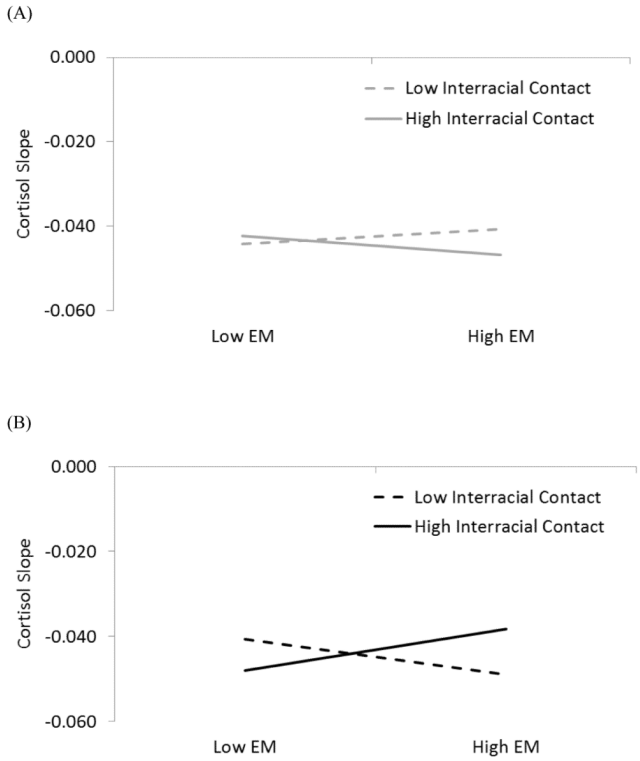

Figure 4.
Cortisol slope in the fall (Panel A) and spring (Panel B) as a function of interracial contact across the year (one standard deviation above and below the mean) and EM scores (one standard deviation above and below the mean)

Table 1

Descriptive Statistics of Study 2 Sample

	M	*SD*
Demographics		
Age: 18	100%	
Race: White	100%	
Gender: Male	30%	
Parental Education	4.00 (College)	1.00
Household Income	175,294.10	163,252.50
Race-related Variables		
EM	5.07	1.70
IMS	7.35	1.00
ATB	2.46	.64

Table 2

Number of Interracial Interactions across the Year

Interaction Partner Race	*M*	*SD*	*Min*	*Max*
White	42.6	15.1	17	69
Black	1.1	1.9	0	10
Hispanic	1.4	2.7	0	11
Asian	11.4	10.2	0	44
Other	2.1	3.0	0	12