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The psychosocial vulnerability model of hostility as a predictor of coronary heart disease

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THE PSYCHOSOCIAL VULNERABILITY MODEL OF HOSTILITY AS A PREDICTOR OF
CORONARY HEART DISEASE

A Dissertation

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ABSTRACT

Coronary heart disease (CHD) is the number one killer for both men and women in the United States today. African Americans are particularly at risk, due to higher prevalence rates and mortality related to CHD (American Heart Association, 2003). Less than half of the new cases of CHD can be predicted with known risk factors (tobacco use, obesity, hypertension), which suggests the possible influence of personality or additional behavioral factors. Hostility is a psychological variable that has been consistently related to health outcomes, particularly to CHD. While the exact mechanism linking hostility to health is currently unknown, a psychosocial vulnerability model has been proposed (Smith, 1992). This model suggests that hostile persons experience higher levels of stress and lower levels of social support due to their cynical nature and negative interactions with others. Because increased levels of stress and low levels of social support have been consistently linked to CHD, it is possible that hostility exerts its influence on health through creating a psychosocial profile that is at risk for heart disease. At present, few studies have examined the psychosocial vulnerability model of hostility, particularly in samples of medical patients at risk for CHD. The current study examined the relationships among the variables included in this model (hostility, minor stress, social support) and the ability of the model to predict disease status in a sample of low-income, African American participants. Results of this study provided only partial support for the psychosocial vulnerability model. Possible explanations for current findings are discussed.

INTRODUCTION AND REVIEW OF LITERATURE

<u>Coronary Heart Disease</u>

Coronary heart disease (CHD) is the single number one killer of men and women in the United States today. The estimated overall prevalence of CHD in the U. S. was 6.4% in 2001, affecting 13 million people and accounting for one of every five deaths in this country that year. Approximately every 26 seconds someone in the United States experiences a coronary event and every minute someone dies from one. The direct and indirect costs of this disease were estimated at 133.2 billion dollars in 2003 (American Heart Association [AHA], 2003). CHD involves any one of several medical conditions that are the expression of underlying coronary artery disease (CAD). CAD involves the accumulation of plaque over time leading to a thickening of artery walls that restrict the artery opening and constrict blood flow (Krantz & McCeney, 2002). This impeded blood flow results in reduced oxygen supply to the heart. Clinical manifestations of CHD occur following the progression of CAD and may include myocardial infarction, myocardial ischemia, angina, and sudden cardiac death (Smith & Ruiz, 2002). Risk factors for CAD include diabetes, hyperlipidemia, obesity, and tobacco use (Davidson, 1994). Given the lethal nature of this disease, as well as its extensive economic impact, it is imperative that further risk factors be identified in order to improve efforts toward the prevention of CHD.

Persons of African American ethnicity and low socioeconomic status (SES) are at particularly high risk for CHD. African Americans are at risk due to the high rates of traditional CHD risk factors (i.e. obesity, hypertension) they experience. They also have higher estimated prevalence rates of heart disease (7.1% for males and 7.5% for females in African Americans, 6.9% for males and 5.4% for females in Caucasians) and higher overall death rates from CHD (AHA, 2003; Finney, Stoney & Engebretson, 2002). In addition, African Americans differ in the

relative importance of risk factors for CHD as compared to Caucasians. Specifically, hypertension is a much more powerful risk factor for CHD, while diabetes has less of an impact on CHD in this population (Jones et al., 2002). With regard to income, it has been determined that low SES itself confers increased risk of morbidity and mortality related to CHD (Smith & Ruiz, 2002).

CHD does not inevitably occur with age, but is the result of biological, behavioral and environmental factors and thus can be viewed as a disorder of lifestyle (Krantz, Contrada, Hill & Friedler, 1988). Several known risk factors for CHD have been identified, including hypertension, diabetes, hyperlipidemia, tobacco use, obesity, and physical inactivity (AHA, 2003; Smith & Ruiz, 2002). Although these traditional risk factors are consistently related to heart disease, information based on these variables alone predicts less than half of the new cases of CHD (Schneiderman, Chesney & Krantz, 1989). This finding suggests that other risk factors, including personality or other behavioral factors may also be influential and has spurred investigation into the relationship between several psychological constructs and heart disease (Krantz & McCeney, 2002). One of the psychological variables most consistently related to health outcomes in general and CHD in particular is hostility (Miller, Smith, Turner, Guijarro, & Hallet, 1996).

Hostility

Initial investigations into psychological risk factors for heart disease focused primarily on the Type A behavior pattern (TABP). This behavior pattern was first identified by Rosenman and Friedman in the 1950s and is defined by pervasive competitiveness, time urgency, impatience, loud and pressured speech, and hostility (Sirois & Burg, 2003). Several early large-scale prospective studies identified TABP as a predictor of heart disease, prompting the American

Heart Association to conclude in 1981 that TABP was indeed a significant risk factor for CHD (Smith & Gallo, 2003). Although the first twenty years of research concerning TABP found consistent associations between this behavior pattern and heart disease, subsequent research failed to replicate early results (Schneiderman et al., 1989). This prompted investigators to begin examining the individual elements of TABP, and several studies found hostility to be the toxic component of this behavior pattern (Smith & Ruiz, 2002).

The early literature on hostility was impacted by the ambiguity concerning the definition of hostility and related concepts, such as anger and aggression (Sirois & Burg, 2003; Smith, 1992). More recently, hostility has been defined as a multidimensional construct that involves emotion, cognition, and behavior. Behavioral aspects of hostility typically involve aggression, which involves intent to harm and might include sarcasm, insult, and opposition. Emotional aspects of hostility might range from annoyance and contempt to anger (Smith, 1992). **The term hostility most accurately reflects cognitive aspects, defined as cynicism, mistrust, and a general belief that others are likely sources of frustration and mistreatment (Barefoot, 1992; Miller et al., 1996; Smith 1992; Smith & Ruiz, 2002). Thus, hostility has been described as an enduring trait that involves a general devaluation of the worth and motives of others and a relational view of being in opposition toward others (Smith, 1994).**

Measurement of Hostility

The measurement of hostility may involve behavioral observations conducted during the course of a structured interview or, more commonly, the use of self-report measures. Rosenman and Friedman developed a structured interview for assessing TABP that incorporated measurements for several behaviors, including the experience of anger, voice stylistics, and the potential for hostility, based on clinical judgments of the respondent's behavior. Scoring systems

were eventually developed to focus exclusively on the hostility components of this interview, the most widely used being the Potential for Hostility (PH; Dembroski et al., 1989). PH ratings have been most consistently related to measures of expressive hostility (Miller et al., 1996). Although the PH demonstrates good evidence of reliability, evidence for construct validity is sparse (Smith, 1992). Other structured interviews have been developed to assess hostility, however the interviews are time consuming to administer and it is difficult to train interviewers to make reliable and valid judgments (Barefoot, 1992). As a result, self-report measures of hostility are more commonly used.

The Buss-Durkee Hostility inventory (BDHI; Buss & Durkee, 1957) is a self-report measure that consists of seven subscales, including Assault, Indirect Hostility, Irritability, Negativity, Resentment, Suspicion, and Verbal Hostility. Factor analysis of the BDHI yields two factors, representing the experiential and the expressive aspects of hostility. Although it possesses good psychometric properties, the BDHI is lengthy to administer and has been used less frequently in CHD research (Miller et al., 1996; Smith, 1994).

The most commonly used measure in the assessment of hostility is the Cook-Medley Hostility (Ho) Scale (Cook & Medley, 1954), originally derived from questions on the Minnesota Multiphasic Personality Inventory (MMPI). The original 50-item measure was determined by identifying items that discriminated between teachers that scored high and low on the Minnesota Teacher Attitude Inventory, a measure of teacher-student rapport. The Ho scale was further refined through review of the items by five clinical psychologists for appropriate inclusion in the assessment of hostility (Cook & Medley, 1954).

Evidence for the reliability of the original Ho scale is strong, with Cook and Medley (1954) reporting an internal consistency of .86 in the initial validation study of the scale. The

scale assesses what appears to be a highly reliable construct, demonstrating a test-retest

reliability of .84 over a four year period and .74 across a ten year period (Barefoot, Larsen, von

der Lieth & Schroll, 1995; Shekelle et al., 1983). Evidence of convergent validity has been

demonstrated through high correlations with other measures of hostility and anger, and

discriminant validity has been demonstrated through low correlations with measures of

depression and anxiety (Smith & Frohm, 1985). It has been suggested that the Ho scale measures

a specific type of hostility, labeled *cynical hostility,* as high scorers tend to be resentful,

suspicious, angry, and distrustful of others, but are unlikely to act out aggressively (Smith &

Frohm, 1985).

Given how the Ho scale was originally devised, it is not surprising that item content is

variable and the construct of hostility is not well-defined (Barefoot et al., 1995). After concerns

regarding the construct validity of the original Ho scale were raised (Smith & Frohm, 1985),

Barefoot and colleagues (1989) conducted a rational analysis of item content, identifying six

subsets of items within the scale: *Hostile Attributions, Cynicism, Hostile Affect, Aggressive*

Responding, Social Avoidance, and *Other.* Initial and subsequent studies found that three subsets

of items (*Cynicism, Hostile Affect, Aggressive Responding*) best represented the construct of

hostility, demonstrating good convergent and discriminant validity. It has been suggested that

these three subsets of items represent the construct of hostility better than the full scale

(Barefoot, Dodge, Peterson, Dahlstrom & Williams, 1989; Barefoot et al., 1991; Surwit et al.,

2002). This short version of the Ho scale has also demonstrated stronger relationships with

health outcome variables than the longer version (Barefoot et al., 1989; Helmers et al., 1993,

Surwit et al., 2002).

<u>Hostility and Coronary Heart Disease</u>

The association between hostility and health outcomes has been repeatedly demonstrated in the literature (Smith & Ruiz, 2002; Surwit, 2002). Hostility has been identified as a risk factor for CHD as well as a predictor of myocardial infarction, CAD, peripheral artery disease, and all-cause mortality (Barefoot, Dahlstrom & Williams, 1983; Deary, Fowkes, Donnan & Housley, 1994; Miller et al., 1996; Shekelle, Gale, Ostfeld & Paul, 1983; Smith & Ruiz, 2002; Williams et al., 1980). Several cross sectional studies have provided evidence for the relationship between hostility and heart disease. Two of the earliest cross sectional studies identified an independent association between hostility, as measured by the Cook Medley Hostility (Ho) Scale, and coronary atherosclerosis in patients undergoing coronary angiography (Blumenthal, Williams, Kong, Schanberg & Thompson, 1978; Williams et al., 1980). Subsequent cross-sectional research found hostility to be associated with peripheral artery disease, angina, and coronary artery disease, although there have been negative findings as well (Dembroski, MacDougall, Williams, Haney & Blumenthal, 1985; Friedman & Booth-Kewley, 1987; Joesoef, Wetterhall, DeStefano, Stroup & Fronek, 1989; Koskenvuo et al., 1988; Smith, 1992).

In addition to cross sectional research, several large-scale prospective studies have identified hostility, as measured through structured interview, as a risk factor for CHD. In reanalyses of the Western Collaborative Group Study, Matthews and colleagues (1977) and Hecker and colleagues (1988) found that interview-rated hostility discriminated between CHD patients and healthy controls. Behavioral ratings of hostility also predicted CHD in a reanalysis of the Multiple Risk Factor Intervention Trial (Dembroski, MacDougall, Costa & Grandits, 1989).

Studies prospectively examining hostility with the Ho scale have found hostility to be predictive of increased risk for myocardial infarction, CHD death, and all-cause mortality (Smith, 1992). The Western Electric Study, a large-scale study involving 1,877 men, found Ho scores to be associated with increased risk of myocardial infarction and CHD death over a 10-year follow-up, and with CHD death, cancer death, and all-cause mortality at 20-year follow-up (Shekelle et al., 1983). Barefoot and colleagues (1983) also found a relationship between high Ho scores and coronary heart disease in a sample of medical students (N=255) at 30-year follow-up. In this study, high Ho scorers in the 1950s had a higher incidence of CHD in 1980, as well as increased mortality from all causes. At least three studies have failed to replicate these findings, although one study utilizing a sample of students who completed the MMPI in the context of a medical school application has been criticized on the grounds that subjects were likely presenting themselves in a favorable light, thus minimizing scores on the Ho scale (Smith, 1992).

Despite some inconsistent findings, the majority of studies indicate that hostile people are at increased risk for CHD (Smith & Ruiz, 2002). Although most studies concerning hostility have been conducted on white men, the limited data available suggest that higher levels of hostility are related to non-White race, male gender, and low socioeconomic status (SES; Finney, Stoney & Engebretson, 2002; Miller et al., 1996). Further, research has indicated that hostility may be more predictive of CHD in African Americans and that hostile African Americans produce greater cardiovascular reactivity to stress than their Caucasian counterparts (Finney et al., 2002). It has even been suggested that elevated levels of hostility may account for part of the differential risk for disease, particularly CHD, in African Americans and low SES populations (Finney et al., 2002; Miller et al., 1996; Surwit et al., 2002). Recent reviews of the literature

regarding hostility encourage further examination of the construct in relation to ethnicity, gender, and SES variables.

Mechanisms Linking Hostility and Health

While the exact mechanism through which hostility affects health remains undetermined, several models have been proposed. A select few of these proposed mechanisms have garnered limited empirical support and are commonly referred to in the hostility literature (Miller et al, 1996; Smith 1992, 1994; Smith & Gallo, 2003). These models hypothesized to account for the hostility-health relationship involve various aspects of health behaviors, physiological reactivity, and related psychosocial variables.

Health Behavior Model. Leiker and Hailey (1988) proposed the health behavior model as a possible pathway linking hostility to disease based on the finding that hostility is associated with poor health habits. They identified hostility as related to higher alcohol consumption, less physical activity, and less self-care activities (adequate sleep and dental hygiene). Additional research has found measures of hostility to be correlated with tobacco use, caffeine intake, greater body mass index, and greater caloric intake (Siegler, Peterson, Barefoot & Williams, 1992; Smith, 1992). Further, it has been suggested that oppositional persons are inherently less adherent to medical regimens and that cynicism decreases the likelihood that health warnings are heeded and recommendations for health behaviors are followed (Miller et al., 1996). Although it is possible that hostility exerts an indirect effect on CHD through unhealthy lifestyle, more recent investigations have controlled for health behavior risk factors and have continued to identify an independent effect of hostility on health outcomes, suggesting that the health behavior model does not completely account for the association between hostility and health (Miller et al., 1996; Smith & Ruiz, 2002).

Psychophysiological Reactivity Model. Williams, Barefoot, and Shekelle (1985) proposed that increased neuroendocrine and cardiovascular responses related to hostility may be the contributing factor for CHD. Hostile persons are more prone to episodes of anger and are likely to be vigilant about scanning their environments for impending mistreatment, producing heightened psychophysiological reactivity. Evidence has shown that hostile persons are more physically reactive during daily activities, in social situations in the laboratory, and when recalling anger-arousing events, demonstrating larger increases in heart rate, blood pressure, and stress-related hormones (Smith, 1992; Smith & Ruiz, 2002; Suarez, Kuhn, Schanberg, Williams & Zimmerman, 1998; Suarez & Williams, 1989). While there is evidence in the literature that hostile people are more physiologically reactive, this reactivity may be restricted to interpersonally stressful events (Miller et al., 1996). Thus, it is possible that the heightened physiological reactivity associated with hostility promotes the incidence of CHD through repeated cardiovascular overactivation (Smith & Gallo, 2003).

Psychosocial Vulnerability Model. This model suggests that hostility negatively impacts health status through its relationship with high levels of stress and low levels of social support (Smith, 1992; Smith & Christensen, 1992). Persons with an angry and resentful interpersonal style are likely to experience a more taxing interpersonal environment involving more stressful life events, including job-related, financial, and interpersonal stressors. They are also likely to experience social conflict and resulting decreased levels of social support (Miller et al., 1996; Smith 1992). Increased levels of stress and low levels of social support have been consistently linked to CHD, therefore hostility may exert its influence on health through creating a psychosocial profile that is at risk for disease (Smith, 1994).

Several studies have independently examined the relationships between hostility, stress, and social support. These studies have demonstrated that hostile people experience higher levels of stress, particularly interpersonal stress, including major life events, daily hassles, and job-related stress (Benotsch, Christensen & McKelvey, 1997; Hardy & Smith, 1988; Smith & Frohm, 1985; Smith, Pope, Sanders, Allred & O'Keefe, 1988). High hostile persons also report fewer social supports and tend to avoid seeking and accepting social support as compared to their low hostile counterparts (Benotsch et al., 1997; Gallo & Smith, 1999; Houston & Vavak, 1991; Smith & Frohm, 1985; Smith et al., 1988).

With the exception of one study, the research described above has been conducted exclusively on college undergraduates. Only two of these studies examined the relationships between hostility, stress, and social support with the inclusion of a health outcome variable. While these studies provide initial support for the model, further research is needed examining these constructs as they relate to health in various populations if psychosocial vulnerability is to be considered a potential mechanism linking hostility and health (Smith et al., 1988).

An extension of these models has been proposed that includes components of both psychosocial vulnerability and psychophysiological reactivity. Smith (1994) labeled this model the transactional model, and suggested that hostile attitudes create an environment of intrapersonal conflict and reduced social support. In addition, hostile individuals have increased reactivity to both everyday stressors and self-imposed stressors, thus increasing the frequency of physiological overreactivity, ultimately contributing to the progression of coronary heart disease (Smith, 1992, 1994; Miller et al., 1996). A complete test of the transactional model remains to be seen in the literature.

Linking Hostility to Health: A Psychosocial Vulnerability Hypothesis

The models linking hostility and health mentioned above are not mutually exclusive and may in fact be complementary. While a significant amount of research exists regarding other models of hostility, limited data is available for the psychosocial vulnerability model. Further, the evidence supporting the psychosocial vulnerability model has primarily been demonstrated in college undergraduates without the inclusion of health outcome variables. Demonstrating support for the notion that stress and social support mediate the relationship between hostility and health in a medical population utilizing a health outcome variable is the next logical step in testing the accuracy of this model.

<u>Stress</u>

Like hostility, the term stress has historically been poorly defined and at present is not a universally defined concept (Brantley & Thomason, 1995). In fact, it has been suggested that stress is too ambiguous to define (Engel, 1985). Despite these problems, a large amount of research regarding stress has accumulated over the past few decades (Kasl, 1996). In general, there exists three currently accepted ways to define stress: 1) as a stimulus, 2) as a response, or 3) as an interaction of environmental events and appraisal of the individual.

Defining stress as a stimulus originated with Walter Cannon (1939), who referred to stress as any emotionally laden event that prompted the "flight or fight" response. The stimulus approach to stress has been described as tangible and objective, and often involves the examination of stressful life events, including both major and minor life events or daily hassles (Brantley & Thomason, 1995). Response theories of stress focus on the fight or flight response described by Cannon (1939) and further delineated by Selye (1936, 1982). Selye labeled the general stress response the General Adaptation Syndrome (GAS), which consists of the initial alarm phase (equivalent to the fight or flight response), the resistance phase, which occurs following continued exposure to the stressor (involving hyperarousal of systems engaged during the alarm phase), and the exhaustion phase, which occurs if the organism is unsuccessful in coping with the stressor and its resources are depleted. The exhaustion phase can involve decreased resistance to infection, tissue damage, shock, and in extreme cases, death (Brantley & Ames, 2001).

A major criticism of stimulus and response theories of stress is that they do not take individual differences into account. Accordingly, Lazarus extended theories of stress to include

aspects of the person-environment relationship, specifically cognitive appraisal and coping ability. Cognitive appraisal involves the individual's evaluation of the transaction between self and the environment, while coping ability determines if he or she can successfully manage the stressor (Lazarus & Folkman, 1984). Therefore, this approach includes stress as a stimulus and a response, while also examining the interplay between person and environment.

Measurement of Stress

Ambiguity regarding the definition of stress has translated into problems in the measurement of stress. Several mechanisms to measure stress have been utilized in the literature, and there is no current consensus as to the best approach. Traditionally, stress was measured through physiological reactions (heart rate, skin conductance) to laboratory-induced stressors (cold pressor tests, mental arithmetic). Catecholamine and corticosteroid levels assessed through blood and urinary assays are also frequently incorporated as indices of the biochemical events associated with stress (Brantley & Thomason, 1995). While both types of measurement continue to be utilized, laboratory-induced stressors are criticized for their lack of generalizability to naturally occurring stressors and biochemical measures used alone are often confounded by other events (i.e. caffeine intake, exercise; Baum, Grunberg, & Singer, 1982). In addition, equipment requirements and excessive cost often prohibit the use of these measures. The most generalizable and commonly used measures of stress are self-report measures.

The measurement of life events stress is one of the most consistent in the literature and has traditionally focused on major life events. Holmes pioneered this area of research with the construction of the Schedule of Recent Experiences (Hawkins, Davis & Holmes, 1957) followed by the Social Readjustment Rating Scale (SRRS; Holmes & Rahe, 1967). The SRRS utilizes weighted life change units (LCU) to measure the amount of readjustment associated with the

stressful life event. Although the SRRS is highly predictive of psychiatric and physical illnesses, concerns have been raised regarding the psychometric properties and the length of time between occurrence of the life event and administration of LCU measures (Horowitz, Schaefer, Hiroto, Wilner, and Levin, 1977). To address some of these concerns, the Life Experiences Survey was created, using subjective (as opposed to weighted) ratings of life change as they relate to major life events (Sarason, Johnson, and Siegel, 1978).

More recently, researchers have begun to focus on minor life events, due to their relationship with health outcomes and to the frequency with which they occur in comparison to major events (Kasl, 1996). Kanner and colleagues (1981) were the first to construct a measure specific to minor life events with the Hassles Scale. Other minor stress measures followed, but were fraught with criticisms concerning frequency of administration and confounding stress with symptoms of psychopathology (Zautra, Guarnaccia, Reich, & Dohrenwend, 1988). In an attempt to resolve these criticisms, Brantley, Waggoner, Jones, and Rappaport (1987) published the Daily Stress Inventory (DSI), which measures the frequency and impact of daily minor stressors. The DSI possesses good psychometric properties and has been validated against other self-report measures and biochemical indices of stress (Brantley, Dietz, McKnight, Jones, & Tulley, 1988).

The Weekly Stress Inventory (WSI; Brantley, Jones, Boudreaux, & Catz, 1997) was developed to assess the frequency and impact of minor stress over longer intervals. The WSI is an 87-item instrument designed to assess the frequency and impact of minor stressors that have been experienced during the past week. Items for the WSI were developed from eight broad domains, including Work/School, Marital/Family, and Social (Brantley et al., 1997), indicating that this measure assesses several interpersonal aspects of minor stress. The WSI possesses good

psychometric properties, good concurrent validity with the DSI, and good test-retest reliability over a 6-month period (Scarinci, Ames, & Brantley, 1999).

Hostility and Stress

Studies examining the relationship between hostility and stress have focused on major life events, minor stressors, and job-related stress. This research has demonstrated that people identified as hostile by the Ho scale have more severe and frequent minor stressors and more negative major life events than low Ho scorers, with no differences in positive life events (Benotsch et al., 1997; Hardy & Smith, 1988; Smith & Frohm, 1985; Smith et al., 1988). It has also been demonstrated that cynically hostile individuals report lower levels of job satisfaction and higher levels of job-related stress, particularly related to the interpersonal aspects of their job (Smith et al., 1988). The majority of this research has been conducted on college undergraduates and has not included related health outcome measures.

Two studies have examined the relationship between hostility and stress, along with a health outcome variable. In a prospective study of Mexican Americans, Miller and colleagues (1995) demonstrated that irritability (as measured by the BDHI) predicted the occurrence of stressful events, especially interpersonal events (i.e. divorce, separation, ending a serious relationship) at eleven-year follow-up. Irritability also predicted self-reported infectious disease and psychosomatic symptoms (Miller, Markides, Chiriboga & Ray, 1995), but the combined relationship of hostility and stress was not examined in relation to self-reported health status. Benotsch and colleagues (1997) demonstrated that hostility was independently related to greater levels of daily interpersonal stress and higher systolic blood pressure (SBP). However, when they examined the relationship of hostility and blood pressure with minor stress considered as a covariate, the association between hostility and SBP was no longer significant. These results

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provided limited initial support for the hypothesis that stress mediates the relationship between hostility and health.

It has been suggested that hostility is most significantly related to stressful events that are of an interpersonal nature (Miller et al., 1996). For example, hostile people report more social and family conflict, and less cohesion and expressiveness within their families (Gallo & Smith, 1999; Smith et al., 1988). They also endorse higher levels of marital conflict and decreased marital satisfaction, particularly in men (Miller et al., 1995; Smith et al., 1988). In fact, the presence of a hostile husband has been identified as predictive of decreases in both husbands' and wives' reports of marital quality over time (Newton & Kiecolt-Glaser, 1995). Further evidence that hostility is related to interpersonal stress suggests that in both high and low-conflict situations, hostile people have a more disparaging view of others and are more cynical and unfriendly (Hardy & Smith, 1988).

Stress and Coronary Heart Disease

The idea that stress contributes to heart disease is centuries old. In 1892 Sir William Osler suggested that CHD results from "the high pressure at which men live and the habit of working the machine to its maximum capacity" (Smith & Gallo, 2003). A variety of physiological stress responses contribute to the initiation and progression of CAD and the precipitation of acute coronary events (Krantz & McCeney, 2002). Stress may promote CAD through transient increases in blood pressure and heart rate, high levels of catecholamines, and lipid deposition, which promote injury to the coronary artery endothelium. Stress may also elicit ischemia by causing increased oxygen demand through increased heart rate and contractile force, or by decreasing oxygen supply through vasoconstriction (Smith & Ruiz, 2002).

Several types of studies suggest that stress promotes CAD and increases risk for CHD. Animal studies have clearly indicated that chronic stress contributes to CAD (Smith & Ruiz, 2002). Both ambulatory and laboratory studies have demonstrated that stress elicits ischemia in patients diagnosed with CHD, and that this effect is even more pronounced in hostile CHD patients (Rozanski et al., 1988). Epidemiological studies suggest that mental stress precipitates myocardial infarction as well as ischemia in susceptible patients (Krantz & McCeney, 2002). Prospective studies have demonstrated that stressful work environments, especially those with high work demands and low decision latitude, are associated with high blood pressure and increased risk of CHD (Krantz & McCeney, 2002). In a review of the literature regarding psychosocial influences on CHD, Smith and Gallo (2003) conclude that there is substantial evidence to support that stress contributes to heart disease.

Stressful life events in particular have been associated with cardiovascular dysfunction and disease. Negative life changes have been associated with transient increases in blood pressure either directly (Theorell & Emlund, 1993) or indirectly through negative health behaviors (increased alcohol intake, poor diet; Lindquist, Beilin & Knuiman, 1997). Epidemiologic studies have demonstrated that major life events, such as the death of a spouse or natural disasters are related to increased rates of heart attacks and sudden cardiac deaths (Krantz & McCeney, 2002). Because major life events like these tend to occur infrequently, increasing attention has turned towards minor stress. Mounting evidence has indicated that minor stressors are more important than major life events in predicting physical illness (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Lazarus & Folkman, 1984). Specifically, minor stress has been associated with risk factors for CHD (Twisk, Snel, Kemper & van Mechelen, 1999) and the severity of heart palpitations (Barsky, Ahern, Bailey, & Delamater, 1996).

Social Support

The concept of social support can be traced back to the clinical observations of Cobb, a physician, and Cassel, an epidemiologist, who noted that people who were socially connected typically had a better prognosis with regard to illness. They originally defined social support as consisting of a sense of belonging to a group (Antonucci & Johnson, 1994). Since then, the complex, multidimensional nature of social support has prompted the use of several definitions in the literature, with most definitions complementing rather than contradicting each other (Bruhn, 1996). Social support has been conceptualized in a variety of ways, often described in dynamic, structural, or functional terms. House (1981) identified four main categories of social support, including emotional support (empathy, caring), appraisal support (affirmation, social comparison), informational support (advice, suggestion), and instrumental support (money, time, assistance). Social support is most commonly described as the "provision of positive psychological, emotional, and material resources to a person through interpersonal relationships" (Quick, Nelson, Matuzek, Whittington & Quick, 1996, pp.269).

Measurement of Social Support

There are a variety of ways to measure social support, with no consistently agreed upon method (Heitzmann & Kaplan, 1988; Quick et al., 1996). Early measurements of social support, conducted through epidemiological research, primarily focused on objective assessments of the structural aspects of social ties, such as marital status, frequency of interactions with family and friends, network size, or number of years network members were known. This quantitative approach failed to take into consideration the quality of support relationships, an aspect of social support that has been subsequently and consistently found to be more important in relation to health variables (Antonucci & Johnson, 1994; Bruhn, 1996; Heitzmann & Kaplan, 1988).

Heitzmann and Kaplan (1988) conducted a thorough review of measures available for assessing social support and identified 23 separate instruments for this purpose. They concluded from this review that although several methods to assess social support are available, many of these measures possess poor psychometric properties. Few measures included in this review met their criteria of reliability coefficients greater than .8 and documentation of validity. Among these few was the Interpersonal Support Evaluation List (ISEL; Cohen, Mermelstein, Kamarck & Hoberman, 1985), a measure of satisfaction with received support that possesses good psychometric characteristics and has undergone extensive validation. The ISEL measures four different types of support, including perceived availability of support, belonging support (affiliation with a social network), self-esteem support (favorable social comparisons), and tangible support (material aid). In addition, the ISEL was constructed to assess the aspects of social support thought to buffer stressful events and has been utilized in research examining psychosocial risk factors for CHD (Benotsch et al., 1997; Gallo & Smith, 1999; Heitzmann & Kaplan, 1988).

Hostility and Social Support

Several authors have demonstrated that hostile individuals experience decreased levels of various types of social support. Evidence supporting a relationship between hostility and social support has demonstrated that high Ho scorers report fewer social supports and less satisfaction with support. These studies further suggest that the relationship between hostility and *satisfaction* with social support is stronger than that with number of supports (Benotsch et al., 1997; Hardy & Smith, 1985; Smith & Frohm, 1985; Smith et al., 1988). Gallo and Smith (1999) identified a group of cynically hostile persons with coexisting low levels of social support. This "hostile-isolated" group endorsed less comfort depending on others. Hostile people, especially

hostile men, also tend to avoid seeking or accepting social support from others (Houston & Vavak, 1991).

Social Support and Coronary Heart Disease

There is remarkable consistency in the literature that social isolation is a risk factor for morbidity and mortality (House, Landis & Umberson, 1988). Social relationships predict morbidity and mortality for men and women (even after adjusting for biomedical risk factors) and are predictive of all types of cardiovascular mortality, as well as all-cause mortality (Bruhn, 1996; Cohen, Kaplan & Manuck, 1994; Orth-Gomer, 1994). Several prospective studies have identified that persons with low levels of perceived social support are at increased risk for CHD and among persons with CHD, those that are socially isolated have more coronary events (Cohen, et al., 1994; Smith & Ruiz, 2002). In addition, animal studies have demonstrated that social isolation promotes CAD (Smith & Ruiz, 2002)

The manner in which social support influences CHD is most likely complex and remains unclear, although psychophysiological and/or behavioral mechanisms have been proposed. Several studies have suggested that the presence of a supportive person can reduce cardiovascular reactivity. In the laboratory, the presence of a friend, mental activation of supportive network ties, and the support of a confederate attenuate heart rate and blood pressure reactivity in response to stressors (Bruhn, 1996; Christenfield et al., 1997; Smith, Ruiz, & Uchino, 2001). These studies support the notion that social support reduces the risk of heart disease by buffering the deleterious effects of stress on the cardiovascular system (Quick et al., 1996). Social support may also be related to heart disease through behavioral mechanisms, such that an individual is influenced negatively by his or her social network to engage in smoking, alcohol use, or poor diet (Antonucci & Johnson, 1994). Alternatively, social isolation has been

associated with higher levels of CHD risk factors, such as smoking (Smith & Gallo, 2003),

suggesting that a *lack* of social ties can also promote unhealthy behaviors.

SUMMARY AND STUDY RATIONALE

Heart disease is the number one cause of death for men and women in America today (AHA, 2003). Known risk factors for CHD, such as tobacco use, obesity, and hypertension, are unable to predict a majority of new CHD cases (Schneiderman et al., 1989). This suggests the possible influence of additional risk factors, including personality or other behavioral factors. The identification of psychosocial risk factors for CHD has important clinical implications with regard to prevention and management of the disease. Although previous research has demonstrated that hostility is a risk factor for CHD, how hostility affects health remains unknown. A psychosocial vulnerability model has been proposed as the link between hostility and health (Smith, 1992, 1994). This model suggests that hostile people experience higher levels of stress and lower levels of social support due to their cynical and mistrusting nature. Increased stress and decreased social support have been linked to CHD, therefore it is possible that these variables mediate the relationship between hostility and CHD. While several studies have demonstrated independent relationships between hostility, stress, and social support, few have examined the psychosocial vulnerability model in its entirety. Further, a majority of this research has been conducted on healthy samples, namely college undergraduates, without linking these variables to health outcomes. Empirical examination of this model in a sample of patients at high-risk for CHD is greatly needed to further the literature regarding the underlying mechanisms of the hostility-CHD relationship (Smith et al., 1988).

It should be noted that a majority of the hostility research has been conducted on middle class, Caucasian men (Miller et al., 1996; Smith & Ruiz, 2002). There is some evidence to suggest that males and persons of non-White ethnicity and low SES exhibit higher levels of hostility (Finney et al., 2002; Miller et al., 1996), however there remains a paucity of research on

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African Americans, low-income individuals, and women in this area. This represents a significant oversight, given that these individuals are at high risk for mortality related to heart disease. Further research is needed examining the relationship between these demographic variables and hostility as they relate to CHD and health in general.

The specific aim of this study was to examine the psychosocial vulnerability model in a sample of hypertension patients, approximately half of whom were diagnosed with heart disease. Hypertensive patients were chosen because they are at high risk for CHD, yet hostility, stress, and social support have not been consistently related to sustained essential hypertension. To demonstrate support for the model, levels of hostility, stress, and social support should differ between hypertensive patients with CHD and those without CHD. Further, if hostility is no longer a significant predictor of CHD status after stress and social support are considered, this result would lend support to the notion that stress and social support mediate the relationship between hostility and CHD. In addition, a small group of healthy participants was obtained in order to examine the psychosocial vulnerability model in groups less restricted in range for health status (CHD versus healthy groups). To date, no studies have examined this model in a medical population with a health outcome variable. Therefore, this study was the first to examine the ability of the psychosocial vulnerability model to discriminate between patients with and without CHD. The current study also furthers the hostility literature by examining this model in a sample of low-income African American men and women.

Study Variables

        Predictor Variables
                Hostility (Ho)
                Minor Stress (WSI)
                Social Support (ISEL)
        Criterion Variable
                Coronary Heart Disease status

Control Variables
    Diabetic status
    BMI
    Tobacco Use

Research Questions and Hypotheses

Preliminary Research Questions

Question #1. Is hostility related to health behaviors (BMI, tobacco use) or diabetic status in this sample?

Hypotheses: Based on previous research regarding hostility and health behaviors, it was expected that BMI would be positively correlated with hostility, and that current smokers would endorse greater levels of hostility than never and former smokers. Regarding diabetic status, a limited number of studies have identified hostility as related to measures of insulin resistance in healthy samples. Extrapolating from this small area of research, it was hypothesized that diabetics would endorse higher levels of hostility than nondiabetics.

Question #2. What is the direction and strength of the relationship between hostility, minor stress, and social support in this sample?

Hypotheses: Based on previous research, it was expected that hostility would be positively, but moderately, correlated with minor stress. It was also expected that hostility would be moderately negatively correlated with social support. Based on previous research suggesting a buffering relationship between social support and stress, it was anticipated that minor stress would be negatively correlated with social support.

Primary Research Questions

Question #3. Is hostility alone a significant predictor of CHD status in low-income African American participants?

Hypothesis: Based on the extensive amount of research linking hostility to heart disease in Caucasians, it was anticipated that hostility would be a significant predictor of CHD status in the current sample.

Question #4. Does the inclusion of minor stress and social support add significantly to the prediction of CHD status?

Hypothesis: Based on the large amount of research linking stress and social support to heart disease, it was expected that these variables would also be significant predictors of CHD status.

Question #5. Does hostility remain a significant predictor of CHD status once minor stress and social support are considered?

Hypothesis: Based on the limited amount of research supporting the psychosocial vulnerability model of hostility in college undergraduates, it was expected that hostility would no longer be a significant predictor of CHD group membership after the inclusion of minor stress and social support to the model.

METHODS

<u>Participants</u>

Participants for the current study were recruited from primary care and specialty clinics at Earl K. Long Medical Center. Of the 219 participants recruited, 95 had a physician confirmed diagnosis of coronary heart disease (CHD), 94 were diagnosed with hypertension, and 30 were considered healthy. Inclusion criteria for the CHD patients consisted of physician diagnosed CHD defined as diagnosed coronary heart disease (CAD), history of myocardial infarction, or history of any angioplastic or coronary bypass procedure. Hypertension patients were included if they had physician diagnosed high blood pressure, but were excluded if they had a current CHD diagnosis or were simultaneously diagnosed with hypertension, diabetes, and hyperlipidemia to facilitate further separation between these patients and the CHD group. Hypertension patients were stratified on age (within five years) and gender to match the CHD patients. Healthy participants were recruited from the Internal Medicine and Woman's clinics as patients seeking preventative healthcare without any chronic medical diagnoses. Participants for all groups were excluded if they were not African American, were less than 18 years of age, or could not orally comprehend material at a 5th grade level as indicated by the Woodcock Johnson Oral Comprehension subtest. They were also excluded if they carried a current diagnosis of major mental illness (schizophrenia, bipolar disorder) or mental retardation as identified by chart review.

<u>Measures</u>

<u>Demographic Questionnaire</u>

A demographic questionnaire was administered to obtain the following information: hospital number, date of birth, marital status, highest level of education completed, employment

status, monthly household income, number of months since hypertension diagnosis, hypertensive medication status, and tobacco use, including the Fagerstrom Test for Nicotine Dependence (Heatherton, Kozlowski, Frecker & Fagerstrom, 1991) for current smokers.

Woodcock-Johnson III Oral Comprehension

The Oral Comprehension section of the Woodcock-Johnson III –Test of Achievement (Woodcock, McGrew, & Mather, 2001) was used to determine if participants had the ability to comprehend study questionnaires. Oral comprehension is measured by the ability to comprehend a short passage and subsequently supply the missing word using syntactic and semantic cues. The test begins with simple analogies and associations and progresses to more complex passages. Oral Comprehension has a median reliability of .89 in adults. For the purposes of the present study, participants had to demonstrate at least a 5th grade oral comprehension level by answering items 7-13 correctly on the comprehension test. This cut-off was determined because the scales used in the present study have a 5th grade reading level. Participants who did not pass the comprehension test were not included in the study.

Cook-Medley Hostility Scale

A brief version of the original Cook-Medley Hostility Scale (Ho; Cook & Medley, 1954) identified by Barefoot and colleagues (1989) was administered to the participants. This scale consists of 27 true/false items and assesses specific aspects of hostility, including cynicism, hostile affect, and aggressive responding. The original Ho scale has demonstrated good psychometric properties, with test-retest reliability of .84 over a four year period and .74 across a ten year period (Barefoot et al., 1995; Shekelle et al., 1983). The brief version of the Ho scale has demonstrated better construct validity and stronger relationships to health outcome variables than the original scale (Barefoot et al., 1989; Helmers et al., 1993, Surwit et al., 2002). The brief

Ho scale has also demonstrated good convergent and discriminant validity (Barefoot et al., 1989, 1991; Surwit et al., 2002).

Weekly Stress Inventory

The Weekly Stress Inventory (WSI; Brantley et al., 1997), an 87-item inventory of daily minor stressors, was administered to the participants. Subjects indicated if each item occurred during the past week, and if so, they rated the severity of each event on a scale ranging from 1 (event happened but was not stressful) to 7 (extremely stressful). The WSI yields an event score (number of minor stressful events) and an impact score (total perceived stressfulness of the endorsed items) of minor stressors during the past week. The WSI has been shown to have high internal consistency, with coefficients ranging from .92 to .96, high test-retest reliability during the same week (r=.83), and retest reliability of .76 for different weeks. It has also demonstrated acceptable concurrent validity with the Hassles Scale and has been validated with medical patients from Earl K. Long Medical Center (Brantley et al., 1997) and heart disease patients (Mosley et al., 1996). The WSI contains a significant number of items assessing interpersonal stressors, which are pertinent to the present study given that previous research has suggested hostility may be more specifically related to interpersonal stress.

Interpersonal Support Evaluation List

The Interpersonal Support Evaluation List (ISEL; Cohen et al., 1985) was administered to the patients as a measure of perceived availability of social support. The ISEL consists of 40 Likert-scale items that contain four 10-item scales measuring different types of social support: appraisal support (perceived availability of support), belonging support (affiliation with a social network), self-esteem support (favorable social comparisons), and tangible support (material aid). The scales are moderately correlated, with intercorrelations ranging from r=.19 to r = .56

(Cohen et al., 1985). This four-factor structure has been replicated in several studies and there is good evidence for the construct validity of the scale (Heitzmann & Kaplan, 1988). Several studies have demonstrated good reliability for the ISEL, with internal consistencies ranging from .88 to .90 and test-retest reliabilities ranging from .63 to .70. The ISEL has also demonstrated good construct and discriminant validity (Heitzmann & Kaplan, 1988).

Procedure

The primary investigator and two research assistants (also clinical psychology graduate students) collected data from the internal medicine, family practice, and women's clinics at Earl K. Long Medical Center. CHD patients were recruited from cardiology clinics, which took place on Tuesday mornings at the internal medicine clinic. Hypertensive patients without CHD were recruited from the general internal medicine clinics and the general family practice clinics that occurred throughout the week. Healthy participants were recruited from the general internal medicine clinics and the women's preventative care clinics on Tuesdays and Thursdays. The primary investigator identified potential participants through medical chart review the day prior to participants' clinic appointments. Patients meeting study inclusion criteria were approached in the waiting rooms of the clinics prior to their appointments, and were informed of the nature of the study, the time commitment, and the monetary compensation for study completion. Interested patients were escorted to an exam room or more confidential area within the clinic. Each participant was instructed that the study was examining the relationship between hostility, stress, and social support and their connection to heart disease. Inclusion criteria for the study were explained to participants and they were informed that if they failed to meet the inclusion criteria (i.e. oral comprehension requirement), their participation would be terminated. Study personnel also explained the limits of confidentiality to participants and they were notified that their

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medical chart would be reviewed for height, weight, and diabetic status if they agreed to participate. Finally, patients were informed that they had the right to withdraw from the study at any time without penalty or adverse consequences to their medical care. Informed consent was then obtained and a copy of the informed consent form that included the researchers' contact information was provided to each participant.

Following informed consent, patients were given a brief measure of oral comprehension to ensure that they were able to comprehend material at a 5th grade level. Patients unable to pass the oral comprehension test at this level were excluded from the study (n = 4). Following the oral comprehension test, study personnel completed the demographic questionnaire, and measures of hostility, minor stress, and social support with eligible participants. Due to the low literacy rate at Earl K. Long Medical Center, measures were read to the patients. Those patients who endorsed high levels of hostility and/or stress were offered the option of receiving psychological services through Earl K. Long Adult Psychology or a similar local agency. Patients were given ample time for questions regarding hostility, stress, social support, and the relationship of these variables to heart disease. Patients were then paid five dollars for participation in the study and escorted back to the clinic waiting room. Finally, study personnel conducted a brief medical chart review to obtain diabetic status and body mass index (BMI), calculated as weight in kilograms over height in meters squared.

RESULTS

Demographic Characteristics

Two hundred thirty-nine patients were approached to participate in the present study. Of these patients 18 (8%) refused to participate and four (2%) did not pass the oral comprehension test at a 5th grade level, leaving a total of 219 participants. Of these participants, 95 were diagnosed with CHD, 94 were diagnosed with hypertension (no CHD), and 30 were considered healthy. Demographic characteristics for all three groups are summarized in Tables 1 and 2.

Table 1

Demographic Information (Percentages)

Variable	CHD (n=95) %	Hypertension (n=94) %	Healthy (n=30) %
Gender			
Male	40.0	40.4	13.3
Female	60.0	59.6	86.7*
Marital Status			
Single	28.4	33.0	33.3
Married	30.5	26.6	26.7
Separated/Divorced	30.6	26.6	33.3
Widowed	10.5	13.8	3.3
Employment status			
Employed (full or part-time)	14.8	30.8	73.4
Unemployed, retired, or disabled	85.3	69.2	26.7
Smoking Status			
Current	33.7	23.4	30.0
Former	43.2	39.4	0
Never	23.2	37.2	66.7

* $p < 0.05$

Hypertension patients were successfully matched on age and gender to CHD patients. The healthy patients tended to be female, younger, better educated, and had a higher monthly income.

Table 2

Demographic Information (Means)

Variable	CHD (n=95) Mean (SD)	Hypertension (n=94) Mean (SD)	Healthy (n=30) Mean (SD)
Age	54.97 (7.72)	54.19 (8.37)	47.00 (4.59)***
Education Level	10.99 (2.56)	11.07 (2.21)	13.29 (2.48)***
Monthly Income	$772.18 ($577.93)	$830.89 (522.92)	$1694.04 (1350.84)***

*** $p < 0.001$

For the entire sample of 219 participants, 64% were female, 31% were married, 30% were employed, and 29% were current smokers. The average age was 54 years old ($SD = 8.09$) and the average years of formal education was 11.32 ($SD = 2.51$). The average household income for the entire sample was $909 ($SD = 750.59) per month.

Study Variables

Composite scores for each predictor variable (hostility, stress, and social support) were computed. The measure of minor stress (WSI) yielded a score for total number of stressful events (Event) over the past week and a score reflecting the subjective impact of those stressful events (Impact). Descriptive characteristics of the predictor variables for each group are presented in Table 3. Group means were similar across variables with the exception of hostility, which was significantly lower in the healthy group as compared to the CHD and hypertension groups.

Distributions of predictor variables and skewness values were examined to detect violations of normality. Although hostility and social support scores were normally distributed, skewness values suggested that the minor stress event and impact scores deviated significantly from normal. Natural logarithm and square root transformations were performed for these two variables and skewness statistics were examined to identify the best data transformation

procedure. Square root transformations were established as the most appropriate (see Figures 1

through 4).

Table 3

Descriptive Characteristics of Predictor Variables

Predictor Variable	CHD (n = 95)		Hypertension (n = 94)		Healthy (n = 30)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Hostility	15.40 (4.73)	1 – 25	15.21 (4.36)	2 – 25	11.37* (4.36)	2 - 20
Minor Stress (Event)	20.60 (14.68)	0 – 76	19.52 (15.75)	0 – 87	26.43 (15.62)	4 – 75
Minor Stress (Impact)	86.65 (75.09)	0 – 343	77.61 (73.45)	0 – 456	75.43 (48.91)	4 - 227
Social Support	86.63 (17.78)	44 - 115	90.94 (18.05)	35 - 117	90.63 (16.74)	51 - 116

* $p < 0.05$
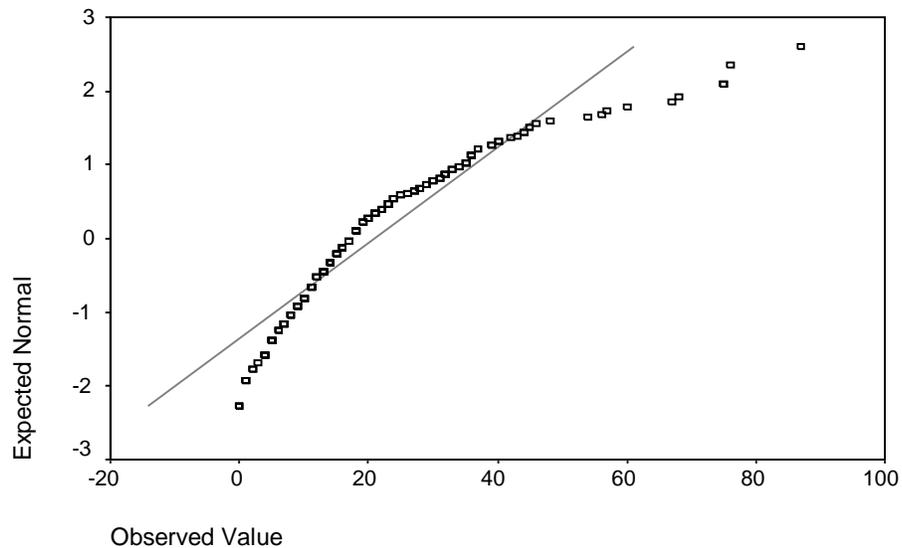
Figure 1: Normal Probability Plot of Raw Minor Stress Event Score – Skewed Distribution
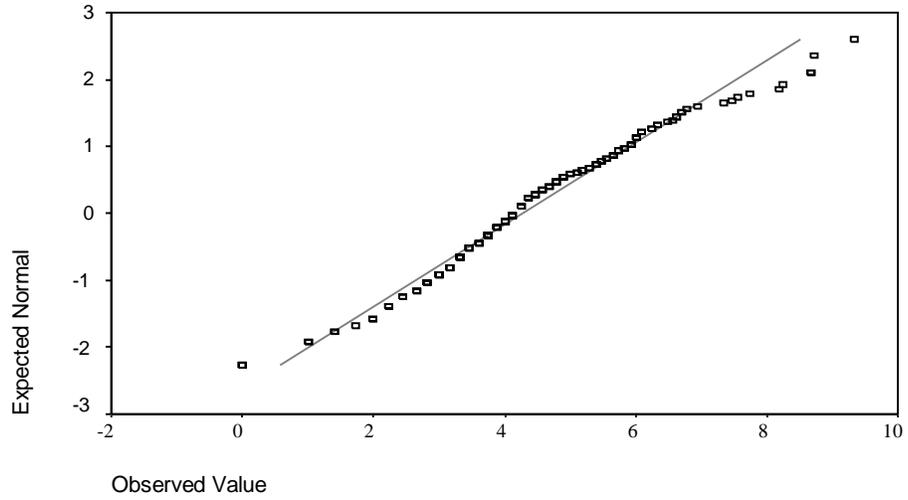
Figure 2: Normal Probability Plot of Transformed Minor Stress Event Score – Normal Distribution
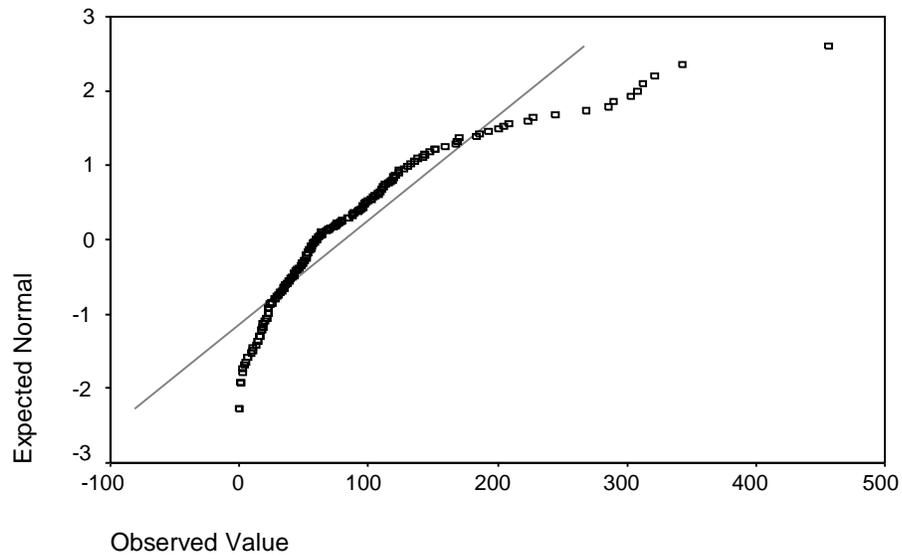
Figure 3: Normal Probability Plot of Raw Minor Stress Impact Score – Skewed Distribution
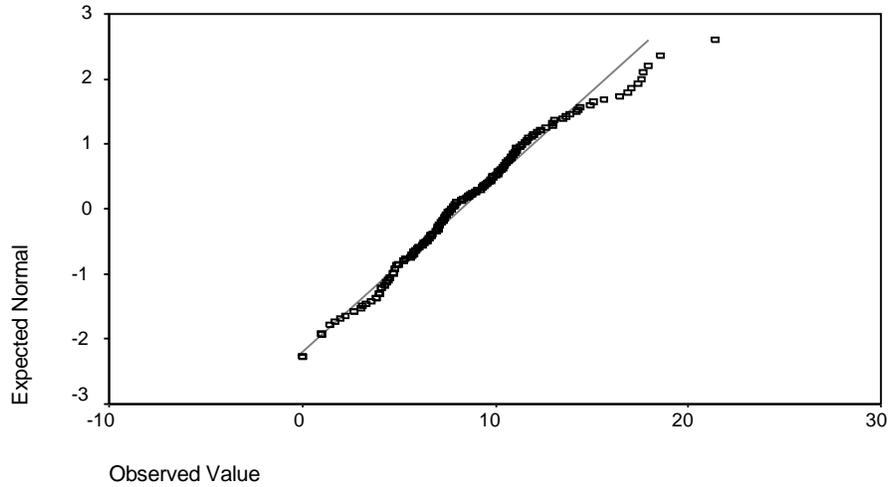
Figure 4: Normal Probability Plot of Transformed Minor Stress Impact Score – Normal Distribution

Relationship of Hostility to Demographic Characteristics

Demographic characteristics of the entire sample were examined for their relationship with hostility levels. Men in the present study endorsed higher levels of hostility than women, $t(217) = 3.345$, $p = .001$, and education was negatively correlated with hostility, $r = -.286$, $p <.001$ (see Figure 5).
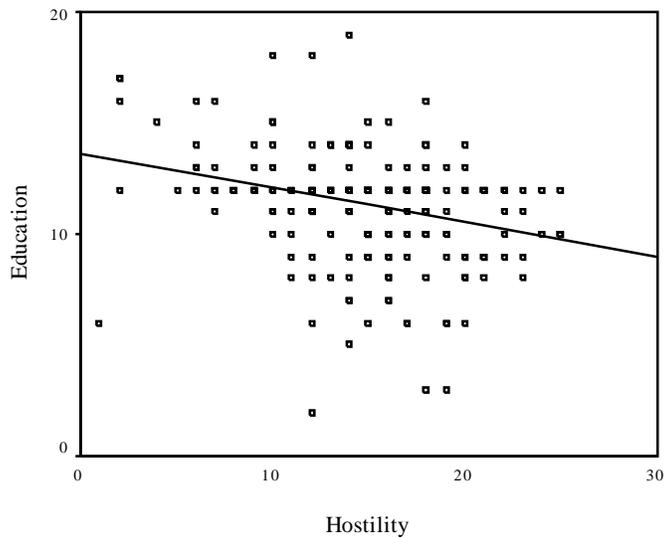
Figure 5: Correlation Between Hostility Scores and Years of Education

Pearson correlations revealed that age, r = .125, p = .066, and income, r = -.111, p = .110 were

not related to hostility in the current sample. A one-way analysis of variance (ANOVA)

indicated that hostility level was not related to marital status, F(4, 217) = .272, p = .896.

<u>Preliminary Analyses</u>

§   Question 1. Is hostility related to health behaviors (BMI, tobacco use) or diabetic status in

     this sample?

        A Pearson product moment correlation revealed that BMI was not significantly related to

hostility (r = -.017, p = .803). A one-way analysis of variance (ANOVA) was significant, F(2,

215) = 4.045, p = .019, indicating that hostility levels differed by smoking status (see Figure 6).

Tukey post-hoc comparisons demonstrated that never smokers (*M* = 13.58) had significantly

lower hostility scores than former smokers (*M* = 15.54; p = .024). Never smokers also reported

lower hostility levels than current smokers (*M* = 15.33; p = .068), but this difference only

approached significance. For the current smokers, level of nicotine dependence (as measured by

the Fagerstrom Test for Nicotine Dependence) was not related to overall hostility, r = .043,   p =

.741. Patients with diabetes (*M* = 16.05) were significantly more hostile than patients without

diabetes (*M* = 14.36), t(215) = -2.485, p = .014.

§   Question 2. What is the direction and strength of the relationship between hostility, minor

     stress, and social support in this sample?

            Pearson product moment correlations were conducted to determine how the

predictor variables related to each other in the entire sample. Hostility was not related to minor

stress event or impact, but was significantly, negatively correlated with social support. Social
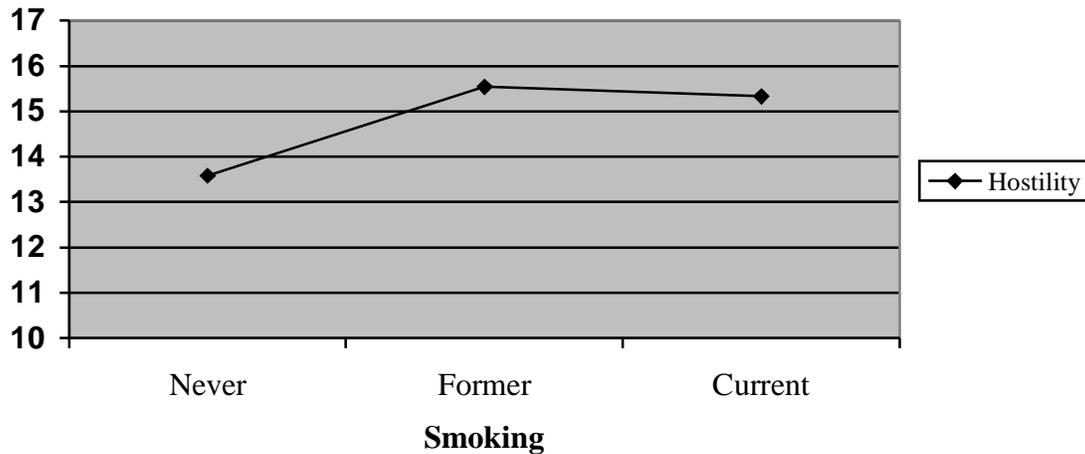
Figure 6: Hostility Levels by Smoking Status

support was significantly, negatively correlated with both minor stress event and impact. Minor stress scores (event and impact) were highly correlated with each other, as would be expected for scores describing the same stressful events for the past week. Correlations among all predictor variables for the entire sample are shown in Table 4.

Table 4

Correlations Between Predictor Variables for the Entire Sample

	Ho	MS-E	MS-I	SS
Hostility	------	-.038	.084	-.224**
Minor Stress – Event		------	.868**	-.133*
Minor Stress – Impact			------	-.261**
Social Support				------

** $p < 0.01$
* $p < 0.05$

Pearson product moment correlations were also conducted to examine the relationships among the predictor variables within each participant group. As demonstrated in Tables 5, 6, and 7, hostility was not related to either minor stress score in any of the groups. Hostility was significantly negatively correlated with social support among the CHD patients (see Figure 7), but not among the hypertension and healthy groups, suggesting that the significant relationship between these variables in the entire sample is primarily reflecting the relationship in the CHD group. Social support was consistently, negatively correlated with impact of minor stress in all

three groups, demonstrating a moderately strong correlation in the healthy group in particular.

Minor stress scores (event and impact) were also highly correlated with each other within each

group.

Table 5

Correlations Between Predictor Variables for the CHD Group

	Ho	MS - E	MS - I	SS
Hostility	------	.033	.101	-.313**
Minor Stress – Event		------	.894**	-.101
Minor Stress – Impact			------	-.244*
Social Support				------

** p < 0.01
* p < 0.05

Table 6

Correlations Between Predictor Variables for the Hypertension Group

	Ho	MS - E	MS - I	SS
Hostility	------	-.021	.016	-.158
Minor Stress – Event		------	.904**	-.152
Minor Stress – Impact			------	-.206*
Social Support				------

** p < 0.01
* p < 0.05

Table 7

Correlations Between Predictor Variables for the Healthy Group

	Ho	MS - E	MS - I	SS
Hostility	------	.019	.311	-.116
Minor stress – Event		------	.715**	-.231
Minor Stress – Impact			------	-.558**
Social Support				------

** p < 0.01
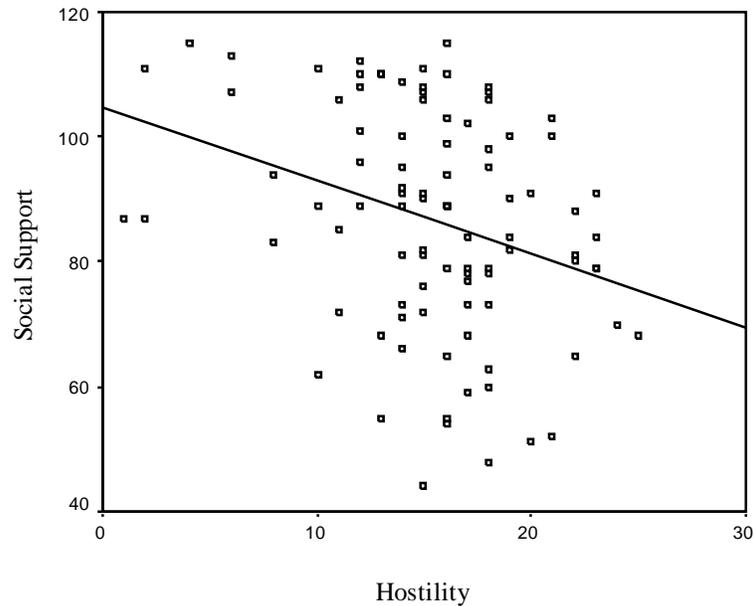
Figure 7: Correlation Between Hostility and Social Support for the CHD Group

Primary Analyses

Comparison of CHD and Hypertension Groups

Hypothesized covariates were examined for their relationship to the dichotomous criterion variable (CHD status) among the CHD and Hypertension groups. These covariates included sex, age, smoking status, BMI, and diabetic status. Pearson chi-square analyses indicated that sex ($\chi^2(1) = .004$, p = .535), smoking status (defined as current versus former/never smokers; $\chi^2(2) = 5.017$, p = .081), and diabetic status ($\chi^2(2) = 1.393$, p = .498) were not significantly related to CHD status in these groups. Although the mean age for each group was quite similar, a paired samples t-test demonstrated that age differed significantly between CHD (M = 55.02) and hypertension participants (M = 54.19), t(93) = 2.772, p = .007. BMI was not significantly related to CHD status, t(93) = .111, p = .912. Therefore age will be considered a covariate in the regression analysis comparing these groups.

§ Questions 3. Is hostility alone a significant predictor of CHD status in low-income African American medical patients?

§ Question 4. Does the inclusion of minor stress and social support add significantly to the prediction of CHD status?

§ Question 5. Does hostility remain a significant predictor of CHD status once minor stress and social support are considered?

In order to test research questions three through five, a sequential logistic regression was performed. For this analysis, CHD status, a dichotomous variable, was the criterion variable. The predictor variables were entered in a hierarchical fashion, based on previous research regarding these variables. Specifically, age was entered in the first step, given its relationship to the outcome variable in these groups and the desire to control for this variable as a covariate. The second step consisted of hostility alone in order to determine its independent ability to predict CHD status. The third step included both minor stress and social support to determine if these variables added significantly to the prediction of CHD status over that of hostility alone. The minor stress impact score was utilized in all regression analyses because of its relationship with social support and evidence that subjective ratings of stress may be more important than number of events experienced (Brantley & Thomason, 1995). None of the predictor variables correlated with each other higher than .4 in these groups (as demonstrated in Tables 5 and 6), indicating that multicolinearity was not an issue (Tabachnick & Fidell, 2001). Analysis was performed using SPSS logistic regression and an a priori acceptance p value <.05 was used for all analyses.

All participants had complete data, therefore 189 cases were available for this analysis. Overall goodness-of-fit analyses (Hosmer and Lemeshow test) test the null hypothesis that the model adequately fits the data. There was good model fit at Step 1 with age entered as a

covariate, χ^2(8, N = 189) = 1.730, p = .988. Good model fit continued in Step 2 with hostility

entered alone, χ^2(8, N = 189) = 9.165, p = .329, and in Step 3 with the addition of minor stress

(impact score) and social support, χ^2(8, N = 189) = 6.509, p = .590. However, comparison of

log-likelihood ratios between steps indicated that none of the variables improved model

prediction (see Table 8).

Table 8

Chi-Square Statistics for Change in Log-Likelihood Between Steps: CHD and Hypertension
Groups

	χ^2	df	Significance
Step 1	.444	1	.505
Step 2	.064	1	.801
Step 3	3.417	2	.181

Table 9 shows the regression coefficients, Wald statistics, odds ratios, and 95%

confidence intervals for odds ratios for the covariate (age) and each predictor variable. The Wald

statistic estimates the contribution of an individual predictor to the model by dividing the

coefficient by its standard error. A significant Wald statistic indicates that the predictor is

associated with the outcome (Tabachnick & Fidell, 2001). As indicated in Table 9, none of the

predictors were reliably associated with CHD status in this sample, with social support the only

variable with a p value <.11. Odds ratios estimated the change in odds of CHD status for a one-

unit increase in each predictor variable while controlling for the other predictors in the model.

An odds ratio is considered significant if the confidence interval surrounding the ratio does not

include one. As demonstrated in Table 8, none of the odds ratios were considered significant,

indicating that a one-unit change in any predictor variable did not alter the likelihood of being

diagnosed with CHD among these groups.

Table 9

Sequential Logistic Regression Analysis: CHD and Hypertension Groups

Step and Predictor Variable	*B*	S. E.	Wald	Sig	Odds Ratio	95% Confidence Interval	
						Lower	*Upper*
Step 1							
Age	.012	.018	.443	.506	1.012	.977	1.049
Step 2							
Hostility	.008	.032	.064	.801	1.008	.946	1.074
Step 3							
Hostility	-.007	.034	.046	.830	.993	.930	1.060
Minor Stress (Impact)	.022	.040	.285	.593	1.022	.944	1.106
Social Support	-.014	.009	2.644	.104	.986	.969	1.003

According to the results reported in Table 9, hostility was not a significant predictor of CHD status in this sample (research question 3). These results also indicated that minor stress and social support variables did not add significantly to the prediction of CHD status over hostility alone (research question 4). Further, there was no change in the ability of hostility level to predict CHD status (it remained non-significant) once these variables were included in the model (research question 5).

The logistic regression analysis also provided the percentage of cases correctly classified by the model (see Table 10). The overall percentage of cases correctly classified by the model

Table 10

Classification Table: CHD and Hypertension Groups

		Predicted		
Observed		CHD Status No	Yes	Percentage Correct
CHD Status	No	53	41	56.4
	Yes	46	49	51.6
Overall Percentage				54.0

was 54%, with 56% of CHD patients and 52% of hypertension patients correctly classified, indicating that the classification accuracy of the model was only slightly better than chance.

Comparison of CHD and Healthy Groups

To determine if nonsignificant results were obtained in comparing the CHD group to the hypertension group due to restricted range, the CHD group was compared with a small group of healthy participants. The healthy group was not matched by age and gender to the CHD group due to difficulty in recruiting these participants. Hypothesized covariates (sex, age, smoking status, and BMI) were examined for their relationship to the criterion variable (CHD status) for the CHD and healthy groups. Pearson chi-square analyses indicated that sex ($\chi^2(1) = 13.448$, $p < .001$) and smoking status (defined as current versus former/never smokers; $\chi^2(1) = 14.226$, $p < .001$) were significantly related to CHD status in these groups. An independent t-test demonstrated that age also differed significantly between CHD ($M = 54.97$) and healthy participants ($M = 47.00$), $t(83) = -6.907$, $p < .001$. BMI was not related to CHD status $t(115) = -1.413$, $p = .160$. Therefore sex, smoking status, and age will be considered covariates in the regression analysis comparing these groups.

§ Questions 3. Is hostility alone a significant predictor of CHD status in low-income African Americans?

§ Question 4. Does the inclusion of minor stress and social support add significantly to the prediction of CHD status?

§ Question 5. Does hostility remain a significant predictor of CHD status once minor stress and social support are considered?

A sequential logistic regression was again utilized to examine research questions 3-5 in comparing the CHD group to healthy participants. CHD status served as the dichotomous

criterion variable and predictor variables were entered in hierarchical fashion. Covariates (sex, smoking status, and age) were entered in the first step, hostility was included in the second step, and minor stress (impact) and social support were entered in the third step.

One hundred twenty-five cases were available for this analysis. Again there was good model fit indicated for all three steps: Step 1 χ^2(7, N = 125) = 5.611, p = .586; Step 2 χ^2(8, N = 125) = 4.272, p = .832; Step 3 χ^2(8, N = 125) = 5.981, p = .649. Comparison of log-likelihood ratios between steps indicated that only the variables entered in Steps 1 and 2 improved model prediction (see Table 11).

Table 11

Chi-Square Statistics for Change in Log-Likelihood Between Steps: CHD and Healthy Groups

	χ^2	df	Significance
Step 1	37.235	3	.000
Step 2	10.132	1	.001
Step 3	4.083	2	.130

Regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios are shown in Table 12. For the covariates, only sex and age were significant predictors of CHD status. Their associated odds ratios were also significant in the expected directions, such that being female and younger were associated with decreased likelihood of being diagnosed with CHD. For the predictor variables, examination of coefficients indicated that hostility was a significant predictor of CHD status in Step 2 (research question 3). Coefficient examination for Step 3 revealed that neither minor stress nor social support were significantly related to CHD status (research question 4). Hostility remained a significant predictor of CHD status after including minor stress and social support in the model (research

question 5). The associated significant odds ratio suggested that a one-unit increase in hostility was associated with a small increase in likelihood of having CHD.

The classification table for the CHD and healthy groups is presented in Table 13. The overall percentage of cases correctly classified was significantly improved over that for the CHD and hypertension group comparison. The overall percentage of cases correctly classified by the model was 83%, with 94% of CHD patients and 50% of healthy participants correctly classified. It is likely that these classification rates are inflated due to differences in group size.

Table 12

Sequential Logistic Regression Analysis: CHD and Healthy Groups

Step and Predictor Variable	*B*	S. E.	Wald	Sig	Odds Ratio	95% Confidence Interval	
						Lower	*Upper*
Step 1							
Sex	-1.608	.653	6.068	.014	.200	.056	.720
Age	.195	.044	19.134	.000	1.215	1.113	1.325
Smoking Status	.154	.277	.307	.579	1.166	.678	2.006
Step 2							
Hostility	.168	.056	8.878	.003	1.183	1.059	1.322
Step 3							
Hostility	.129	.058	4.910	.027	1.138	1.015	1.276
Minor Stress (Impact)	.091	.081	1.257	.262	1.095	.934	1.284
Social Support	-.024	.017	1.899	.168	.976	.944	1.010

Table 13

Classification Table: CHD and Healthy Groups

		Predicted		
Observed		CHD Status		Percentage Correct
		No	Yes	
CHD Status	No	15	15	50.0
	Yes	6	89	93.7
Overall Percentage				83.2

DISCUSSION

This study examined the psychosocial vulnerability model of hostility, which hypothesizes that stress and social support mediate the relationship between hostility and CHD, in low-income African Americans. Specifically, the associations between hostility, stress, and social support were examined separately and in relation to disease status (CHD, hypertension, healthy). A variety of statistical techniques were utilized to examine these relationships, and the following is an interpretation of the present findings along with a discussion of these findings in the context of the extant literature.

Relationship of Hostility to Demographic Characteristics

Consistent with the hostility literature, men in the present study endorsed higher levels of hostility than women. Education was also related to hostility in the expected manner, such that participants with higher levels of education endorsed less hostility. Contrary to the literature however, hostility was not related to age or income level in the current sample. Previous work has demonstrated that the relationship between hostility and age is curvilinear: scores tend to be the highest during young adulthood, fall to their lowest levels between the ages of 30 and 50, and then rise again slightly between 50 and 70 years of age (Barefoot et al., 1991). The lack of a correlation between hostility and age is most likely related to the age range of participants (36 – 77 years) recruited for the present study. Even though income level ranged from zero to $5,000 per month in this study, most participants were at the low-end of this range, suggesting that hostility was not related to income due to the lack of variability in income in this sample.

Relationship of Hostility to Health Behaviors and Diabetic Status

In the current sample, hostility was not significantly related to BMI (research question 1). This finding differs from the literature that has demonstrated a positive correlation between

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hostility and BMI (Niaura et al., 2000; Scherwitz et al., 1992; Siegler et al., 1992). Two large

prospective studies have identified a relationship between hostility and body mass index in

predominantly middle class Caucasian samples (Niaura et al., 2000; Siegler et al., 1992). Both

studies reported considerably lower mean BMIs (26.8, $SD = 3.6$ and 22.8, $SD = 4.3$, respectively)

compared with the present sample (31.8, $SD = 7.3$), whose mean BMI is considered to be in the

obese range. The current results are more consistent with those of Scherwitz and colleagues

(1992) who failed to find a cross-sectional relationship between hostility and BMI in a large

sample of African American and Caucasian young adults. Surwit and colleagues (2002) also

found that the relationship between hostility, BMI, and measures of fasting glucose differed

based on ethnicity. They suggest that the health behavior model of hostility may not be as

relevant for African Americans as it is for Caucasians. The lack of a relationship in cross-

sectional studies, but significant findings for prospective studies suggests that hostility may

influence BMI at an early age or subtly over time.

Hostility score was related to smoking status, although the relationships between the

groups differed slightly from anticipated (research question 1; see Figure 6). There is some

evidence to suggest that hostility is not only related to smoking status, but also to reasons for

smoking and lower odds of maintaining abstinence after smoking treatment (Kahler, Strong,

Niaura, & Brown, 2004). As hypothesized, people who had never smoked in the current study

endorsed the lowest levels of hostility. Former smokers, however, endorsed slightly higher levels

of hostility than current smokers, however the difference between these groups was minimal and

not statistically significant. Although information regarding length of smoking cessation for

former smokers was not obtained, it may be that a portion of this group had recently quit and was

experiencing the related negative emotional effects, causing them to endorse slightly higher

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levels of hostility than current smokers. Diabetics endorsed higher levels of hostility than

nondiabetics (research question 1), consistent with the emerging literature suggesting a

relationship between hostility and factors related to glucose metabolism and insulin resistance

(Knox, Weidner, Adleman, Stoney, & Ellison, 2004; Surwit et al., 2002).

Predictor Variables: Hostility, Stress, and Social Support

Mean hostility scores for the entire sample were higher than previous research involving

Caucasians and older African Americans. Consistent with the literature, males did endorse more

hostility than females overall, however females in the current study endorsed high levels of

hostility compared with other studies utilizing the same hostility measure (Barefoot et al., 1991;

Miller, Freedland, Carney, Stetler & Banks, 2003). With regard to stress, participants endorsed

fewer minor stress events ($M = 20.94$) and less impact of stress ($M = 81.23$) compared with the

normative sample for the WSI (event $M = 29.57$, impact $M = 94.50$; Brantley et al., 1997), but

much higher stress levels compared to a sample of male veterans with CHD (event $M = 15.78$;

impact $M = 38.48$; Mosley et al., 1996). Overall, participants reported average levels of

perceived social support.

Relationship of Hostility to Stress and Social Support

Hostility was not related to number or impact of minor stressful events during the past

week in either the entire sample or individual groups (research question 2). This finding is

unexpected and differs from the literature on college samples, which has consistently found a

relationship between high levels of hostility and increased stress (Benotsch et al., 1997; Hardy &

Smith, 1988; Smith & Frohm, 1985; Smith et al., 1988). Prior research has often demonstrated

the hostility-stress relationship in persons specifically selected for high levels of endorsed

hostility, suggesting that this relationship may be nonlinear. In the current sample, the lack of

relationship between hostility and minor stress held even when examining participants in the highest quartile of hostility scores and those scoring above the median for hostility. These results suggest that previous findings demonstrating a relationship between hostility and stress may have been a function of the samples utilized in these studies. For example, it would seem plausible that behaving in an angry and hostile manner might engender more stress for a healthy college student, but that a low-income medical patient will experience a more constant stress level regardless of their personality traits.

Overall, hostility was related to social support in the expected direction, such that higher levels of hostility were related to lower levels of perceived social support, although the effect size was small (research question 2). While this correlation was significant for the entire sample, examination of individual groups revealed that the CHD group was primarily responsible for this relationship. This finding is consistent with the literature supporting the psychosocial vulnerability model (Benotsch et al., 1997; Gallo & Smith, 1999; Hardy & Smith, 1988; Houston & Vavak, 1991; Smith et al., 1988). The corroboration of this relationship in the current sample suggests that the correlation between hostility and social support is fairly robust, regardless of age, SES, ethnicity, and may be even more salient for medically ill patients.

As hypothesized, social support was related to impact of minor stress: participants endorsing higher levels of support reported experiencing less impact of stressful events. This relationship was consistent across all levels of analysis, and demonstrated a moderate effect size in the healthy group, even with less statistical power due to small sample size. Perhaps the types of stressors endorsed by the healthy group are those that are more amenable to the positive influence of social support, as opposed to the unhealthy groups. The inverse relationship between

social support and stress in the current study is consistent with a large body of literature that supports the buffering hypothesis of social support on stress (Coyne & Downey, 1991).

Relationship of Hostility to CHD Status

Hostility was not significantly related to CHD status when comparing CHD patients to hypertensive patients, but did differentiate between CHD patients and healthy subjects, even with less statistical power (research question 3). This pattern of results was unexpected and is most likely related to the restricted range in health status between the CHD and hypertension groups. These results are somewhat contrary to the literature that has consistently demonstrated a relationship between hostility (as measured by the Cook-Medley Hostility Scale) and heart disease, but not hypertension. In the present study, endorsed hostility levels were quite similar for the CHD and hypertensive groups, but less so for the healthy group. The reason for these findings is uncertain. Although the literature has suggested that hostility exerts its influence on disease as early as adolescence, these results would indicate that hostility may also contribute to the disease process later in life and following the onset of illness. The present findings also support the notion that hostility is related to sustained essential hypertension, even though this relationship has not been consistently demonstrated in the literature, especially with women (Delehanty, Dimsdale, & Mills, 1991; Lahad, Heckbert, Patrick, & Psaty, 1996).

Relationship of Stress and Social Support to CHD status

Stress was not a significant predictor of CHD status in either group comparison (research question 4). This differs from the literature that has identified stress as a risk factor for heart disease (Smith & Gallo, 2003) and is contrary to the hypotheses of the current study. The reasons for this finding are uncertain, but may be related to the cross-sectional nature of the study or the demographic characteristics of the current sample. In addition, the stress-heart disease

relationship is a complex one that is not fully understood at present. It is possible that while minor stress was not related to CHD status in the present study, examination of collateral measures of stress (i.e. physiological measures, major life events) would have assisted in further elucidating this relationship.

Contrary to the hypotheses of the current study, social support was not significantly related to CHD status in either comparison (research question 4), although as a predictor it appeared to approach significance more readily than minor stress. Again, this is contrary to the literature which has consistently found social support to be protective of health in general (House, Landis & Umberson, 1988) and heart disease in particular (Orth-Gomer, 1994). The reason for these null findings is unclear, however it may be that that relationship between social support and heart disease is better identified over time, rather than in a cross-sectional manner.

Testing the Psychosocial Vulnerability Model

The psychosocial vulnerability model suggests that stress and social support mediate the relationship between hostility and CHD. Support for this mediational model would have been demonstrated if: 1) hostility was correlated with both variables in the expected directions, 2) hostility alone was a significant predictor of CHD status, and 3) the relationship between hostility and CHD status was diminished once stress and social support were included in the model (research question 5; Baron & Kenny, 1986). Results of both comparisons did not fully support the psychosocial vulnerability model. In comparing the CHD and hypertension groups, hostility was negatively correlated with social support (the expected relationship; in bold, see Figure 8), but was not related to minor stress. Further, hostility alone was not a significant predictor of CHD status in these groups, and this nonsignificant relationship remained unaltered with the inclusion of minor stress and social support in the model.
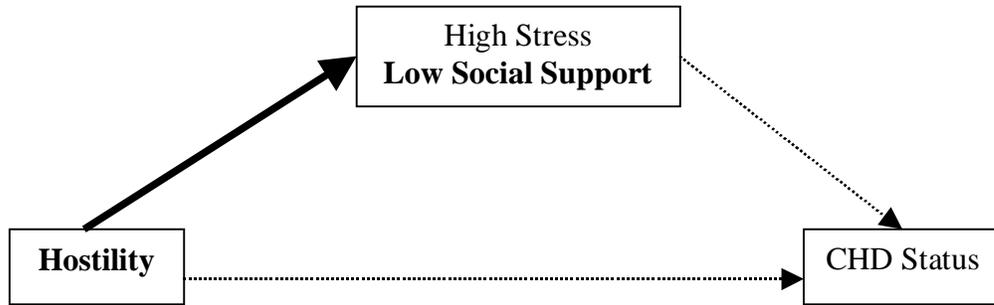
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Figure 8: Mediation as Proposed by the Psychosocial Vulnerability Model – Comparison of CHD and Hypertension Groups

Results differed slightly in testing the psychosocial vulnerability model with the CHD and healthy groups: 1) hostility was again correlated with social support in the expected direction, but was not related to minor stress, 2) hostility alone *was* a significant predictor of CHD status, and 3) the relationship between hostility and CHD status was diminished slightly once stress and social support were included in the model, but remained significant (see Figure 9). This comparison differs from the previous (CHD group compared to hypertension group) in that hostility was a predictor of disease status in these groups and remained a significant predictor after the mediator variables were included in the equation.
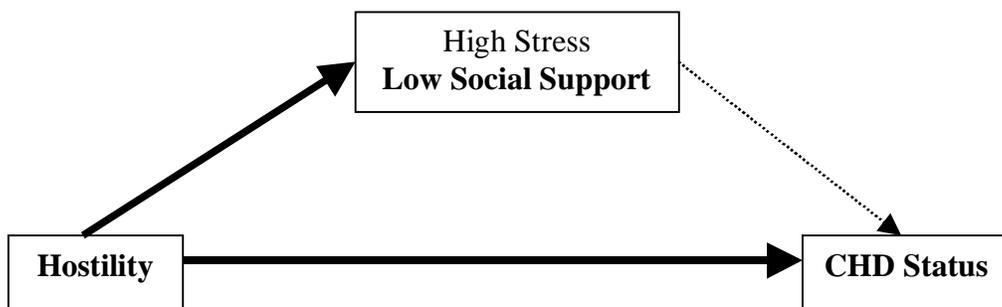

Figure 9: Mediation as Proposed by the Psychosocial Vulnerability Model – Comparison of CHD and Healthy Groups

Therefore, the only aspect of the psychosocial vulnerability model that was replicated in both comparisons for the current study was the relationship between high levels of hostility and decreased social support. Hostility was only related to CHD status in comparing CHD patients to healthy participants. Hostility was not related to minor stress and minor stress and social support were not related to CHD status in any analyses. There are several possible reasons for these results that differ somewhat from the literature, including the high levels of hostility endorsed by the unhealthy participants, the cross-sectional nature of the study, and the demographic characteristics of the current sample.

An interesting finding in the present study is that mean hostility scores for the unhealthy participants were much higher than reported for previous studies conducted with Caucasians, mixed ethnicity samples, and a nationally representative sample (see Figure 10; Barefoot et al., 1991, 1993; Helmers et al., 1993; Miller et al., 2003; Scherwitz et al., 1991).
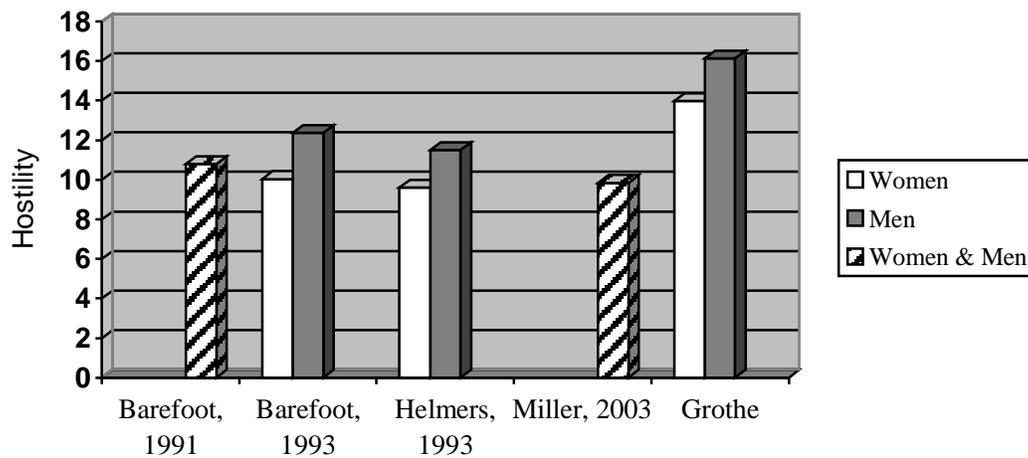

Figure 10: Comparison of Hostility Scores Across Studies

Although males typically endorse higher levels of hostility than females, the women in the current sample were reporting more hostility than the males of previous work. Hostility levels in the current study may have been influenced by income level, as low socioeconomic

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status has been linked to increased hostility. The average income for the participants in this study was less than $11,000 per year, whereas samples from the other studies (not including the national sample of Barefoot et al., 1991) either did not include reported income level or were described as primarily middle class. High hostility scores in the present study may also have been influenced by context, as participants were queried while waiting for medical appointments. For chronically ill patients, it would seem plausible that attending a medical appointment and wait time for that appointment could influence their affect. Perhaps the high levels of hostility endorsed by this sample affected the relationships among the predictor variables and thus the ability to provide complete support for the psychosocial vulnerability model. This is not likely to be the case however, as the underlying premise for the psychosocial vulnerability model would suggest that higher levels of hostility should have been more strongly related to increased stress and decreased social support.

Due to the cross-sectional design of this study, only hypothesized directionality could be tested. Therefore, the current findings may indicate that hostility is the result of medical illness, rather than a precursor. The strongest empirical support for hostility as a risk factor for heart disease has been demonstrated in large, prospective studies. These studies revealed that initially healthy subjects who endorsed high levels of hostility experienced more morbidity and mortality over time than their less hostile counterparts, suggesting hostility is a risk factor for illness rather than a consequence (Barefoot et al., 1983; Shekelle et al., 1983; Williams et al., 1980). Hostility appears to be a fairly stable trait and several studies have demonstrated that receiving a hypertensive diagnosis does not affect hostility level (Cottington, Brock, House, & Hawthorne, 1985; Irvine, Garner, Craig, & Logan, 1991; Waal-Manning, Knight, Spears, & Paulin, 1986). Further, it has been demonstrated that levels of hostility tend to peak during young adulthood and

increase only slight after age 50 (Barefoot et al., 1991), a time when most people experience increased medical problems. Thus, although the hostility literature would suggest that the high levels of hostility endorsed by the unhealthy groups in this study are not a result of chronic illness, the cross-sectional nature of this study cannot preclude this possibility.

As emphasized in the literature review, the majority of the large prospective studies linking hostility and CHD have been conducted with Caucasian males (Smith & Ruiz, 2002). The current study examined hostility in a low SES, middle-aged, African American sample that contained a majority of women. Perhaps the lack of support for the psychosocial vulnerability model in its entirety in the present study was a function of these demographic variables. Because limited research has examined hostility in minority populations, related environmental variables specific to these groups have been overlooked. Perceived discrimination, for example, has been linked to nonspecific psychological distress, negative emotions, and psychological reactivity (Kessler, Mickelson, & Williams, 1999). The Cook Medley Hostility Scale has been described as a measure primarily of cynical mistrust, an aspect of hostility that would likely be influenced by the experience of discrimination. In fact, being somewhat mistrustful and cynical towards intolerant people and inequitable situations might even be considered an appropriate or effective response. Perhaps the cognitive aspect of hostility is not as strongly linked to level of stress or perceived social support in minorities, for whom some cynicism has proven adaptive.

Limitations

There are several notable limitations to the present study. The strongest limitation is the cross-sectional nature of study, which allows only correlational analyses with hypothesized directionality. A stronger test of the psychosocial vulnerability model would be achieved with the use of a prospective design beginning with healthy African Americans and following them

over time. Although exclusion criteria attempted to achieve maximum group separation, the restricted range in health status most likely impacted the comparison between CHD and hypertension patients. This limitation did not apply in comparing the CHD and healthy groups, however this analysis was probably affected by limited statistical power due to the small sample size of the healthy group. Difficulty recruiting healthy African Americans over the age of forty prevented attainment of a larger comparison group.

Another general limitation of the current study included the assessment of hostility levels in patients attending medical appointments. This context may have negatively influenced participants' responses if they experienced long wait times, or if they had negative expectations regarding their appointment. Assessing hostility in a more neutral setting would preclude this confound. Finally, the current study included only low-income African Americans. This limits external validity and allows for generalizability only to other African Americans of similar socioeconomic status. Further research on the relationship of hostility to heart disease is needed in persons of differing ethnicity and socioeconomic status.

General Discussion and Conclusions

Although the relationship between hostility and heart disease has been well documented in the literature, it is not well understood. Several mechanisms of action have been proposed and supported with limited research, including the psychosocial vulnerability model of hostility and health. The current study provides only partial support for the psychosocial vulnerability model, replicating only the relationship between hostility and social support. No relationship between hostility and minor stress was identified in any type of analysis. The replication of high hostility levels linked to low social support suggests that this relationship is robust and may apply broadly to various groups. The lack of relationship between hostility and stress however, suggests that

hostility may only influence stress level at certain ages or income levels. This would explain the fairly consistent relationship between hostility and stress found among college undergraduates in the literature, but not demonstrated here. The current results can only be considered preliminary in nature and additional research replicating the lack of relationship between hostility and stress in samples of varying age and economic status is needed to confirm this finding.

Another possible explanation for the current findings is that the psychosocial vulnerability model does not fully account for the relationship between hostility and health. Additional variables related to hostility, such as cardiovascular reactivity as proposed in the transactional model, may need to be considered while controlling for the effect of health behaviors (smoking, BMI, physical activity) on cardiac outcome. As previously suggested, additional variables specific to underresearched populations, such as discrimination, may also need to be considered. Due to the complex nature and insidious onset of heart disease, it is not likely that any one model can account for the relationship between hostility and disease outcome for all populations at all points in time. Additional research including minorities, women, and persons of differing economic status is needed to further delineate how hostility impacts health.

The results of this study confirm that hostility is a potent risk factor for CHD, as evidenced by the fact that hostility was the only significant psychological predictor of disease status in comparing the CHD and healthy groups, even with limited statistical power. These results also provide support for a relationship between hostility and sustained essential hypertension. Given the finding that both unhealthy groups endorsed high levels of hostility compared to the healthy group, perhaps hostility also has a persisting influence on the progression of medical illness after the onset of disease. This may be especially true for low-income persons for which higher levels of hostility and poorer health are typically found.

The current study furthers the hostility literature by testing the psychosocial vulnerability model with psychometrically sound measures of hostility, stress, and social support in a minority sample and including a health outcome variable. This study has implications for future research concerning hostility and heart disease and highlights the importance of considering the influence of ethnicity and socioeconomic status when studying health. Models attempting to explain the relationship between psychosocial variables and health that have not been tested in ethnically diverse samples cannot be universally accepted until this is achieved. In fact, examinations of these models in diverse samples may help elucidate the mechanisms underlying the health disparities in heart disease. The importance of examining health disparities cannot be emphasized enough and has been bolstered by the recent initiation of the Jackson Heart Study, the first large-scale epidemiologic study of cardiovascular disease in African-Americans, funded by the National Heart, Lung, and Blood Institute. It is hoped that results from the Jackson Heart Study will provide a better understanding of factors related to cardiovascular disease in African Americans to help promote improved outcomes for this at risk population.

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VITA

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