Physical Triggers of Anxiety in African Americans

Tynessa L. Gordon¹, Amanda R. W. Steiner¹, and Bethany A. Teachman¹

Abstract
Understanding the primary triggers of anxiety for African Americans, and the cultural factors associated with these triggers, can enhance our knowledge of emotional responding in African Americans and can ultimately influence how we assess and treat anxiety disorders in this population. In the current study, we investigated the experience of anxiety for African Americans following physical stressors, with an emphasis on cardiovascular arousal. Specifically, anxious responding, following cardiovascular arousal, other physical stressors, and a control task, was evaluated among African American (n = 23) and European American (n = 23) groups on affective, cognitive, and physiological measures of anxiety. Findings suggest physical stressors in general (as opposed to cardiovascular arousal specifically) may be a prominent trigger of anxiety for African Americans. Discussion centers on the idea that the observed relationship between anxiety and physical stressors for African Americans may stem from a cultural sense of vulnerability regarding physical disease.

Keywords
anxiety, physical, ethnicity, culture, African American, cardiovascular disease

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Historical accounts from emotion researchers reveal early assumptions that emotions are biologically prewired internal processes that regulate behavior (Ellsworth, 1994). Such accounts were relatively void of any recognition of cultural and ethnic influences on the shaping of emotional responses (Kitayama & Markus, 1994). More recent research examining the role of culture and ethnicity on emotion and psychopathology has demonstrated that emotions are influenced by the family dynamics, socialization patterns, and the general values of one’s culture (Draguns & Tanaka-Matsumi, 2003; Jenkins, 1994; Kirmayer, 2001; Mineka & Zinbarg, 2006).¹ In this article, we are primarily interested in African American culture and ethnicity and the triggers of anxiety that are especially significant for this group. We define anxiety as an emotion marked by tension and perceived threat or apprehension that often consists of physiological responses, such as increased heart rate and perspiration. The term anxiety disorders refers to the collection of disorders outlined in the Diagnostic and Statistical Manual of Mental Disorders characterized by excessive fear or anxiety in response to perceived threat, which is often accompanied by behavioral avoidance of the threat (examples include panic disorder, generalized anxiety disorder, and specific phobias; American Psychiatric Association, 2013). The current study is novel in its use of a range of in vivo anxiety provocations (as opposed to self-report measures alone), inclusion of culturally relevant moderators of anxiety, and multimodal assessment of anxiety responses, including both subjective and physiological measures of anxiety.

African Americans and Anxiety

Prevalence of Anxiety Disorders. Although much of the cross-cultural anxiety research has focused on comparisons of Western and non-Western groups, a growing body of work has examined cultural and ethnic variation within the United States. Several studies have evaluated the prevalence of various anxiety disorders for African Americans relative to other groups, but findings have been inconsistent (Brown, Eaton, & Sussman, 1990; Carter, Sbrocco, & Carter, 1996; Eaton, Dryman, & Weissman, 1991; Horwath, Johnson, & Horning, 1994; Karno & Golding, 1991; Regier et al., 1984; Smith, Friedman, & Nevid, 1999). It is widely recognized that factors such as sampling procedures, the impact of socioeconomic status, questionable construct validity of measures of anxiety, and the effect of stigma on subjective report have considerable influence on prevalence rates, making it challenging to synthesize the literature. Research examining the underlying structure of anxiety for African Americans may help clarify discrepant prevalence findings by highlighting the specific sources of distress, unique patterns of symptoms, and the
interpretation of symptoms that characterize anxiety for African Americans (Kirmayer, Young, & Hayton, 1995; Petrie, Chapman, & Vines, 2012). The current study follows this more nuanced approach by exploring culturally relevant triggers of anxiety for African Americans through the use of anxiety provocations and a multimodal, repeated measures design.

**Focus on Physical Sensations.** Hunter and Schmidt (2010) offer an intriguing sociocultural model of anxiety for African Americans. In their model, awareness of racism, stigma of mental illness, and the salience of physical illness each affect how African Americans express and interpret anxiety symptoms. The salience of physical illness reflects the prediction that African Americans are aware that their group has higher incidence and mortality rates for a range of physical illnesses (e.g., cancer, diabetes, cardiovascular disease, flu, obesity, hypertension, and HIV/AIDS; see Byers, 2010; Cosorrow & Falkner, 2004; Li, Yin, Cai, Temkin-Greener, & Mukamel, 2011; Morenoff et al., 2007; National Center for Health Statistics, 2011; Williams, 1999), which may lead African Americans to experience somatic symptoms of anxiety as more threatening. Several studies have in fact revealed that African Americans report a greater number of physical symptoms and more intense physical symptoms during panic attacks than other groups (Friedman & Paradis, 1991, 2002; Friedman, Paradis, & Hatch, 1994; Horwath et al., 1994; Johnson et al., 2007). The Hunter and Schmidt model provides a useful framework for testing a number of hypotheses that can advance our understanding of how social and cultural variables affect both pathological and nonpathological anxiety in African Americans. The current study offers an empirical investigation of possible implications of the “salience of physical illness” component of their model, in that we elicit physical sensations associated with both anxiety and physical illness (e.g., shortness of breath and dizziness) and assess group differences in anxiety responses, including subjective affect, behavior, and how the elicited sensations are interpreted.

A number of prior studies suggest a unique link between anxiety and various physical sensations for African Americans, especially between anxiety and cardiovascular arousal (e.g., Carter, Miller, Sbrocco, Suchday, & Lewis, 1999; Neal, Rich, & Smucker, 1994). For instance, in an analysis of the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986), a questionnaire that measures concerns about anxiety symptoms, Carter et al. (1999) found that the three-factor structure for the questionnaire established with other ethnic groups did not fit the data from an African American sample. In studies conducted with largely European American samples, the index measures three factors of anxiety symptoms, including physical, mental incapacitation, and social concerns. However, Carter and colleagues found that
the single physical concerns factor reported for other populations was better modeled as two separate factors in African American samples: (1) a cardiovascular concerns factor (e.g., “When I notice my heart beating rapidly, I worry that I might have a heart attack”) and (2) an unsteady factor (e.g., “It scares me when I feel faint”). Cardiovascular concerns appeared particularly salient for African Americans, as the items from this factor were most highly correlated with the total ASI. Based on the factor structure analyses, the authors suggested that cardiovascular concerns might be uniquely related to the expression of anxiety in African Americans (Carter et al., 1999).

Prior studies have identified an interesting pattern of changes in prevalence rates for cardiovascular disease among African Americans. According to Crook et al. (2003), rates for cardiovascular disease were lower for African Americans relative to European Americans in the early 1900s. Although there has been debate about whether these findings were limited to the specific geographical area examined in the study (rural Georgia), the historical pattern begs the question of how and why cardiovascular disease rates have become disproportionately high for African Americans in the ensuing years (while rates for other groups have declined in recent decades). A number of studies have addressed this issue, and they suggest that factors including, but not limited to, changes in environmental stress, poverty, diet, and insulin resistance among African American populations have been implicated (Lepore et al., 2006). Furthermore, there are several studies revealing that African Americans demonstrate higher rates of cardiovascular reactivity than other groups in response to stress. For example, Guyll, Matthews, and Bromberger (2001) found that African American women demonstrated a higher level of cardiovascular reactivity in response to tasks simulating interpersonal maltreatment, relative to European American women. Given these findings, African Americans in the current study are expected to demonstrate a relationship between anxiety and triggers of physical sensations, with an especially strong association between anxiety and cardiovascular arousal, relative to European Americans.

Additional research suggesting differences in the underlying structure of anxiety for African Americans includes two earlier studies from our research lab (Gordon & Teachman, 2004, 2008). The first study examined ethnic group differences on a questionnaire developed to assess anxious cognitions following the reading of several anxiety-provoking scenarios (Ethnic Variations in Anxious Cognitions [EVAC]; Gordon & Teachman, 2004). Results indicated that African Americans reported a higher number of physical concerns associated with anxiety (e.g., “The tingling in my hands and feet isn’t normal”) in comparison to other groups. The findings supported the expectation that African Americans would demonstrate a link between anxiety
and physical concerns, though ethnic differences in cardiovascular concerns were not explicitly explored.

A second study examined ethnic differences in anxious responding following three in vivo anxiety provocations that each elicited a different type of anxiety concern. One of the provocations elicited physical concerns and involved breathing through a thin beverage straw for 1 minute; this provocation triggers sensations of shortness of breath and feelings of suffocation. Results indicated that African Americans exhibited greater anxiety following this provocation relative to Asian Americans but not to European Americans. The results partially supported the hypothesis that African Americans would demonstrate a pronounced relationship between anxiety and physical concerns. The finding that African Americans and European Americans demonstrated a similar pattern of anxious responding (contrary to the expectation that they would be different) may reflect the narrow selection of physical sensations examined in this earlier study. Consequently, the current study assesses anxious responding following a wider range of physical provocations, including ones tied to cardiovascular arousal.

Other studies that support a distinct association between ethnicity, anxiety, and cardiovascular arousal include several investigations, indicating higher rates of comorbidity for isolated sleep paralysis (ISP; a condition that causes temporary paralysis as an individual is awakening from sleep or falling asleep), panic disorder, and hypertension for African Americans (Neal et al., 1994). Given the reported link between these conditions, Neal et al. (1994) hypothesized that there may be a subset of African American patients whose anxiety is characterized by unique psychophysiological factors. Interestingly, a study conducted with a Nigerian sample found that prevalence rates for ISP were equal to those reported for European American samples, and panic attacks and ISP were not related to increased stress or hypertension (Ohaeri, Odejide, Ikuesan, & Adeyemi, 1989). These findings suggest that the link between anxiety and hypertension is not a purely biological or a genetic relationship that can be accounted for by race alone. Instead, the results implicate possible cultural differences in the triggers and expression of anxiety for African Americans.

Consistent with this view, prior researchers have made it clear that investigators should seek to understand the context or conditions under which ethnic group differences exist, rather than simply reporting on the differences alone (Betancourt & Lopez, 1993). In her exploration of the critical facets of ethnicity, for example, Phinney (1996) argues that it is critical to measure ethnic identity along with other cultural norms and attitudes that may affect the psychological outcome of interest when examining group differences. Along these lines, we hypothesize that the strength of the predicted ethnic
group differences in anxious responding will vary based on individual levels of cultural factors that are central to many African Americans’ experiences. In particular, we assess two proposed moderators: Cardiovascular Disease Exposure, Worry, and Knowledge, and Ethnic Identity.

**Potential Moderators of the Relationship Between Ethnic Group and Anxiety Responses**

**Cardiovascular Disease Exposure, Worry, and Knowledge.** As outlined above, there are several research studies that suggest a link between anxiety and cardiovascular arousal for African Americans. Key examples include a factor analysis of the ASI, which found a unique “cardiovascular concerns” factor for this group (Carter et al., 1999), as well as studies demonstrating higher cardiovascular reactivity in response to stress for African Americans (e.g., Guyll et al., 2001).

In addition to these findings, cultural factors that may be implicated in African Americans’ experience of anxiety include their exposure to and worry about developing cardiovascular disease, and their knowledge about the higher prevalence rates of cardiovascular disease for their ethnic group. Epidemiological research reveals drastically higher rates of cardiovascular disease for African Americans, relative to many other groups (Kalinowski, Dobrucki, & Malinski, 2004; Lloyd-Jones et al., 2009). Thus, a disproportionate number of African Americans have been exposed to cardiovascular disease via the illness and death of family members. Given this shared cultural experience of heightened cardiovascular disease risk, we suspect that African Americans who have been personally exposed to cardiovascular disease will be especially anxious following physical triggers that elicit sensations associated with cardiovascular disease. This hypothesis follows from prior studies indicating that exposure to chronic illness among family members may increase sensitivity to particular sensations associated with that illness. Ehlers (1993), for example, noted, “Observing physical suffering can contribute to the evaluation that somatic symptoms are dangerous and that special care is needed” (p. 276). Moreover, Craske, Poulton, Tsao, and Plotkin (2001) argue that distorted beliefs about bodily sensations may develop from observing significant illness in others, among other pathways. Related to an individual’s exposure to cardiovascular disease, research demonstrates that perceived risk of cardiovascular disease is two to three times greater in individuals with a family history of cardiovascular disease (Watt, McConnachie, Upton, Emslie, & Hunt, 2000). It seems likely, then, that exposure to cardiovascular disease and an individual’s worry about potentially developing this disease will occur more frequently for African Americans.
Americans (vs. European Americans), and will heighten the experience of anxiety in the face of physical stressors for African Americans in particular, given their cultural ties to cardiovascular disease. Relatedly, we hypothesize that African Americans who are knowledgeable about the higher rates of cardiovascular disease for African Americans relative to other groups will demonstrate greater sensitivity to cardiovascular triggers of anxiety, given that this knowledge may prime a sense of cultural vulnerability for their group.

Taken together, the higher prevalence rates for cardiovascular disease for African Americans, and the research findings suggesting a pronounced relationship between anxiety and cardiovascular arousal, provide the framework for the current hypothesis that exposure to, worry about, and knowledge of the higher rates of cardiovascular disease for African Americans will moderate the relationship between ethnic group and anxiety reactions following physical triggers. This test offers a preliminary exploration of possible emotional effects at the individual level that follow from high rates of cardiovascular disease within African American populations.

**Ethnic Identity.** Ethnic identity will also be examined as a potential moderator of the relationship between ethnic group and anxiety reactions. Ethnic identity refers to an individual’s sense of membership in his ethnic group and the attitudes and feelings associated with that membership (Keefe, 1992). We expect African Americans who report stronger ties to African American cultural values, beliefs, and practices to demonstrate a stronger anxiety reaction to physical triggers than individuals who report lower ethnic identity. This hypothesis follows from Hunter and Schmidt’s (2010) theoretical model. As described above, this model highlights the influence of factors such as awareness of racism and salience of physical illness on how African Americans experience anxiety. We expect that these factors and related sociocultural phenomena associated with increased disease, such as lack of access to medical care and lack of belief in the efficacy of available medical care for African Americans, will be especially influential for individuals who report that being African American is a salient part of their overall identity. We hypothesize that African Americans who report stronger ethnic identity will be more greatly affected by these factors and therefore demonstrate more anxiety in response to the physical triggers.

**Overview**

The present study evaluates anxious responding following a series of anxiety provocations, designed to elicit different physical sensations that are
commonly tied to anxiety. Anxious responding is measured using multiple modes of assessment, including affective, cognitive, and physiological measures. Using various modes of anxiety measurement was considered important given previous findings indicating inconsistencies across different measures of anxiety (Lang, 1985), including among African American samples (Gordon & Teachman, 2008). The goal of the study is to determine if provocations that elicit physical sensations in general and elevated heart rate in particular result in greater anxiety among African Americans relative to European Americans.

**Method**

**Participants**

Forty-six students enrolled in introductory psychology courses at the University of Virginia participated in the study in exchange for 1 hour of course credit to fulfill their research participation requirement or for pay. Prior to the study, all introductory psychology students completed a set of prescreening questionnaires that assessed their qualification for various psychology studies. Those who reported their ethnic group as either African American or European American were contacted via email with an invitation to participate in this study (though they were not informed that they were selected based on their ethnicity). Individuals who reported a history of asthma, epilepsy, or severe motion sickness during the prescreening session were excluded from participation in the current study due to concerns that some of the planned provocations could cause sickness for these individuals.

Participants completed a demographics questionnaire assessing gender, family income, age, and physical fitness. Physical fitness was measured to ensure that group differences in anxious responding during the physical provocations were not related to baseline level of physical fitness. The average age for the sample was 19 years ($SD = 0.9$), and the average annual household income was $70 to $80,000 ($SD = $30,000). There were 23 African American (15 female) and 23 European American (9 female) participants. Individuals who reported their ethnic group as mixed or biracial were excluded from the study to increase the homogeneity within each ethnic group.

**Materials**

*Physical Anxiety and Control Provocations.* Participants completed five tasks that were designed to evoke mild to moderate levels of anxiety and one control task that was not designed to elicit anxiety. Each of the physical anxiety
provocations is commonly used in the evaluation of panic symptoms and involves no actual risk or danger. The tasks derive from the Panic Control Treatment (Barlow & Craske, 1994), as recommended in Woody and Sanderson’s (1998) guide to manuals for empirically supported treatments. When receiving the instructions for each task, participants were told they could end the tasks if they became too uncomfortable; this instruction was provided to reduce the likelihood of coerced participation. A metronome was used for provocations that required standardization of the participant’s pace while completing the task.

**Cardiovascular Provocations**

*Jogging in place (Barlow & Craske, 1994).* Participants jogged in place rapidly for 60 seconds to produce sensations of racing heart and shortness of breath. The metronome was set to 184 beats per minute, and participants were asked to place one foot on the ground every time the metronome clicked.

*Stair climbing.* The stair-climbing task was modeled after the Queen’s College Step Test (McArdle, Katch, Pecah, Jacobson, & Ruck, 1972), which is used to assess the health of an individual’s cardiovascular system. Participants repeatedly stepped on and off of a 16-inch step for a period of 3 minutes. The metronome was set to 88 beats per minute, and participants were told to take a step every time the metronome clicked. This task produces sensations of racing heart and shortness of breath.

**Other Physical Provocations**

*Candle blowing (Barlow & Craske, 1994).* Using their index finger as an imaginary candle, participants repeatedly and rapidly blew on their finger as if blowing out a candle for 60 seconds. The metronome was set to 100 beats per minute, and participants were asked to blow out every time the metronome clicked. The candle-blowing task typically produces a range of sensations, including dizziness, tingling and numbness, hot flushes, and sweating.

*Straw breathing (Taylor & Rachman, 1994).* Participants were asked to breathe through a thin straw for 60 seconds, a harmless activity that produces very temporary dizziness and light-headedness. This provocation was designed to activate potential hypersensitivity to shortness of breath sensations.

*Chair spinning (Barlow & Craske, 1994).* Participants were asked to spin around in a chair that swivels for up to 60 seconds. The metronome was set to 40 beats per minute, and participants were instructed to push off strongly with one foot every time the metronome clicked. This task produces sensations
of dizziness and mild nausea, which are typical sensations for individuals prone to anxiety.

**Control Provocation**

**Foot stomping.** Participants were asked to stomp their right foot every ten seconds for up to 1 minute. This task was not designed to elicit any intense physical sensations related to anxiety, but was designed to match the other tasks in terms of being a physical provocation without the likely intense physical sensations related to anxiety. Similar control tasks (e.g., breathing slowly) have been used in previous research (e.g., Antony, Ledley, Liss, & Swinson, 2005). Foot stomping was used as the control task for the current study since it requires physical movement like the other provocations, but it was not expected to elicit strong physical sensations associated with anxiety.

**Responses to Provocations (Completed Following Each Provocation)**

**Bodily Sensations Questionnaire (BSQ; Chambless, Caputo, Bright, & Gallagher, 1984).** The BSQ is a 17-item self-report instrument that assesses fear of bodily sensations. Each item represents an anxiety-related sensation (e.g., heart palpitations) and is rated on a 1 (“Not frightened or worried by this sensation”) to 5 (“Extremely frightened by this sensation”) Likert-type scale. The scale has demonstrated high internal consistency and test-retest reliability (Chambless et al., 1984). Participants completed this measure following each provocation to assess fear of physiological arousal during the provocation. The measure was found to have acceptable reliability in the current sample (Cronbach’s alpha for each of the provocations: jogging = .94, stair climbing = .91, candle blowing = .83, straw breathing = .85, chair spinning = .92, foot stomping = .68).

**Ethnic Variations in Anxious Cognitions (EVAC; Gordon & Teachman, 2004).** The EVAC is a 9-item questionnaire designed to measure cognitions associated with state anxiety, analogous to the trait-based ASI. The scale includes a list of cognitions that address physical (e.g., “I might throw up”), mental incapacitation (e.g., “I am losing emotional control”), and social (e.g., “I am embarrassing myself”) concerns. Participants indicated to what extent they experienced each thought using a 7-point Likert scale (ranging from “Not at all” to “Extremely”). The EVAC was designed so that it has a similar factor structure for different ethnic groups, allowing for valid comparisons across groups. The measure has been validated on African American, Asian American, and European American college student samples, and has adequate psychometric properties (Gordon & Teachman, 2004). Reliability of the EVAC was excellent in this sample (Cronbach’s alphas: jogging = .87,
stair climbing = .87, candle blowing = .87, straw breathing = .91, chair spinning = .91, and foot stomping = .79).

Positive and Negative Affect Schedule–Fear Subscale (PANAS; Watson, Clark, & Tellegen, 1988). Participants completed the fear subscale of the PANAS, both at the start of the study as a baseline measure and after each provocation. The fear subscale includes six words reflecting fearful emotions: “afraid,” “scared,” “frightened,” “nervous,” “jittery,” and “shaky.” Participants were asked to rate each word to indicate “to what extent you felt this way during the last task.” Items were rated using a 5-point scale ranging from “Very slightly or not at all” to “Extremely.” Previous research has demonstrated strong reliability and validity for the various subscales of the PANAS (Watson et al., 1988), and the measure had sound reliability in this sample (Cronbach’s alphas: baseline = .76, jogging = .77, stair climbing = .86, candle blowing = .67, straw breathing = .89, chair spinning = .79, and foot stomping = .70).

Physiological Measure: Heart Rate. Heart rate was recorded both during a baseline period of 2 minutes at the start of the study and during the six anxiety provocations. The Polar E600 (Polar, USA) heart rate monitor uses electrodes that are enclosed in a transmitter that is worn across the chest to detect cardiac electrical impulses. The detection of the electrical impulses is transferred to a wristband receiver that the experimenter held (out of the participant’s sight) throughout the study. The receiver calculates the interbeat interval between the impulses and converts the interbeat interval to a heart rate reading that is then displayed on the receiver. The Polar monitor was programmed to sample heart rate values every 5 seconds (i.e., the interbeat interval was recorded every 5 seconds), the shortest interval allowed by the equipment. In previous studies, Polar heart rate monitors have demonstrated adequate validity and reliability and heart rate measures that are comparable with electrocardiography (e.g., Bar-Or, Bar-Or, Waters, Hirji, & Russell, 1996; Terbizan, Dolezal, & Albano, 2002).

General Mood and Symptom Measures (Completed at the End of the Study)

Beck Depression Inventory (BDI-II; Beck, Brown, & Steer, 1996). The BDI-II is a 21-item inventory, which is widely used as a clinical screening tool for depressive symptoms. This instrument has strong psychometric properties, including good internal consistency (Beck et al., 1996; α = .92 for the current sample). The BDI-II was included to assess ethnic group differences in depressive symptoms.

Anxiety Sensitivity Index (ASI; Reiss et al., 1986). The ASI is a 16-item self-report inventory that assesses fear about the negative consequences associated
with various anxiety symptoms. Each of the items on the ASI is rated from 0 (“Very little”) to 4 (“Very much”) to reflect one’s usual way of thinking and feeling (e.g., “When I notice that my heart is beating rapidly, I worry that I might have had a heart attack.”). This measure has adequate psychometric properties (Reiss et al., 1986; $\alpha = .86$ for the current sample), and it was included to assess differences in concerns about anxiety symptoms.

**Potential Moderators of the Relationship Between Ethnic Group and Anxiety Responses**

**Cardiovascular Disease Questionnaire (CVD).** The CVD is an 11-item questionnaire that was developed for the current study to assess exposure to cardiovascular disease via family members’ and friends’ illness (e.g., “Has your mother ever been diagnosed with cardiovascular/heart disease?”). In addition to assessing CVD exposure, one item measures how often the respondent worries about developing cardiovascular disease (responses range from “constantly” to “never”). Also, one item measures the respondent’s knowledge about the discrepant rates of cardiovascular disease for African Americans and European Americans (this item was administered separately at the end of the study to avoid priming participants for the study’s focus on ethnicity). This item includes 5 responses ranging from “Rates are much lower for African Americans” to “Rates are much higher for African Americans.” Correlational analyses revealed weak relationships between the exposure, worry, and knowledge components of this measure ($r = .04-.23$), so each component was analyzed separately to assess whether the CVD components moderated the relationship between ethnic group and anxious responding.

**Multigroup Ethnic Identity Measure (MEIM; Phinney, 1992).** The MEIM is a 12-item questionnaire that assesses the degree to which an individual identifies with his or her ethnic group (plus three demographic items). The measure comprises two factors: (1) ethnic identity search and (2) affirmation, belonging, and commitment. Ethnic identity search takes place over time, as people explore and make decisions about the role of ethnicity in their lives. Phinney (1992) proposes a three-stage progression from an unexamined ethnic identity through a period of exploration to an achieved or committed ethnic identity (e.g., “I understand pretty well what my ethnic group membership means to me”). The affirmation component of the MEIM assesses an individual’s acceptance of and involvement in the social life and cultural practices of one’s ethnic group. The measure uses a 4-point Likert-type scale, ranging from “strongly disagree” to “strongly agree.” Cronbach’s alpha in the current sample was .88.
Procedure

Participants were told that the purpose of the study was to measure emotional reactions to various tasks. No mention of ethnicity was made. Following informed consent, each participant completed the PANAS. Next, participants were provided with instructions and a demonstration of how to attach the chest transmitter of the heart rate monitor. To assess baseline heart rate, participants were asked to sit as quietly and as still as possible in a chair and stare at a target that was placed on the computer screen for 2 minutes. Participants then completed the six anxiety provocations in a randomized order to minimize order effects. Following each provocation, participants completed the PANAS, BSQ, and the EVAC (in that order). After the questionnaires, participants completed 30 seconds of relaxation exercises (slow, diaphragmatic breathing) to minimize residual anxiety between tasks. Participants next completed the ASI, BDI-II, CVD, and MEIM, and provided demographic information. The order of the final questionnaires was randomized. Following these questionnaires and a check for residual anxiety on the PANAS, participants were fully debriefed.

Results

Sample Characteristics

Demographic variables for African Americans and European Americans were compared. An independent samples t-test indicated no significant differences in the average age, \( t(44) = -.47, p > .05, d = .14 \), of the ethnic groups, and chi-square analysis did not reveal significant group differences in family SES (\( \chi^2 = 10.77, p > .05 \)) or reported level of physical fitness (\( \chi^2 = 5.91, p > .05 \)). In both groups, most participants reported an average level of physical fitness (i.e., “I participate in some form of exercise, such as walking, aerobics class, and running, on 3-4 days of the week.”). Although not significant, chi-square tests indicated a nonsignificant trend for a higher ratio of females to males among African Americans (\( \chi^2 = 3.14, p = .08 \); African Americans, 65.2% female; European Americans, 39.1% female). Thus, to increase confidence that ethnic group differences are responsible for any observed ethnic group effects (versus other factors that differ between the groups), gender was used as a covariate in relevant analyses.

Means and standard deviations for the baseline and symptom measures (PANAS, heart rate, ASI, and BDI-II) are provided by ethnic group in Table 1. As expected, ANCOVAs covarying gender revealed no group differences on the BDI-II, \( F(1, 42) = .73, p > .05, \eta_p^2 = .02 \), baseline PANAS, \( F(1, 43) = 1.14, p > .05, \eta_p^2 = .03 \), or baseline heart rate, \( F(1, 43) = 1.25, \eta_p^2 = .03 \),
This lack of significant group differences on the baseline and symptom measures is notable because it suggests that any observed ethnic group differences in anxious responding following the provocations reflect differences in reactivity, rather than general mood differences or a response bias.

Finally, given the hypothesis that African Americans have a pronounced relationship between anxiety and physical sensations, this group was expected to have higher scores on the ASI. Results revealed that there was not a significant difference on this measure ($p > .05$).

**Ethnic Group Differences on Provocations**

Given the goal of examining the relationships between ethnic group and cardiovascular arousal, and between ethnic group and physical sensations more broadly, composite scores were computed for the three types of anxiety provocations. Specifically, scores on the dependent variables for the cardiovascular provocations (jogging and stair-climbing) were combined. Although the other physical provocations (candle blowing, chair spinning, and straw breathing) each elicited different physical sensations, we computed composite scores because we had the same hypothesis for all the tasks in this category. The composite scores served to simplify the analyses, create more reliable indicators of the cardiovascular and other physical provocations constructs, and better align the analyses with the overarching questions for the study (rather than conducting multiple comparisons across the six provocations).

Prior to creating the composite scores, we examined the relationships between the stair climbing and jogging provocation dependent variables to determine whether the pattern of anxious responding supported the decision to combine them to reflect cardiovascular arousal. Results indicated strong correlations between the dependent variables for the stair climbing and jogging provocations, lending support to the combination of these tasks.
Furthermore, the average heart rate for the jogging and stair-climbing tasks was compared with that of the other tasks to validate their classification as “cardiovascular” provocations. Results revealed that the average heart rate for the jogging and stair climbing provocations was significantly higher than that of the other provocations (all $p < .05$; see Table 2). We also examined the pattern of correlations across the other physical tasks and found that relationships for the BSQ, EVAC, and PANAS across tasks were generally high and that all were significant, supporting the decision to combine the tasks (though heart rate was less stable across tasks with nonsignificant correlations).

A repeated measures multivariate analysis of covariance (MANCOVA) was conducted to determine whether there were ethnic group differences in anxious responding across the provocations. Ethnic group (African American or European American) was included as a between-subjects factor. Type of provocation (cardiovascular, other physical, and control) was included as a repeated measures within-subjects factor, and the various modes of anxious responding for each provocation (subjective fear—PANAS, anxious cognitions—EVAC, fear of physiological arousal—BSQ, and actual physiological arousal—average heart rate; all $z$-scored) comprised a within-subjects factor, termed type of measure. Also, given the trend of ethnic group differences in gender, gender was included as a covariate. Note that change scores were computed for the measures of subjective fear (PANAS) and physiological arousal (average heart rate) to account for baseline scores on these variables.

Results indicated the expected significant main effect of ethnic group, $F(1, 34) = 6.39, p = .02, \eta^2_p = .16$, with African Americans responding with

<table>
<thead>
<tr>
<th>Task</th>
<th>PANAS, $M$ (SD)</th>
<th>EVAC, $M$ (SD)</th>
<th>BSQ, $M$ (SD)</th>
<th>HR, $M$ (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td></td>
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</tr>
<tr>
<td>Jogging in place</td>
<td>8.91 (2.93)</td>
<td>15.96 (8.03)</td>
<td>25.18 (10.15)</td>
<td>133.92 (29.15)</td>
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<tr>
<td>Stair climbing</td>
<td>9.71 (3.81)</td>
<td>15.91 (7.61)</td>
<td>27.96 (9.58)</td>
<td>138.24 (24.20)</td>
</tr>
<tr>
<td>Other physical</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Candle blowing</td>
<td>7.72 (2.16)</td>
<td>17.37 (8.28)</td>
<td>23.25 (5.82)</td>
<td>101.11 (20.75)</td>
</tr>
<tr>
<td>Chair spinning</td>
<td>8.87 (3.31)</td>
<td>17.00 (10.52)</td>
<td>27.47 (9.55)</td>
<td>97.26 (23.84)</td>
</tr>
<tr>
<td>Straw breathing</td>
<td>13.78 (5.61)</td>
<td>16.22 (9.37)</td>
<td>26.78 (7.78)</td>
<td>86.26 (17.93)</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot stomping</td>
<td>6.61 (1.57)</td>
<td>13.57 (5.66)</td>
<td>17.87 (1.71)</td>
<td>91.49 (24.94)</td>
</tr>
</tbody>
</table>

Note. PANAS = Positive and Negative Affect Schedule; EVAC = Ethnic Variations in Anxious Cognitions; BSQ = Bodily Sensations Questionnaire; HR = heart rate.
more anxiety than European Americans across the provocations. Interestingly, the interactions between ethnic group and either type of provocation or type of measurement response were not significant (all $p > .05$), suggesting that, irrespective of the type of physical task or means of expressing anxiety, the pattern was consistent. Group means on the four measures of anxiety for each of the anxiety provocations are noted in Table 2.

The repeated measures MANCOVA was used to integrate each of the between- and within-subject factors in one analysis. However, we recognize that there are limitations to using different outcome measures (that are not originally on the same scale) in a repeated measures test, so we also conducted separate ANCOVAs for each type of anxiety measure to check that this approach confirmed our finding that African Americans respond with more anxiety than European Americans to the physical tasks generally. Consistent with the overall MANCOVA, the separate repeated measures ANCOVAs for the PANAS, EVAC, and BSQ, with type of provocation as the within-subjects factor and gender as the covariate, each showed the significant main effect of ethnic group (PANAS: $F[1, 43] = 7.40, p = .009, \eta^2_p = .15$; EVAC: $F[1, 43] = 4.83, p = .03, \eta^2_p = .10$; BSQ: $F[1, 43] = 5.94, p = .02, \eta^2_p = .12$). Only the measure of heart rate change was not characterized by a main effect for ethnic group, $F(1, 34) = .15, p > .05, \eta^2_p = .004$. Replicating the earlier results, the interactions between ethnic group and type of provocation were not significant for the PANAS, BSQ, EVAC, and heart rate change (all $p > .05$), suggesting a consistent pattern of group differences across tasks.

Taken together, these findings provide support for the expectation that African Americans demonstrate higher anxiety than European Americans in response to a range of provocations. Interestingly, this pattern appears to carry across physical tasks for the most part, even when they are not particularly strenuous (i.e., the foot-stomping task). Finally, the finding of no ethnic group difference in average heart rate change suggests that it is on subjective measures of anxiety that the groups differ, rather than on actual physiological reactivity, consistent with the idea that it is response to anxious arousal that is central to anxiety (not arousal itself).

**Cardiovascular Disease: Exposure, Worry, and Knowledge**

The CVD measure was included to assess individual exposure to cardiovascular disease via the illness/death of family members and close friends, worry about personal vulnerability to cardiovascular disease, and knowledge of the discrepant rates of cardiovascular disease for African Americans and European Americans. African Americans were expected to score higher on each component of the CVD. Furthermore, African Americans who scored
higher on the CVD components were expected to demonstrate greater anxiety in response to the Cardiovascular and Other Physical provocations, reflecting a greater sensitivity to a range of physical triggers.

As expected, a univariate ANCOVA (covarying gender) found that African Americans reported greater exposure to cardiovascular disease than European Americans, $F(1, 43) = 4.03, p = .05, \eta^2_p = .09$, and a chi-square analysis (not covarying gender) revealed that more African Americans than European Americans correctly reported that the rates of cardiovascular disease are higher for African Americans than European Americans ($\chi^2 = 9.58, p = .002$; African Americans, 87% responded correctly; European Americans, 43.5% responded correctly). However, there was no ethnic group difference on the univariate ANCOVA (covarying gender) for frequency of worry about CVD, $F(1, 39) = 0.72, p > .05, \eta^2_p = .02$.

Next, the overall repeated measures MANCOVA was rerun once for each of the three CVD components, with the CVD variable entered as a moderator in each case. Contrary to predictions, there were no significant interactions between ethnicity and exposure to CVD, worry about CVD, or knowledge about ethnic group differences in CVD (all $p > .05$), though there was a main effect for greater worry about CVD to be associated with more anxiety across the physical provocations and anxiety measures, $F(1, 29) = 4.92, p = .04, \eta^2_p = .15$.

Overall, results for the CVD questionnaire indicate that African Americans report more exposure to cardiovascular disease and are more knowledgeable about the discrepant rates of cardiovascular disease than European Americans. Furthermore, participants (regardless of ethnic group) who report greater worry about cardiovascular disease indicated higher anxiety in response to the provocations.

**Ethnic Identity as a Moderator of Group Differences in Anxious Responding**

It was hypothesized that ethnic identity would act as a moderator of the relationship between ethnic group and anxiety in response to physical triggers. That is, African Americans who reported stronger identity with their ethnic group were expected to demonstrate the hypothesized relationship more strongly than individuals reporting lower levels of ethnic identity. As expected, an ANCOVA (with gender as a covariate) revealed that African Americans reported higher levels of ethnic identity than European Americans, $F(1, 43) = 25.77, p < .001, \eta^2_p = .38$. This finding is consistent with a number of previous studies documenting higher ethnic identity in minority groups, relative to European Americans (e.g., Phinney & Alipuria, 1990).
To assess the moderating effects of ethnic identity, the overall repeated measures MANCOVA was rerun including total scores on the MEIM as a continuous moderator. We focus only on those interactions that include ethnic group and the MEIM, given the specific moderation question being examined here. The three-way type of provocation by ethnic group by MEIM interaction was significant, \(F(2, 31) = 3.32, p = .049, \eta_p^2 = .18\). Follow-up ANCOVAs were then conducted to compare the ethnic groups’ overall anxiety scores (collapsing across the different types of anxiety measures by taking an average of the \(z\)-scores) separately for each type of provocation, with the MEIM entered as a continuous moderator and gender as a covariate. Interestingly, the ethnic group by ethnic identity interaction was not significant for either the Cardiovascular or Other Physical tasks (both \(p > .05\)) but was significant for the foot–stomping control task, \(F(1, 41) = 4.23, p = .045, \eta_p^2 = .09\). To understand the significant interaction, a median split was performed on the MEIM variable so that overall anxiety on the foot-stomping task could be compared within and across the ethnic groups as a function of ethnic identity level. Independent samples \(t\)-tests comparing persons high versus low in ethnic identity on overall foot-stomping anxiety was not significant for either the European Americans, \(t(21) = .01, p > .05, d = .004\), or the African Americans, \(t(21) = 1.29, p > .05, d = .56\). Similarly, the independent samples \(t\)-test comparing European Americans and African Americans on overall foot-stomping anxiety was not significant for persons high in ethnic identity, \(t(23) = .94, p > .05, d = .39\), or low in ethnic identity, \(t(19) = 1.90, p > .05, d = .87\).

**Relationships Across Modes of Anxious Responding**

To examine the relationships among the various modes of anxious responding, Pearson’s correlations were calculated for each type of provocation (see Table 3). For the cardiovascular tasks, the relationships between the PANAS, EVAC, and BSQ ranged from moderate to high and were all significant \((r = .40-.66)\). Relationships for heart rate with the other measures were generally weak and not significant \((r = .04-.10)\). Similar relationships were revealed for the other physical provocations. That is, the PANAS, EVAC, and BSQ shared relatively strong and significant relationships \((r = .60-.81)\), whereas heart rate had weak, nonsignificant relationships with the other measures \((r = .13-.20)\). For the control provocation, correlations between the four anxiety measures were low and not significant \((r = .06-.22)\), with only one exception (i.e., the BSQ was moderately correlated with the PANAS at .53). Correlations were also examined for African Americans and European Americans separately, with results indicating a similar general pattern for both groups.
The current study examined anxiety in response to physical stressors, with a special emphasis on anxious responding following cardiovascular arousal for African Americans. It was hypothesized that African Americans would demonstrate greater anxious responding following the range of physical provocations, with an especially pronounced anxiety response for cardiovascular provocations. Findings for between-group comparisons were largely supportive of this hypothesis, indicating that African Americans demonstrated greater anxiety than European Americans across the various physical provocations and measures of anxiety, but this difference was not more pronounced for the cardiovascular triggers. Importantly, results were not consistent across all modes of expressing anxiety, in that changes in actual heart rate did not vary by ethnic group, whereas changes in subjective fear, anxious cognitions, and fear of physiological arousal did show group differences, consistent with prior research on the desynchrony of emotional response modalities (e.g., Lang, 1985). These findings suggest that, despite equal levels of actual physiological arousal, African Americans demonstrated more anxiety on the subjective measures than did European Americans. This finding lends support to
cognitive models of anxiety (e.g., Beck, Emery, & Greenberg, 1985) by highlighting the importance of distorted reactions to physical sensations (as opposed to the actual level of the sensations, as indicated by heart rate) in the anxiety response. Note, the fact that heart rate for African Americans and European Americans was not significantly different is interesting given previous studies suggesting higher rates of cardiovascular reactivity in African Americans in response to stress (though it should be noted that heart rate is only one index of cardiovascular reactivity, other indices such as blood pressure were not assessed; Lepore et al., 2006). As noted by Lepore et al. (2006), higher levels of cardiovascular reactivity for African Americans may be limited to specific stressors, such as situations evoking anger, which did not apply in the present study.

Although these findings do not indicate a particular sensitivity to cardiovascular arousal for African Americans, the results suggest a link between anxiety and a range of physical concerns. These findings provide intriguing evidence for the importance of physical triggers of anxiety for African Americans, and they may help explain, in part, the tendency for African Americans to seek help from medical rather than mental health providers. In addition, as noted by Hunter and Schmidt (2010), this focus on physical symptoms may contribute to the lower reported prevalence rates of some anxiety disorders for African Americans. Current measures of anxiety may not adequately tap the worries and concerns most relevant for African Americans.

**Heightened Anxiety to Physical Cues for African Americans**

Findings generally revealed that African Americans demonstrated more anxiety following the various physical provocations in comparison to European Americans. These results are consistent with findings from previous studies suggesting that African Americans may strongly link anxiety with physical stressors or sensations (Carter et al., 1999; Gordon & Teachman, 2004, 2008; Neal et al., 1994).

Evidence for cultural variables that might moderate these effects was less clear. One of the hypotheses for the current study was that African Americans who reported higher ethnic identity would exhibit greater anxiety following physical triggers than those with lower ethnic identity. Although African Americans reported higher ethnic identity than European Americans, ethnic identity did not moderate the relationship between ethnic group and anxious responding. Similarly, it was hypothesized that African Americans’ greater worry about and exposure to cardiovascular disease (e.g., via their families, based on group differences in incidence and mortality rates) would be related to greater anxiety following cardiovascular arousal. Results revealed that although African Americans have a higher incidence of cardiovascular
disease exposure among their friends and family and greater knowledge of the disparate rates of cardiovascular disease for African Americans and European Americans, these variables did not uniquely affect anxious responding for African Americans. However, it does appear that individuals who worry more about cardiovascular disease (regardless of ethnic group) experienced more anxiety across the various provocations. This suggests that worry about future physical illness may exacerbate a range of anxiety symptoms triggered by physical arousal, independent of ethnic group.

It is plausible that the same line of reasoning underlying the hypothesized link between African American’s anxiety and cardiovascular triggers can be expanded to explain the current finding that African Americans demonstrated more anxiety following a wide range of physical provocations. Specifically, epidemiological studies in medicine have documented higher prevalence rates for a number of diseases for African Americans in comparison with European Americans. For example, African Americans have been shown to have higher rates of diabetes, hypertension, and stroke, and greater mortality rates associated with these diseases (e.g., Anderson, McNeilly, & Myers, 1993; Kalinowski et al., 2004; Kulig, 2006; Townsend & Belgrave, 2009).

Several additional factors may also increase African Americans’ sensitivity to signs of physical illness. For instance, African Americans have been documented as having lower levels of medical treatment utilization, lack of access to insurance coverage, and lower income overall (Becker & Newsome, 2003; Bell et al., 2001; Hreybe & Saba, 2004; Williams, Neighbors, & Jackson, 2003), suggesting that access to medical care may be compromised. Additional factors associated with lower quality of care are also likely critical to ethnic group disparities in health: greater delays in the prescription of effective medications and in administering procedures (e.g., specific dosing practices) for African American patients, less participation in medical decision making by African American patients, and African American patients’ less optimistic beliefs about the efficacy of medical care (e.g., see McBride, 2011). These factors affect the quality of health care for African Americans and may be related to the interpretation of physical sensations as more threatening. In particular, African Americans may have been more sensitive to the physical sensations elicited in the present studies (e.g., dizziness, racing heart, shortness of breath, and hot flushes) due to the combination of perceived risk for developing physical disease and related doubts about the likelihood that such diseases can be effectively treated by medical care (see also Neal et al., 1994). Future studies may advance the current research by examining individual exposure to a range of physical diseases, perceived risk of physical disease, and beliefs about the efficacy of medical treatment.

Determining whether there is an elevated risk for clinically significant anxiety among those with a personal or family history of physical illnesses
will be important for physicians and mental health practitioners alike. For mental health practitioners, family history of illness and perceived risk of illness may be important to explore in treatment. Distorted beliefs about bodily sensations may also be good targets for cognitive treatments aimed at helping patients replace those beliefs with more balanced appraisals. This is a standard component of current cognitive behavior therapies for panic disorder, and it may be beneficial to include more broadly in other anxiety treatments for African Americans.

The elevated risk of developing a range of physical diseases (and evidence suggesting disparities in health care) for African Americans may beg the question of how the perceptions of vulnerability can be labeled as distorted. In fact, there does appear to be reason for increased concern among African Americans about physical sensations and their relation to physical disease. However, in the current study, participants were assured that none of the anxiety provocations involved actual risk or danger. Nevertheless, participants experienced anxious cognitions and distress during the tasks, which suggests that fears about the relevant sensations may be disproportionate to the actual risk or danger.

Interestingly, African Americans tended to exhibit more anxiety, relative to European Americans, on self-report measures, rather than on the physiological arousal measure. The presence of main effects, rather than interactions with type of task, imply this occurred even when responding to the foot-stomping control task that was not designed to elicit strong physical sensations. This raises the possibility that a response bias may exist (i.e., uniformly higher reporting of distress by African Americans). Although this is always an important issue to consider, we think it is unlikely response bias played a large role in the current findings. First, ethnic group differences were not uniformly evident across all self-report measures. Second, the general measures of negative mood administered at the start of the study (the BDI-II and PANAS administered at baseline) did not show ethnic group differences, suggesting there was not a pervasive response bias. Instead, we suspect that the strangeness of the foot-stomping task meant it was not an ideal control task because it did elicit some anxiety for participants; perhaps just not to the level of the more strenuous physical tasks. One possibility is that African Americans may have experienced more anxiety during the foot-stomping task due to uncertainty and suspiciousness about the purpose of this task. The seemingly simple nature of the foot-stomping task may have raised questions about the researcher’s intentions and possible deception. Prior studies have documented historical feelings of mistrust and suspiciousness toward research among African Americans (e.g., Harris, Gorelick, Samuels, & Bempong, 1996) that may have been a factor here. It is unclear though
whether these feelings are prevalent among young adult groups and in non-medical studies. To help address this issue, future studies might use a task such as slow breathing, or a nonphysical stressor, such as giving a speech, as an alternate control.

**Limitations and Conclusion**

It is important to acknowledge several limitations of the current study. First, the sample was a nonclinical college sample, which limits the generalizability of the findings. Although the sample was appropriate for answering questions about characteristics of premorbid anxiety, future studies that explore these relationships with clinical populations will be important. In addition, we did not have an equal number of males and females in our ethnic groups, although group differences held with gender entered as a covariate. We should also note that the sample size was relatively small. However, the robust pattern of ethnic group differences found across multiple measures suggests that low power did not limit the ability to observe these medium to large effects. Last, the CVD questionnaire used to investigate how concerns about cardiovascular disease influence the link between ethnic group and anxious responding had not previously been validated, so its psychometric properties are not well understood. It will be important for future studies to employ measures of cardiovascular concerns with clear reliability and validity among African American samples. Also, as noted, assessing exposure to and concern about a wider range of physical diseases, beyond just cardiovascular disease, may be helpful given the current findings of sensitivity to a broad range of physical triggers. Moreover, testing mediators of the observed ethnic group differences in anxiety responses will be critical; for instance, examining whether thoughts about vulnerability to illness immediately following physical triggers can account for African Americans’ subsequent elevations in anxiety could be informative.

Despite these limitations, the present study offers intriguing evidence for the prominence of physical triggers of anxiety for African Americans. Overall, results indicated that African Americans demonstrated a pronounced relationship between anxiety and physical concerns more broadly, as opposed to cardiovascular arousal, in particular. The design of the study allowed for a multimodal analysis of anxious responding by incorporating affective, cognitive, and physiological measures of anxiety. Importantly, the current findings are consistent with cultural theories of anxiety and Hunter and Schmidt’s (2010) salience of physical illness model, which generally point to the significance of culture and ethnicity in shaping emotional responses (e.g., Good & Kleinman, 1985). Furthermore, the current study provides evidence that
the experience of anxiety for African Americans may involve considerable sensitivity to physical threat, and it raises important questions about the emotional sequelae of greater physical disease prevalence within this group.

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Notes
1. We use the terms *culture* and *ethnicity* here to denote a group of individuals who share a set of values, beliefs, language, customs, and behaviors, though we recognize that the terms *culture* and *ethnicity* are not interchangeable.
2. The State Trait Anxiety Inventory (Spielberger, 1983) was also included. Participants completed the trait scale of the State Trait Anxiety Inventory, which consists of 20 items that assess how the respondent “generally feels” (e.g., “I lack self-confidence”). There were no group differences on this measure.

References


