DEFENSIVE HOSTILITY: PSYCHOSOCIAL CORRELATES AND ASSOCIATION WITH CARDIOVASCULAR RESPONSES

1993

HELMERS

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
F. EDWARD HÉBERT SCHOOL OF MEDICINE
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APPROVAL SHEET

GRADUATE EDUCATION

TEACHING HOSPITALS
WALTER REED ARMY MEDICAL CENTER
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Title of Dissertation: "Defensive Hostility: Psychosocial Correlates and Associations with Cardiovascular Responses"

Name of Candidate: Karin Helmers
Doctor of Philosophy Degree
April 21, 1993

Dissertation and Abstract Approved:

Committee Chairperson	21 Apr 1993 Date
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ABSTRACT

Title of Dissertation: "Defensive Hostility: Psychosocial Correlates and Associations with Cardiovascular Responses"

Karin F. Helmers, Doctor of Philosophy, 1993

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An exaggerated cardiovascular response (CVR) to stress has been postulated as a mechanism in the development of coronary artery disease (CAD). Hostility is a personality trait that is linked to CAD and CVR, though nonsignificant associations have also been reported. It is suggested that inconsistent findings in this area sampled populations differing on the trait of Defensiveness (the tendency not to report undesirable self-characteristics). The present research evaluated psychosocial correlates and cardiovascular responses to stress associated with Defensive Hostility (DH), characterized by high scores on Hostility and Defensiveness. DH subjects were compared to Low Hostile (LH -- Low Hostility and Defensiveness), High Hostile (HH -- High Hostility, Low Defensiveness), and Defensive (Def -- Low Hostility, High Defensiveness) subjects.

In Study I, 72 men & 73 women completed a battery of personality measures. DH men in comparison to LH, HH and Def men, demonstrated the greatest suppression of anger, less total anger, less positive emotions, and the least social support. However, these results were dependent upon the scale cutpoints

used for Hostility and Defensiveness. By contrast, no significant differences were observed for DH women in comparison to LH, HH and Def women on any of the personality measures.

In Study II, 34 men and 34 women were evaluated for their cardiovascular responses in response to stressful speech and math tasks. In males, DH men in comparison to Def and HH men, exhibited greater SBP and DBP levels during baseline and tasks. Unexpectedly, LH men exhibited SBP and DBP levels which were not significantly different from those of DH men. By contrast, LH women in comparison to Def, HH and DH women, demonstrated low SBP and DBP levels during baseline and tasks.

These results indicate that the combination of Hostility and Defensiveness differentiates cardiovascular levels during rest and stress and may explain previous null findings in the hostility-CVR literature. Furthermore, DH men had a personality profile that differentiated them from Def, LH and HH men. A consistent finding in this study was that gender differences exist in physiological and psychosocial responses related to Defensive Hostility and stress reactivity.

Defensive Hostility:

Psychosocial Correlates and

Associations with Cardiovascular Responses

By

Karin F. Helmers

Dissertation submitted to the faculty of the Department of Medical Psychology Graduate Program of the Uniformed Services University of the Health Sciences in partial fulfillment of the requirement for the degree of Doctor of Philosophy, 1993.

ACKNOWLEDGMENTS

I would like to dedicate this dissertation research to my father, F. Leslie C.H. Helmers, who always supported and wanted me to continue my education but who did not live to see his wish come to fruition.

I would like to thank my husband, Yavin Shaham for his endless support and encouragement to finish this dissertation and to thank my son, Jonathan, for his constant distraction from this laborious undertaking.

I would like to aknowledge:

Dr. David Krantz for all his help and support during the process of this dissertation, his never accepting less than my best, and for his encouragement during all of my graduate years.

The committee members, Andrew Baum, Sheryle Gallant and Robert Ursano for their swift response and attention to the minute details of this dissertation.

Jennifer Falconer whose efficiency and reliability made her the natural candidate for all details of the dissertation process; Ivan Graf who recorded all cardiovascular responses and kept me company during the entire experimental protocol; and Sandra Jochum who undertook the screening and scheduling of all subjects.

Donna Posluszny who immediately volunteered to be the second experimenter and Sandra Zakowski who encouraged me throughout this process.

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INTRODUCTION

Coronary artery disease (CAD) is the leading cause of death in the United States (U.S. Dept. of Health, Education, and Welfare, 1979). Standard risk factors such as smoking, hypertension, and cholesterol, are unable to predict all new cases of CAD, thus the search for risk factors has expanded to include social, psychological, psychophysiological and environmental factors. Cardiovascular reactivity, the increase in cardiovascular parameters elicited during physical or mental stressors, has been postulated as one possible bio-behavioral mechanism in the development of CAD (Krantz & Manuck, 1984). Among the personality traits examined as psychosocial risk factors, hostility is currently the most promising trait to be associated with both CAD and cardiovascular responses. However, some inconsistent results have been found in both hostility-coronary disease and hostility-cardiovascular reactivity associations. Based on the literature reviewed below, it is suggested that positive, negative, or null findings may stem from the fact that the sampled populations differed on defensiveness (the tendency not to report socially undesirable self-characteristics).

The research proposed here will evaluate the personality trait of Defensive Hostility, which may account for some of the inconsistent findings in the relationship between hostility and coronary disease/cardiovascular reactivity. The Defensive Hostile individual is characterized by high scores on hostility (Cook-Medley Hostility Inventory; Ho) and high scores on defensiveness

(Marlowe-Crowne Social Desirability scale; MC). As measured by these questionnaires, Defensive Hostile subjects are hostile, have a cynical view of the world, and expect others to have negative intentions. At the same time, Defensive Hostile subjects are also concerned with a positive self-representation, and want to be viewed in a positive manner. These subjects are defensive or cautious about the expression of their negative and hostile feelings, hence the label Defensive Hostility.

Recent research indicates that Defensive Hostile subjects (high Ho, High MC) in comparison to other hostility styles (Low Hostile -- low Ho, low MC; High Hostile -- high Ho, low MC; and Defensive -- low Ho, high MC), exhibit increased cardiovascular responses in healthy males in a field study (Jamner et al, 1991) and the most severe myocardial ischemia in coronary patients in both a field and laboratory study (Helmers et al, 1991). At present however, the specific psychological components of the Defensive Hostility construct are not well-defined. Neither is the link between the Defensive Hostile style and increased cardiovascular reactivity well established in healthy individuals, and no data are available as to the relationship between Defensive Hostility and increased cardiovascular responses among women. Therefore, this dissertation will consist of two studies. In the first study, psychological correlates of the Defensive Hostility construct are examined. In study 2, under controlled laboratory conditions, the association between Defensive Hostility and cardiovascular responses are evaluated in a sample of healthy males

and females.

The research dealing with cardiovascular reactivity, the hostility construct, and associations among hostility-coronary disease and hostility-cardiovascular reactivity is reviewed below in order to provide the rationale for the research hypotheses.

CARDIOVASCULAR REACTIVITY AND CORONARY ARTERY DISEASE

Cardiovascular reactivity (CVR) is defined as the changes in cardiovascular physiological parameters in response to stress, as opposed to sole assessment of resting cardiovascular physiological levels. The most frequently used cardiovascular measurements in studies of healthy populations are heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP). Cardiovascular reactivity has been implicated in the development of coronary atherosclerosis and/or may be a marker of pathogenic processes involved in this disorder (Krantz & Manuck, 1984).

Coronary atherosclerosis is a process which begins in childhood with the accumulation of fatty streaks in the inner layer of the coronary arteries. With the process of aging, particularly in susceptible populations, these fatty streaks are replaced with lipid plaques which can protrude into the vessel lumen and with further growth can occlude the coronary artery (Ross & Glomset, 1976; McGill, 1984). Injury to the coronary endothelium is believed to be the initial event in the atherosclerotic process (Ross, 1981), and stressful events produce episodic cardiovascular changes in heart rate and blood pressure which may damage the

coronary endothelium. These episodic events presumably also accelerate the atherosclerotic process once it has begun. Evidence for the association between cardiovascular reactivity and atherosclerosis has been obtained from an animal model and from human studies.

Animal Studies on Cardiovascular Reactivity

Confirmation for a relationship between CVR and atherogenesis has been provided by Manuck, Kaplan, Clarkson and colleagues in experimental studies using an animal model. In one study, male cynomolgus monkeys were fed an atherogenic diet for approximately two years and were divided into high and low HR reactors depending upon their response to the presentation of a glove which was the stimulus for capture (Manuck et al, 1983). High HR reactors exhibited significantly more extensive coronary artery atherosclerosis than low HR reactors, yet high HR reactors were not different from low HR reactors on resting HR, blood pressure, or serum lipid concentration. A second study replicated these findings in female monkeys (Manuck et al, 1985). These results suggest that monkeys with high HR reactivity had an accelerated atherosclerotic process when compared to low HR reactors. It should be noted that the HR measurements were taken after many months on an atherogenic diet and just prior to necropsy of the animals, thus these findings are retrospective in nature (Manuck & Krantz, 1986).

Human Studies on Cardiovascular Reactivity

An association between cardiovascular reactivity and coronary disease has also been demonstrated in case-control studies comparing CAD patients with non-CAD control subjects. In one of the first published studies, Schiffer al (1976) evaluated three groups of executives during the administration of a quiz: a control group and two coronary groups consisting of stable angina with or without history of hypertension. None of the subjects took any cardiovascular medication for 72 hours prior to the laboratory study. Both groups of angina patients had higher HR responses than the controls. Executives with angina and a history of hypertension had higher SBP and DBP responses to the quiz than controls and angina group without a history of hypertension. Sime et al (1980) replicated this study using the same quiz in a group of post-MI patients and healthy controls. Results indicated that the post-MI patients, in comparison to controls, had greater DBP and lower HR responses, but similar baseline values. Similar results were found by Corse et al, (1982). Three stressors were given sequentially without any resting periods between the tasks to 24 normal controls and 34 CAD patients who were not taking any beta-blockers. CAD patients in comparison to controls had significantly greater DBP change scores.

Dembroski et al (1979) evaluated post-MI patients and non-CAD controls. CAD patients in comparison to controls, evidenced marginally higher SBP increases to a history quiz, but not to a challenging interview. The post-MI patients were not tapered off

of beta-blockers which may have prevented or interfered with the sympathetic nervous system response to stress (Krantz and Manuck, 1984).

In contrast, Krantz et al (1981) evaluated patients referred for diagnostic cardiac catheterization. No significant relationships were found between severity of atherosclerosis and cardiovascular responses during a quiz and a challenging interview. These results may be due to a selection bias inherent in angiography studies. That is, a reduced variance in disease severity is found in angiography studies as most patients referred for coronary angiography are diagnosed with CAD and patients without a positive diagnostic test cannot be considered healthy normal subjects (Pickering, 1985). Thus the patient population employed in angiography studies comprises a more homogeneous group (i.e., subjects suspected of CAD), a factor that reduces the chance of finding an association between CVR and extent of atherosclerosis.

In a more recent study, Krantz et al (1991) evaluated three groups of coronary patients and their response during three stressors (mental arithmetic, Stroop task, and a public speaking task). All patients were tapered off of their cardiac medications. Those coronary patients with the most severe ischemia during stress (based on radionuclide ventriculography) evidenced the greatest SBP reactivity, in comparison to non-ischemic and moderately ischemic patients.

There is one prospective study of middle-aged healthy men

which evaluated CAD development, standard risk factors and CVR (Keys et al, 1971). Greater diastolic blood pressure responses to the cold pressor test was predictive of subsequent CAD. In fact, cold pressor response was a stronger predictor of CAD events than the two standard risk factors which were significant in predicting CAD development (SBP and serum cholesterol).

In sum, CVR is believed to be a mechanism or marker for processes involved in the pathogenesis of atherosclerosis and/or clinical CAD. This hypothesis is corroborated by an animal model, prospective epidemiologic, and case-control studies.

THE CONSTRUCT OF HOSTILITY

Before evaluating the relationships between hostility and CAD/cardiovascular reactivity, a description of assessment and psychosocial correlates of hostility will be followed by a review of the evidence relating hostility to coronary artery disease.

Definition of Hostility

Hostility, defined as a negative attitudinal set (Williams et al, 1985), is characterized by a cynical view of the world, an antagonistic manner, and the expectation of negative intentions from others. The constructs of hostility, anger, and aggression are interrelated, and at times are used interchangeably in the literature. While hostility is a negative attitudinal set, anger refers to an emotional state, and trait anger is viewed as a proneness to become angry in varying situations (Spielberger et al,

1985). Aggression is regarded as the behavioral expression of anger or hostility directed towards another individual or object (Spielberger et al, 1985). Though these three constructs are treated independently, on many occasions they are interrelated in that hostile individuals experience more frequent anger, and may express aggression more frequently than a person with low hostility (Williams et al, 1985).

Measurement of Hostility

Hostility is most commonly assessed by two means -- a behavioral technique derived from the Type A Structured Interview (SI), or by a self-report paper and pencil questionnaire. The Type A Structured Interview is an interpersonal interview during which the interviewer challenges and interrupts the subject in order to elicit a behavioral response (Friedman and Rosenman, 1974). The SI can be scored both for content and behavioral responses of hostility, as well other components including vigorous speech characteristics, response latency, anger suppression, and competition for control of the interview (Dembroski, 1983; Matthews, et al, 1977). The SI-derived hostile individual is characterized as argumentative and challenging in response to interviewer questions, with voice characteristics indicating boredom and surliness, and responses to specific questions are characterized by impatience, anger, or irritability (Dembroski, 1983). Thus, this semi-structured interview provides a score which reflects a clinical judgment of overt behavioral potential-for-

hostility.

The most frequently used paper and pencil questionnaire to evaluate hostility is the Cook-Medley Hostility Inventory, a 50 item true/false questionnaire derived from the Minnesota Multiphasic Personality Inventory (Cook & Medley, 1964). Interest in the components of hostility has resulted in several factor analyses of the Cook-Medley. These components include mistrust in people's good intentions (Williams et al, 1985), cynicism, aggressive responding, and hostile affect (Barefoot et al, 1989), paranoid alienation (Costa et al, 1986), as well as anger (Blumenthal et al, 1987). Studies employing factor analyses of items suggest that the Cook-Medley Hostility Inventory may be measuring several components which individually may or may not be related to CAD.

The relationship between the Cook-Medley Hostility Inventory and the SI derived Potential-for-Hostility was found to be moderate (r=.37) in 131 patients referred for diagnostic cardiac catheterization (Dembroski et al, 1985). This finding suggests some overlap between these two scales but also suggests that these two measurements of hostility are not identical and are only moderately correlated.

Hostility and Other Psychosocial Variables

To further characterize the construct of hostility, associations between the Cook-Medley Hostility Inventory and several psychosocial variables have been examined. In studies of

both male and female undergraduate students, increasing hostility scores (assessed using the Cook-Medley Hostility Inventory) were positively correlated to frequency of angry episodes, and suspiciousness (Smith & Frohm, 1985; Hardy & Smith 1988), and inversely correlated with number of social supports (Smith & Frohm, 1985; Hardy & Smith 1988). Decreased social support has been implicated in the development of illness and mortality (Berkman & Syme, 1979; House et al, 1982), and hostility may therefore be a common link to disease endpoints in studies of social support systems.

Fontana et al (1989) evaluated middle-aged male coronary and non-coronary patients admitted to the hospital for medical or surgical interventions. A condensed version (21 items) of the Cook-Medley Hostility Inventory was administered. Results demonstrated that increasing hostility scores were associated with increased feelings of self-worth and self-criticism in both groups. In coronary patients, a positive correlation was found between hostility and dependency on others, which was nonsignificant in the non-coronary patients. Results were interpreted as suggesting that coronary patients are conflicted about the desire to oppose others due to their high hostility and dependency needs.

Houston and Kelly (1989) evaluated women for psychosocial correlates of hostility. Ninety-two middle-aged employed women completed the Cook-Medley Hostility Inventory and other questionnaires. Hostility was positively correlated with stressful job experiences, underutilization of skills, and reported daily

stress and tension. Unlike the findings of most studies with undergraduate students, hostility was not related to measures of social support.

Hostility also appears to be positively related to anger, but the relationship between the Cook-Medley Hostility Inventory and anger expression or anger suppression is not entirely clear. Spielberger (1985) developed the Anger Expression Scale which measures not only the frequency of anger experienced, but also the direction of anger: Anger-in (suppression of anger) and Anger-out (expression of anger). In high school students, the scales for Anger-in and Anger-out were independent orthogonal factors, showing no significant correlation with each other. Trait anger (measured by Spielberger's Trait Anger) was positively correlated with both Anger-in and Anger-out (Spielberger et al, 1985). The relationship of trait anger with Anger-out was much stronger than Anger-in which suggests that the more prone a high school student is to anger, the more prone he/she is to expressing that anger.

When examining the relationship between Cook-Medley hostility and anger suppression, inconsistent relationships have been found. Some of these inconsistencies may be due to using different questionnaires to measure anger expression. No relationship was demonstrated between Framingham Anger-in and hostility in 60 male undergraduates and 91 middle-aged employed women (Smith & Houston, 1987; Houston & Kelly, 1989). Likewise no relationship was found between SI-derived Potential-for-Hostility and SI derived Anger-in in patients referred for coronary angiography (Dembroski et al,

1985). However, a positive correlation between hostility and Spielberger's Anger-in was demonstrated in a group of healthy young males (r=.48; Suarez and Williams, 1990) and in undergraduate male and female students (r=.29; Smith & Frohm, 1985).

Correlations between Cook-Medley Hostility Inventory and Anger-out are also inconsistent. A negative correlation was demonstrated in undergraduate males using the Framingham Anger-out (r=-.33; Smith and Houston, 1987), but a positive correlation was found in 91 middle-aged employed women (r=.26; Houston & Kelly, 1989). A positive correlation was found in a group of young male subjects using Spielberger's Anger-out (r=.41; Suarez and Williams, 1990) and in male and female undergraduates (r=.42; Smith & Frohm, 1985).

Houston and Vavak (1991) evaluated 134 male and female undergraduate students who had either high or low Cook-Medley hostility scores. High hostile subjects had significantly greater scores for suppression of anger (measured by the Multi-dimensional Anger Inventory) when compared to low hostile subjects. The outward expression of anger was not significantly different between these two groups.

Studies have reported an inconsistent relationship between anger expression and hostility. The Framingham Anger Expression Questionnaire may not accurately reflect the individual's mode of anger expression since it gives a score based on a few hypothetical situations. In contrast, Spielberger's Anger Expression scale has ten items for both Anger-in and Anger-out which may provide

increased reliability in comparison to the Framingham Anger Expression questionnaire. The Cook-Medley Hostility Inventory appears to be associated with both Spielberger's Anger-in and Anger-out. However, it is not clear whether Anger-in and Anger-out were independent factors in these data sets, as this was not reported in these studies. The research proposed here will further evaluate the interrelationships between Cook-Medley hostility and the Spielberger Anger Expression Scale, which measures both Anger-in and Anger-out in healthy control subjects.

To summarize briefly, high hostility scores are associated with increased angry episodes, feelings of self-worth and self-criticism, the outward expression of anger, suppression of anger and possibly increased dependency on others, and decreased social supports. In general, it would appear that high hostile subjects may experience an array of ambivalent feelings, but further research is needed to clarify this hypothesis.

ASSOCIATIONS OF HOSTILITY WITH CORONARY ARTERY DISEASE

Considerable effort has been undertaken to evaluate the relationship between hostility and coronary artery disease. Relevant studies in this area were recently reviewed by Helmers, Posluszny, and Krantz (1993). This review concluded that hostility is related to: (1) extent of atherosclerosis in patients referred for cardiac catheterization studies; (2) to the recurrence of cardiac events in post-myocardial infarction patients; (3) to the premature development of CAD in initially healthy subjects; and (4)

the Structured Interview derived Potential-for-Hostility in comparison to the Cook-Medley Hostility Questionnaire, demonstrated more consistent associations between hostility and CAD. Rather than repeating this review, only those studies that used the Cook-Medley Hostility Inventory or the Structured Interview derived Potential-for-Hostility will be reviewed here. Several studies using other paper and pencil questionnaires will also be mentioned as they shed additional light on the relationship between hostility and CAD. The studies reviewed below will include cross-sectional cardiac catheterization studies and studies on coronary patients, as well as longitudinal studies of initially healthy subjects and coronary patients.

Cross-Sectional Coronary Angiography Studies

Cook-Medley Hostility Inventory. Three studies examined relationships between hostility and angiographic evidence of severity of atherosclerosis in patients at high risk for the development of CAD. Williams et al (1980) demonstrated that hostility was significantly related to extent of coronary occlusion in 424 cardiac catheterization patients, including 117 women. Since data for men and women were analyzed together, association of hostility with CAD could have been confounded by gender. Specifically, because women are found to be less hostile (Blumenthal et al, 1987) and develop CAD at a later age than men (Johansson, 1989), associations between hostility and severity of atherosclerosis may be due to gender differences.

A recent study by Helmer, Ragland, and Syme (1991) evaluated both the Cook-Medley Hostility Inventory and an SI-derived measure of hostility in 118 men and 40 women who underwent diagnostic cardiac catheterization. No significant relationship was found between Cook-Medley hostility scores and the presence or absence of any significant coronary occlusion. These analyses were repeated using the SI-derived hostility, with no significant relationships emerging from these analyses as well.

Dembroski et al (1985) also used both the Cook-Medley Hostility Inventory and the SI derived Potential-for-Hostility. There was no significant association between Cook-Medley hostility scores and number of obstructed vessels in 80 patients at high risk for the development of CAD.

In sum, research has demonstrated inconsistent relationships between Cook-Medley Hostility Inventory and coronary angiographic evidence of CAD. Only one of three published studies found a positive relationship (Williams et al, 1980), while the two remaining studies found nonsignificant relationships (Dembroski et al, 1985; Helmer, Ragland, & Syme, 1991).

Structured Interview. Four studies have measured the construct of hostility by deriving it from tape recorded assessments of the Type A Structured Interview. Arrowood, Uhrich, Gomillion, Popio, and Raft (1982) examined 76 patients admitted for diagnostic coronary angiography. The hostility component of the SI was significantly correlated with degree of CAD obstruction.

Dembroski, MacDougall, and colleagues conducted two separate

studies that analyzed relationships among both SI Potential-for-Hostility and Anger-in (suppression of anger), and cardiac catheterization results (Dembroski, MacDougall, Williams, Haney, & Blumenthal, 1985; MacDougall, Dembroski, Dimsdale, & Hackett, 1985). Dembroski et al (1985) evaluated 131 patients (including 33 females) who were referred for diagnostic coronary angiography at Duke University. Study results indicated that both the characteristics of Potential-for-Hostility and Anger-in added significantly to standard risk factors in predicting number of obstructed vessels. Furthermore, there was a significant interaction between Potential-for-Hostility and Anger-in; that is, high hostile patients who were also high on anger-in had the greatest number of obstructed vessels.

A second study evaluated 126 male patients from Massachusetts General Hospital who were referred for diagnostic coronary angiography (MacDougall et al, 1985). Potential-for-Hostility and Anger-in significantly predicted the number of obstructed vessels. Unlike the previous study, no significant interaction between Hostility and Anger-in was found. A fourth study in this category has already been reviewed in the Cook-Medley section (Helmer, Ragland, & Syme, 1991). Results indicated no relationship between the SI based hostility and significant occlusion in patients referred for coronary angiography.

Thus, three out of four high risk studies using the SI-derived measurement of hostility found positive associations with extent of coronary occlusion (Arrowood et al, 1982; Dembroski et al, 1985;

MacDougall et al, 1985). One recent study did not find a significant association (Helmer, Ragland, & Syme, 1991).

Other self-report questionnaires. A study by Siegman et al. (1987) is unusual because it evaluated two different components of hostility from the Buss-Durkee Hostility Inventory -- neurotic hostility and reactive hostility -- in 51 males and 21 females referred for diagnostic coronary angiography. In prior research, neuroticism has been found to be related to angina, but not to clinical CAD endpoints (Costa & McCrae, 1987). Neurotic hostility is characterized by resentment, suspicion, and the experience of anger and irritability, whereas reactive hostility refers to self-reports of the display of anger. In subjects below 60 years of age, neurotic hostility was inversely related to severity of atherosclerosis, whereas reactive hostility was positively related to severity of atherosclerosis, even when gender was partialled out. No significant relationships were found among older patients. This study underscores the importance of separating out the neurotic component from hostility and that the relationship between hostility and CAD may be limited to younger populations.

Summary of Cross-Sectional Studies

Five out of six studies evaluating high risk patients found a positive association between hostility and extent of obstruction during cardiac catheterization. Using paper and pencil questionnaires, Williams et al (1980) found a positive relationship between hostility and coronary artery obstruction, and Siegman et

al (1987) demonstrated a positive association between hostility and CAD in young populations, but not in older populations. Using the SI-derived hostility, positive associations were demonstrated in three studies (Arrowood et al, 1982; Dembroski et al, 1985; MacDougall, 1985) and one study did not find an association (Helmer et al, 1991).

Longitudinal Studies of Initially Healthy Subjects

Cook-Medley Hostility Inventory. There are currently six published longitudinal studies of initially healthy subjects using the Cook-Medley Hostility Inventory. Barefoot, Dahlstrom, and Williams (1983) analyzed hostility in a 22 year follow-up of 225 male medical students from the University of North Carolina. There were significantly fewer CAD events for those subjects with low hostility scores in comparison to those subjects with high hostility scores. In a second study, Barefoot et al (1989) evaluated 118 law students in a 29-year follow-up and found a positive association between hostility scores and total mortality (mortality from all causes). This analysis could not be done solely for CAD mortality because only 6 of 13 deaths were attributed to CAD. Furthermore, a Composite Hostility score was a better predictor of total mortality than the full-scale hostility score. The Composite Hostility score was obtained from the summation of three subscales of the Cook-Medley Hostility Inventory.

A sample of 656 young physicians with an average age of 47 at

followup were evaluated by McCranie, Watkins, Brandsma, and Sisson (1986). The MMPI was administered some 22 years earlier during subjects' medical school admission interview. No significant relationship was found between hostility and CAD development. This study, however, may be confounded by factors related to social desirability since the Cook-Medley Hostility Inventory was administered during an admission interview. The students may have presented themselves in a more favorable manner, thus explaining the markedly lower hostility scores obtained in this study when compared to other studies. Therefore, the lack of a relationship between hostility and the development of CAD may have been due to biased self-reports of hostility.

A social desirability bias may also explain the lack of a significant relationship between hostility and subsequent development of CAD in another study using 280 middle aged men (Leon et al, 1987). Subjects were businessmen and professionals from Minnesota, average age 45, who were then followed for 30 years. The authors indicated that the mean hostility score was low for this particular group in comparison to similar groups of men. This may reflect social desirability factors, and could possibly account for the nonsignificant results.

Factors associated with social desirability do not appear to explain the lack of significant results reported by Hearn, Murray, & Luepker (1989). This is a 33 year follow-up of 1399 men (mean age 52 at follow-up) who had taken the MMPI as part of their freshmen orientation. There was no relationship between Cook-Medley

hostility and CAD mortality and CAD morbidity. These null findings may be attributed to the subjects' young age at assessment. Subjects were on average 19 years old when the Cook-Medley was administered, considerably younger than other studies, and personality traits may not be fully formed at this age. A recent study concluded that personality traits may not be fully established until age 21 and possibly not until 30 years of age (Siegler et al, 1990). Thus, the reliability between hostility scores at age 19 and some later age may be low, resulting in a nonsignificant relationship.

The final study that used the Cook-Medley Hostility Inventory reanalyzed data from the Western Electric Study for 20 year incidence of MI and CAD death in 1877 men (Shekelle et al, 1983). At the 20 year follow-up, hostility scores were subdivided into quintiles and hostility was marginally related to CAD mortality. Results indicated that the highest incidence of CAD mortality was in the middle quintile. Thus, these results demonstrate an inverse U shaped curve, rather than a linear relationship between hostility and CAD mortality.

In sum, longitudinal studies of initially healthy subjects involving the Cook-Medley Hostility Inventory have yielded inconsistent findings. Of the studies, two were positive (Barefoot et al, 1983; 1989), one found an inverse U-shaped relationship (Shekelle et al, 1983) and three were negative (Hearn et al, 1989; Leon et al, 1987; McCranie et al, 1986). These studies were confounded by issues related to social desirability (McCranie et

al, 1986; Leon et al, 1987), and stability of hostility trait (Hearn et al, 1989).

Other self-report questionnaires. Haynes, Feinleib and Kannel (1980) analyzed 1674 subjects from the Framingham Heart Study for development of CAD over an 8-year period. The variables of interest here are Anger-in (suppression of anger) and Anger-out (the expression of anger). Men and women were evaluated separately, as well as in three age groups for each sex: 45-54, 55-64, 65+. In males, Anger-out was significantly higher in the 55-64 year old male controls than among CAD patients. Coronary females in the 55-64 age range had significantly higher Anger-in, and lower Anger-out than control females. Results indicate that suppression of anger, rather than expression of anger was related to development of coronary disease.

Structured Interview. This section will review two studies that have employed the Structured Interview (SI) to assess hostility in initially healthy subjects. Matthews et al (1977) were among the first to separate out factors in the SI, including hostility, that may predict CAD. In this study, a subsample from the prospective Western Collaborative Group Study (WCGS) was analyzed. Sixty-two 62 men who developed CAD over the course of 4.5 years, were compared to a control sample of 124 healthy men. Hostility items were endorsed more frequently in individuals who subsequently developed CAD. Hecker et al (1988) extended Matthews et al's (1977) research on WCGS by comparing 250 men who developed CAD to 500 male controls. The mean age for the two groups was 48.5

and these men were followed for 8.5 years. Hostility was significantly higher in the CAD patients even after controlling for the standard risk factors.

In conclusion, both longitudinal studies of initially healthy subjects using the Structured Interview had positive findings (Matthews et al, 1977; Hecker et al, 1988). However these are not independent samples since both studies used subjects from the WCGS, thus they should be regarded as deriving from one study.

Summary of Longitudinal Studies of Initially Healthy Subjects

Of eight longitudinal studies reviewed, five showed positive hostility-CAD relationships and three showed no such associations. Both studies of initially healthy subjects that employed the SI found a positive relationship between hostility and CAD, although the two samples are not independent (Matthews et al, 1977; Hecker et al, 1988). Of these eight studies, those using the Cook-Medley Hostility Inventory reveal inconsistent findings. Barefoot et al (1983, 1989) found a positive relationship between hostility and CAD, and Shekelle et al (1983) found an inverse U-shaped relationship. However, no relationship was found in the remaining three studies employing the Cook-Medley Hostility Inventory (McCranie et al, 1986; Leon et al, 1987; Hearn et al, 1989). Using other paper and pencil questionnaires, Haynes et al (1980) demonstrated that anger suppression was related to CAD development in men and women.

Cross-Sectional Studies of Coronary Patients

Recently, Helmers et al (1993) evaluated the association between Cook-Medley hostility and extent of exercise-induced myocardial ischemia in coronary patients. In this study, a Composite Hostility score (summation of subscales Cynicism, Hostile Affect, and Aggressive Responding; Barefoot et al, 1989) was found to be predictive of exercise-induced ischemia in 80 CAD patients. When subsets of this sample were analyzed, no significant relationship was demonstrated between Composite Hostility and exercise-induced ischemia in all men (N=63), but was predictive in young men below the age of 60 (N=17) and in women (N=17). These results suggest that the relationship between hostility and exercise ischemia may only be exhibited in younger male populations, and that factors associated with aging may have obscured this relationship in the total male subsample. Factors associated with aging may not have had as much influence on the women in this sample, because women develop coronary disease at a later age than men (Johansson, 1989). The full-scale hostility score was not found to be significantly related to exercise thallium ischemia.

To summarize, Composite Hostility, rather than the full-scale hostility score was significantly related to exercise-induced ischemia. Thus, Composite Hostility may be a more sensitive measure of hostility than the full-scale score to index severity of disease in CAD patients. These results also underscore the need to separately evaluate men versus women, as well as old versus young

patient populations.

Longitudinal Studies of Coronary Patients and Those at High Risk for CAD

Two studies investigated prospectively the associations between hostility and occurrence of CAD events in either coronary patients or subjects at high risk for the development of CAD. These studies employed the SI derived Potential-for-Hostility.

Dembroski et al (1989), compared 192 high risk men who developed CAD to 384 men who remained free of disease in a 7.1 year follow-up of the MRFIT study. Results indicated that dichotomized hostility scores (high/low hostility) added significantly to known risk factors in predicting MI or cardiac death. These analyses were repeated for patients who were 47 years of age or younger (median), versus those who were older than 47 years of age. The dichotomous hostility score was significantly related to MI or coronary death in younger patients but not older patients. These results suggest that the relationship between hostility and CAD is manifested in younger populations even after adjusting for known risk factors.

Powell and Thoresen (1985) utilized a subsample from the Recurrent Coronary Prevention Project, which followed 118 men with a previously diagnosed MI for the recurrence of a cardiac event. Hostility was found to be significantly higher in those men who experienced a second MI.

In studies of CAD patients or patients at high risk for the

development of CAD, hostility predicted future occurrence of a cardiac event. Powell and Thoresen (1985) found that SI derived hostility predicted a recurrent cardiac event in cardiac patients and Dembroski et al (1989) demonstrated that the SI hostility predicted MI or cardiac death in high risk patients.

Conclusion

There is evidence that hostility is related to CAD in angiography studies of patients at high risk for the development of CAD, in cross-sectional studies of coronary patients, in longitudinal studies of initially healthy populations who develop CAD prematurely, and in longitudinal studies of high risk or CAD patients. Research needs to further evaluate possible gender differences as there have been few studies which have evaluated the relationship between hostility and CAD in women. The SI derived potential-for-hostility was found to show more consistent associations between hostility and CAD. Finally, components of the Cook-Medley Hostility Inventory which are related to CAD need to be established. The Composite Hostility score (Barefoot et al, 1989) may be an alternative form of the Cook-Medley Hostility Inventory which will have a greater magnitude of association between hostility and CAD than the full-scale score.

It has been noted on several occasions that the relationship between hostility and coronary disease is not always consistent and that this may be a weak association. An alternative explanation is that the relationship between hostility and coronary disease may

only be demonstrated in certain subsets of subjects with high hostility scores. This would suggest the need to further differentiate hostility according to other psychological constructs (e.g., defensiveness) and/or other physiological characteristics (e.g., cardiovascular reactivity, cholesterol levels). Accordingly, the constructs of hostility and defensiveness will be examined in greater detail in the section entitled "Defensive Hostility".

HOSTILITY AND CARDIOVASCULAR REACTIVITY

As previously noted, cardiovascular reactivity (CVR) has been proposed as a mechanism or marker which mediates behavioral influences in the development of coronary artery disease (Krantz & Manuck, 1984). In the following section, the relationship between CVR and hostility will be reviewed. This section will be subdivided into those studies which employed the Cook-Medley Hostility Inventory, other paper and pencil questionnaires, or the SI-derived measure of Potential-for-Hostility.

Cook-Medley Hostility and Cardiovascular Responses

Weidner et al (1989) evaluated both male and female undergraduates during a stressor involving unsolvable anagrams which were described as simple to solve. Regardless of gender, hostility scores were positively associated with both SBP and DBP during the task (Weidner et al, 1989). Subjects scoring high on hostility had higher anger scores, but anger did not mediate the

relationship between hostility and blood pressure reactivity. The authors suggested that describing the anagram as simple induced suspiciousness and mistrust in high hostile subjects which may have mediated the increased CVR rather than anger.

Suarez and Williams (1989) compared high and low hostile college males on CVR and affective responses to harrassment. High hostile men had increased DBP and longer SBP recovery times, and greater intensities of anger, irritation and tension during tasks which involved harrassment of the subject. High and low hostile men were not found to differ on tasks that did not involve harrassment. The anger ratings of high hostile men were positively correlated to blood pressure reactivity, whereas low hostile men exhibited no relationship between anger ratings and CVR. Thus anger appeared to mediate CVR in high hostile men. Results of this study suggests a personality-situation interaction, in which sufficient anger arousal is needed during a task to induce a differential response in CVR between high and low hostile individuals. Furthermore, Suarez and Williams (1989) also evaluated the Composite Hostility score (Subscales Hostile Affect, Cynicism, and Aggressive Responding; Barefoot et al, 1989). Similar results to the full-scale score were found but with greater F values, indicating that the Composite Hostility scale was a better predictor of cardiovascular responses to stress than the full-scale score.

This personality-situation interaction may explain the nonsignificant results found in a study by Sallis et al (1987) on

hostility and CVR. A total of 46 male and 30 female subjects (mean age = 36) were evaluated during mental arithmetic and cold pressor task. No significant relationships were found during either of the tasks, but the nonsignificant results for mental arithmetic may be explained by the lack of harrassment during this task. Further analyses did not indicate any gender by hostility interactions for CVR, though there were gender differences with males evidencing higher SBP baselines and SBP cold pressor responses.

Harrassment was used in two other studies which did not find a relationship between CVR and hostility (Anderson et al 1984; Smith and Houston, 1987). Smith and Houston (1987) evaluated 60 male undergraduates during mental arithmetic with harrassment and Stroop color word task. No significant relationship were found between hostility and cardiovascular responses, though state anger increased during the tasks. Anderson et al (1984) evaluated male college students during a Word Identification Task which included criticism of the subject by a confederate. Significant increases in cardiovascular responses and affect ratings were found during harrassment, but did not differentiate between high and low hostile subjects. This study was presented in a short abstract form and number of subjects was not reported. Thus it is unclear if this study had enough power to detect differences between high and low hostile subjects.

Other studies have found a positive relationship between hostility and CVR using personally relevant tasks instead of a task employing harrassment. Hardy and Smith (1988) evaluated 68 male

undergraduates who were randomly assigned to high or low conflict role plays. Low conflict involved role playing asking for directions from a stranger. High conflict involved situations such as role playing the return of a defective item to a reluctant sales-clerk. High hostile subjects had higher DBP reactivity to the high conflict role play, but not to the low conflict role play. Smith and Allred (1989) evaluated 36 male college students who were randomly assigned to debate either a pro or con position on several topics (e.g., abortion, capital punishment). Results indicated that high hostile subjects exhibited greater SBP and DBP responses when arguing a position during a debate than low hostile subjects.

Finally, Houston, Smith and Cates (1989) evaluated 60 male undergraduates during Stroop and a mental arithmetic task. Subjects were divided into 3 groups based upon cluster analysis of their responses on the Cook-Medley Hostility Inventory. Subjects intermediate in hostility scores evidenced the greatest SBP reactivity to the two tasks. Analyses of the items endorsed suggests that intermediate hostile subjects experience negative attitudes towards others but inhibit the expression of these feelings. This study suggests that the interaction between hostility and expression of anger may have a differential impact on cardiovascular responses to stress.

Other Self-Report Questionnaires and Cardiovascular Responses

Diamond et al (1984) evaluated 60 male undergraduate students for CVR using the Buss-Durkee Hostility Scale and the Framingham

Anger Expression scale. Those subjects who were classified as high hostile (N=29), had anger-out scores which correlated positively to both SBP and HR reactivity. Whereas these same high hostile subjects had anger-in scores that were negatively correlated to SBP and HR reactivity. Low hostile subjects (N=31) did not demonstrate any relationship between CVR and anger-in and anger-out. These results suggest that high hostile individuals who express rather than suppress their anger manifest higher CVR in response to stress.

Suarez and Williams (1990) have provided an additional explanation for the inconsistencies in relationships between hostility and CVR. Forty-five white males completed several questionnaires on hostility and took part in a laboratory task of anagrams either with or without harrassment. A factor analysis was undertaken of the hostility questionnaires. Two factors were obtained: an antagonistic hostility -- characterized by increased anger-out and decreased agreeableness -- and a neurotic hostility -- characterized by high neurotocism, anger-in, and the experience of anger. High antagonistic hostile subjects exhibited greater SBP reactivity and poorer SBP recovery during harrassment in comparison to subjects low on antagonistic hostility. Affect ratings of anger were correlated to mean SBP in the high antagonistic group but not in the low antagonistic group. This suggests that anger mediates SBP reactivity. Neurotic hostility was not related to cardiovascular responses. This study suggests that expressed hostility is related to CVR.

Structured Interview-Derived Potential-for-Hostility and CVR

One of the first studies using this measure examined the SI-derived Potential-for-Hostility and CVR in 50 male college students (Dembroski et al, 1978). Blood pressure and heart rate were averaged across three mental tasks (choice reaction time, video game, and difficult anagrams). Increased Potential-for-Hostility was positively correlated to both SBP and HR change scores.

These results are in contrast to Glass et al's (1983) findings. Fifty-six male volunteers (mean age = 41.6) underwent a mental arithmetic task (without harrassment) and a modified version of the Stroop color world test. SI derived Potential-for-Hostility scores had an inverse relationship to SBP and DBP change scores to either task. State anger during tasks had a positive correlation to SBP change scores (to both tasks). These results may be due to the lack of harrassment which precluded sufficient anger arousal in high hostile subjects. However, Dembroski et al (1978) also did not use harrassment of subjects, and it is unclear why these two studies find such contradictory results.

Summary

Twelve studies evaluated the relationship between CVR and hostility. Eight studies observed a positive relationship between hostility and CVR. It was demonstrated that sufficient anger arousal or personal relevancy is needed to differentiate cardiovascular responses in high and low hostile subjects (Hardy and Smith, 1988; Smith and Allred, 1989; Suarez and Williams, 1989;

1990). Two of the four studies that did not find a positive relationship did not use a harrassment condition (Glass et al, 1983; Sallis et al, 1987). Furthermore, it was demonstrated that antagonistic hostility is related to CVR rather than neurotic hostility (Suarez and Williams, 1990). It needs to be mentioned that only two of the twelve studies reviewed used women as subjects (Weidner et al, 1989; Sallis et al, 1987). It is unknown whether the relationship between hostility and CVR found for men holds for women, as they have rarely been evaluated.

The association between hostility and CVR is not consistent, thus suggesting either an association of a small magnitude or that there are other psychological and/or biological factors which differentiate high and low reactive hostile subjects. Specifically, the research proposed below will review whether the construct of defensiveness, in combination with hostility, is a better predictor of CVR than hostility alone (See Defensive Hostility section).

METHODOLOGICAL AND CONCEPTUAL CONSIDERATIONS

In the previous sections, associations between hostility-coronary artery disease and hostility-cardiovascular reactivity were examined. The majority of these studies assessed hostility by self-reports. Unfortunately, inconsistencies exist between trait self-report and actual behavior or physiological measurements (Parsons et al, 1969; Weinberger, Schwartz, & Davidson, 1979). This section will review three issues which may affect results

obtained from self-report questionnaires.

Issues Related to Defensiveness

Psychological studies that have evaluated personality traits may be confounded by factors related to defensiveness. Defensive individuals are characterized by a tendency to present themselves in a favorable, socially desirable manner, and are not candid and frank when completing questionnaires, which could result in lowered hostility scores. It has been demonstrated that self-report measures given in a public situation in comparison to anonymous situations, are answered in a more socially desirable manner (Paulhus, 1984). A recent study evaluated 204 healthy male job applicants for a number of personality traits (Carmody et al, 1989). The mean Cook-Medley hostility score was 8.4 for these male job applicants which is considerably lower than scores obtained from a national survey (ranging from 17.3 to 25.2 depending upon the age group examined; Barefoot et al, 1991), which leaves considerable doubt concerning the validity of this study. A similar problem was observed in McCranie et al's study (1986), in which hostility scores were obtained from students during a medical school admission interview. Hostility scores were lower than other studies, and it is not surprising that in this study no relationship was demonstrated between hostility and future development of CAD.

The Cook-Medley Hostility Inventory is negatively correlated with defensiveness as measured by the Marlowe-Crowne Social

Desirability scale. Increased defensiveness is related to decreased hostility in undergraduate students (Fontana et al, 1989; Smith and Frohm, 1985) and in coronary patients (Helmers et al, 1991). The wide range of correlations reported between hostility and defensiveness suggests that in the studies previously reviewed, the impact of defensiveness varies with the population studied. Thus, inconsistencies in results between hostility and CAD/CVR may be partially due to different levels of defensiveness in the populations studied (See also Defensive Hostility section).

Issues Related to Measurement of Hostility

It has been suggested that the Cook-Medley Hostility Inventory measures several components of hostility, only some of which are related to CAD and CVR. The Cook-Medley Hostility Inventory is highly correlated with neuroticism (r=.50, Suarez and Williams, 1990), which is a measure of anxiety, depression, and anger. Several studies have demonstrated that neuroticism is related to symptom reporting of CAD (e.g., angina) but is not associated with objective clinical endpoints such as myocardial infarction or obstruction of coronary arteries (Belgian-French Pooling Project, 1984; Costa and McCrae, 1987). Thus nonsignificant associations between hostility and CAD/CVR may be due to sampling subjects who are high on neuroticism rather than the hostility associated with CAD/CVR. This was demonstrated by Suarez and Williams' (1990) study in which neurotic hostility was inversely related to cardiovascular responses whereas antagonistic hostility was

positively associated with cardiovascular reactivity. Similarly, Siegman et al (1987) demonstrated that neurotic hostility was inversely related to severity of atherosclerosis, whereas reactive hostility (displaying of anger) was positively related to severity of atherosclerosis. These studies suggest that if the neurotic component was removed from the Cook-Medley Hostility Inventory, greater associations may be found between the revised hostility questionnaire and CAD/CVR.

The Composite Hostility score (Barefoot et al, 1989) appears to be a subscale of the Cook-Medley Hostility Inventory which is not associated with neuroticism. Composite Hostility is composed of three subscales entitled Hostile Affect, Cynicism, and Aggressive Responding. Composite Hostility scores were demonstrated to be better predictors of mortality (Barefoot et al, 1989) and better predictor of cardiovascular responses (Suarez & Williams, 1989) than full-scale Cook-Medley scores. In coronary patients, Composite Hostility was associated with exercise-induced ischemia, whereas the full-scale score was not significantly associated with exercise ischemia (Helmers et al, 1993). Thus, the Composite Hostility subscale may be more sensitive than the full-scale score for detecting associations between hostility and CAD/CVR.

Issues Related to Gender

There are gender differences in the clinical development and presentation of CAD and in CVR and these differences may affect

results obtained in studies in this area. Specifically, the diagnosis of CAD is on average 10 years later in women than men, and women are on average 20 years older than men for the occurrence of myocardial infarctions (Lerner & Kannel, 1986). Angina as the initial presentation of CAD occurs more frequently in women than men, however comparing cardiac catheterization results, women with angina manifest less coronary artery obstruction than men with angina (Kennedy et al, 1982). In general, women are at lesser risk for coronary disease mortality when compared to men. However, once CAD is present, women are at equal or greater risk of mortality (Lerner & Kannel, 1986).

There are three major hypotheses about why women are at lowered risk for the development of CAD and overall CAD mortality: 1) men engage in behaviors that are more health damaging than women, 2) hormonal factors protect women from CAD, and 3) the interaction of behavioral and hormonal factors are less damaging to women (Wingard, Suarez, & Barrett-Connor, 1983; Matthews, 1989). Nevertheless, when standard risk factors (smoking, alcohol consumption, cholesterol levels) are adjusted in analyses, men continue to be at greater risk for CAD endpoints (Wilhelmsen et al, 1977; Woodbury et al, 1981). Thus, the standard risk factors do not fully explain the sex differential in morbidity and mortality. It is believed that women are protected by their hormonal profile until they reach menopause, and one such mechanism is that the hormonal profile attenuates cardiovascular responses to stress in women when compared to men (Wingard, Suarez, & Barrett-Connor,

1983; Matthews, 1989).

A recent meta-analytic review on gender differences in cardiovascular responses to stress was performed by Stoney, Davis, and Matthews (1987). In accordance with the hypothesis that women exhibit attenuated cardiovascular responses to stress, men demonstrated significantly higher SBP baselines, and higher SBP changes to stress. Women on the other hand, had higher baseline HR's, but only exhibited marginally higher HR changes to stress. DBP was not significantly different for gender. Thus it appears that women have attenuated cardiovascular responses to stress.

An alternative explanation for the attenuated cardiovascular stress responses in women as compared to men, is the lack of personal relevancy of the stressor tasks for women. Stoney et al (1988) evaluated two tasks which were classified a priori as a male-relevant task (mental arithmetic) and a female-relevant task (public speaking). Males had significantly greater blood pressure reactivity (SBP & DBP) to all tasks, and rated themselves as trying harder than the females on the math task. Females had significantly greater HR increases during the speech task, and both males and females rated the speech task as requiring more feminine attributes (requiring more emotion, empathy, and submissiveness). Matthews and Stoney (1988) evaluated males and females during mental arithmetic and star tracing. Males had increased blood pressure reactivity during both stressors. Females outperformed males on the star tracing task, but demonstrated increased heart rates during the math task (previously designated a male task).

This study suggests that performance on a task (e.g., star tracing) does not explain gender differences found for CVR.

Relationships among gender, hostility, and CAD/CVR have rarely been evaluated. Women are less hostile than men (Barefoot et al, 1991; Blumenthal et al, 1987; Helmers et al, 1993), but it is unknown if the relationships between hostility and CAD/CVR found in men also holds for women. Only three studies evaluating hostility and CAD studied women, and two of these were longitudinal studies on women. In one, aggression was not predictive of the development of CAD (Hallstrom et al, 1986) and in the other suppression of anger rather than expression of anger was predictive of CAD development (Haynes et al, 1980). A third study evaluated women with CAD and found a positive relationship between Composite Hostility and severity of thallium exercise-induced ischemia (Helmers et al, 1993). In studies evaluating hostility and CVR, only two of the studies reviewed included women as subjects, though neither of these studies evaluated women separately from men (Sallis et al, 1987; Weidner et al, 1989). Thus the relationships between hostility and CAD and hostility and CVR in women are unknown.

In sum, women develop CAD at a later age than men and standard risk factors are unable to explain all the variance in gender differences. One possible mechanism by which women develop CAD later is that women have decreased cardiovascular responses during stress. This appears to be the case because men continue to have greater blood pressure responses even when a task is a feminine

task, and despite the fact that women outperform men on certain tasks. However, at times women do have greater HR responses to stressors: in one study, speech (feminine task) elicited greater HR responses, and in the other study, math (masculine task) elicited greater HR responses. Thus the classification of a task as feminine or masculine does not always provide consistent results in cardiovascular responses, and the proposed research will use both a math and a speech task. Accordingly, the research proposed here will examine both men and women in a controlled laboratory session on cardiovascular responses to stressors. Gender differences will be examined for cardiovascular responses, hostility scores and other psychosocial variables, and for differential cardiovascular responses in hostile men and women.

DEFENSIVE HOSTILITY

We have noted that associations between hostility and CAD/CVR are not invariable, and that the strength of these associations may depend on the sample studied and the hostility measure used. It is therefore reasonable to suggest that hostility in combination with other psychosocial variables may be better predictors of CAD/CVR than the assessment of hostility alone. Specifically, defensiveness (measured by the Marlowe-Crowne Social Desirability scale, MC) in combination with hostility (measured by the Cook-Medley Hostility Inventory, Ho) may identify a subgroup of individuals who demonstrate the greatest associations between CAD and CVR. Defensiveness is defined as the conscious or unconscious

tendency not to report socially undesirable aspects of oneself, the concern with a positive self-representation, and the need to be viewed in a positive manner by others (Crowne & Marlowe, 1964; Paulhus, 1984). The combination of hostility and defensiveness depicts four groups: Defensive Hostile (high Ho, high MC), High Hostile (high Ho, low MC), Low Hostile (low Ho, low MC), and Defensive (low Ho, high MC). The Defensive Hostile subject is of particular interest, and is characterized by a hostile, cynical view of the world, and the expectations of negative intentions by others. Yet, the Defensive Hostile subject wants to be viewed in a positive manner by others, and is concerned with a positive self-representation, despite a negative attitudinal set.

Two recent studies have examined associations between Defensive Hostility and physiological parameters. Those subjects classified as Defensive Hostile demonstrated the most severe ischemia in a group of coronary patients, and Defensive Hostility was associated with increased cardiovascular reactivity in healthy males when compared to other hostility styles (Helmers et al, 1991; Jamner et al, 1991). It may be that by taking this personality construct into account, some inconsistencies in the reported relationship between hostility and CAD/CVR may be resolved. These two studies are examined in greater detail below.

Defensive Hostility and Myocardial Ischemia

In two independent samples of coronary patients, the interaction between hostility and defensiveness was examined for

its impact on myocardial ischemic activity (Helmers et al, 1991). In one study, thirty-two male coronary patients underwent two randomly administered stressors: mental arithmetic with harrassment and a public speech about personal faults. The dependent measure was echocardiographic abnormal wall motion scores, which are indicative of presence and severity of myocardial ischemia. Median splits on Ho and MC were performed: Low Hostile (low Ho, low MC), High Hostile (High Ho, low MC), Defensive (low Ho, high MC), and finally Defensive Hostile (high Ho, high MC). Results indicated that Defensive Hostile patients exhibited the worst wall motion scores, especially during speech, while Defensive patients (low Ho, high MC) exhibited the least wall motion abnormalities during the stressors (See Figure 1).

These results were replicated using a second independent sample of coronary patients (See Figure 2). Seventy-nine coronary patients underwent exercise thallium tomography which measures severity of ischemic perfusion defects during exercise. Greater perfusion defects are indicative of more severe ischemia. In multiple regression analyses, the interaction between hostility and Marlowe-Crowne added marginally significant variance ($p=.06$) to the variance obtained by gender, Ho, and MC. Inspection of the means (See Figure 2) indicated that Defensive Hostile coronary patients had the worst perfusion defects and Defensive patients had the least perfusion defects.

A subset of these coronary patients (N=39) underwent ambulatory monitoring for ischemia during activities of daily life.

Dependent variables for ambulatory monitoring are total minutes of ischemia, frequency of ischemic episodes, and maximum ST depression obtained during 24 hours of monitoring. Three separate multiple regressions were performed for each of the dependent variables. The interaction between hostility and defensiveness added significant variance to the variance obtained by gender, Ho, and MC for total minutes of ischemia ($p=.02$) and marginally for frequency of ischemic episodes ($p=.07$). Inspection of means indicated that Defensive Hostile patients had the greatest total minutes of ischemia and the most frequent ischemic episodes during activities of daily living. Defensive patients appeared to have the least frequent ischemic episodes and were intermediate in total minutes of ischemia during activities of daily life.

To summarize, the Defensive Hostility style (the combination of Ho and MC) is correlated with severity of CAD activity. In two independent CAD patient populations, and using three separate methods for measuring ischemia, Defensive Hostile coronary patients exhibited the worst ischemia as measured by wall motion abnormalities during stressors, thallium perfusion defects during exercise testing, and longer duration and possibly more frequent episodes of ischemia during activities of daily life.

Defensive Hostility and Cardiovascular Responses

Jamner et al (1991) examined 33 male paramedics in a field study using ambulatory blood pressure monitors. Median splits on Ho and MC were performed to obtain the following four groups: Low

Hostile (low Ho, low MC), High Hostile (High Ho, low MC), Defensive (low Ho, high MC), and finally Defensive Hostile (high Ho, high MC). The Defensive Hostile paramedics exhibited the greatest HR reactivity upon returning to the hospital with a patient, but not during the ambulance run, nor when resting quietly (See Figure 3). A similar trend was found for DBP. The other hostility styles, Low Hostile, High Hostile, and Defensive exhibited cardiovascular responses very similar to one another and had markedly lower responses than the Defensive Hostile subjects. These results were interpreted to suggest that the return to the hospital was a time of interpersonal conflict which induced higher HR's and possibly DBP's in Defensive Hostile subjects.

Defensive Hostility and Inconsistent Results for Hostility and CAD/CVR Associations

As reviewed previously, studies of associations between hostility and CAD and hostility and CVR have not yielded entirely consistent results and the Defensive Hostile personality style may provide an alternative explanation for these inconsistencies. Specifically, the populations sampled may differ as to their defensiveness scores. As previously described (Helmers et al, 1991; Jamner et al, 1991) when hostility scores were further subdivided into high and low Marlowe-Crowne categories, results for cardiovascular responses and myocardial ischemia differentiated these four groups. Defensive Hostile (high Ho, high MC) subjects exhibited the greatest HR and DBP's in a field study of paramedics,

and Defensive Hostile coronary patients exhibited the worst ischemia during stress in a laboratory session, exercise ischemia, and during activities of daily life. In comparison, the other hostility styles (High Hostile, Low Hostile, and Defensive) had considerably lower HR's and DBP's in a field study of paramedics. Similar results were found for myocardial ischemia in the coronary patients; High Hostile, Low Hostile, and Defensive subjects exhibited considerably less frequency of ischemic episodes, and total minutes of ischemia during activities of daily living, and less ischemia during thallium exercise and during stressors in a laboratory session.

It is suggested then, that the Defensive Hostility construct may explain some of previous research's nonsignificant associations between hostility and CAD/CVR. For example, main effects for hostility are obtained when there are a substantial amount of subjects who score high on both Cook-Medley Hostility Inventory and Marlowe-Crowne. When the sample is skewed so that the majority of high hostile subjects are low on their Marlowe-Crowne scores then insignificant results may be obtained.

How Might Defensive Hostility be Harmful?

At present it is not clear how Defensive Hostility could affect behavior and/or pathophysiological processes. Since previous research has not examined the relationships between Defensive Hostility and other psychosocial variables, the present research examined the personality correlates of Defensive Hostility

in order to characterize the Defensive Hostile subject. To provide a rationale for this work, consideration of how Defensive Hostility may be related to the expression of anger, ambivalence of feelings, deception of others, and social support is provided.

Expression of anger. As reviewed previously, Cook-Medley Hostility appears to be associated with both the suppression and expression of anger, and more frequent angry episodes (Smith & Frohm, 1985; Suarez and Williams, 1990). It is hypothesized that Defensive Hostile subjects might experience frequent angry episodes, but due to their defensiveness will suppress the expression of this anger in order to continue to be viewed in a favorable manner by others. High Hostile subjects, unencumbered by restrictions of defensiveness or positive self-representation, will not suppress the expression of anger, but will express their anger outwardly.

It was previously reported that suppression of anger was related to the development of CAD in intially healthy populations (Haynes et al, 1980), and that high hostile subjects who suppressed their anger demonstrated the greatest number of obstructed vessels (Dembroski et al, 1985). When evaluating studies on CVR, Houston, Smith & Cates (1989) demonstrated that hostile individuals who endorsed suppression of anger items exhibited the greatest cardiovascular responses during Stroop and a math task. Furthermore, Mills, Schneider, and Dimsdale (1989) evaluated Spielberger's Anger Expression Scale in 40 healthy males during a mental arithmetic stressor. In this study, Anger-out was

negatively related to HR reactivity suggesting that the more one expresses anger the decreased responsivity to stress. Thus, the relationship between suppression of anger and CAD/CVR has not been a consistent one in prior research. It is hypothesized that Defensive Hostile subjects will report the greatest suppression of anger.

Ambivalent feelings. In one study, high hostile subjects demonstrated increased feelings of self-worth, self-criticism, and dependency upon others (Fontana et al, 1989) that were interpreted to suggest that high hostile subjects are conflicted about their desire to oppose others. It is suggested that this is a valid statement only for high hostile subjects who are also high on defensiveness. It is hypothesized that Defensive Hostile subjects feel greater ambivalence and conflict than the other Defensive Hostility styles. Defensive Hostile subjects have a negative attitudinal set, see the world as intending them harm, and frequently feel angry, yet they are concerned with behaving in a socially appropriate manner, and being viewed in a positive way. It is hypothesized that of all the hostility styles, Defensive Hostile subjects may experience the most ambivalence or conflict about the expression of feelings, especially negative feelings.

Other-deception versus self-deception. The Marlowe-Crowne Social Desirability Scale measures a complex set of constructs. It was originally designed to measure social conformity or tendency to behave in socially desirable ways (Crowne & Marlowe, 1964), and then it was viewed as measuring affect inhibition and repressive

defensiveness as a means of protection of self-esteem (Wiesenthal, 1974). Currently, most investigators believe that the Marlowe-Crowne questionnaire measures both self-deception and other-deception (Paulhus, 1984). Self-deception occurs when the individual actually believes their self-reports, it is an unconscious positive self-representation. Self-deception items which are denied by self-deceptors are behaviors or thoughts which occur but are psychologically threatening (i.e., "Have you ever doubted your sexual adequacy?"). Other-deception refers to deliberate false representation in order to be viewed in a socially desirable manner. Items endorsed for other-deception reflect behaviors which are socially desirable but do not always occur (i.e., "I am always courteous, even to people who are disagreeable"). Paulhus (1984) factor analyzed several different questionnaires including the Marlowe-Crowne to obtain 20 items which loaded on either self-deception or other-deception. These 20 items will be used in the proposed research to further characterize Defensive Hostility. It is hypothesized that other-deception will better characterize the Defensive Hostile individual than self-deception items.

Social support. As reviewed previously, Cook-Medley Hostility appears to be inversely correlated with amount of social support (Smith & Frohm, 1985; Hardy & Smith, 1988), though nonsignificant associations between these constructs have been also found among middle-aged women (Houston & Kelly, 1989). Previous research has also demonstrated that decreased social support is implicated in

the development of illness and mortality (Berkman & Syme, 1979; House et al, 1982) and it was postulated that hostility may be the common link between the development of disease endpoints and social support systems. It is hypothesized here that Defensive Hostile individuals, in comparison to High Hostile, Low Hostile and Defensive individuals, will report the least number of social supports. The Defensive Hostile individual's small support system may be evident in spite of their attempts to be viewed in a positive, socially desirable manner.

CONCLUDING REMARKS AND OVERVIEW OF PROPOSED STUDIES

It is suggested that the differentiation of hostility into hostility styles by the Marlowe Crowne Social Desirability Scale will add significantly into the understanding of the associations between hostility and CAD/CVR. The purpose of the two studies proposed here are: 1) to evaluate the psychosocial correlates which are associated with Defensive Hostility, and 2) to examine in a controlled laboratory session the hypothesis that Defensive Hostile subjects will exhibit increased cardiovascular responses in comparison to other hostility styles.

Study I evaluates the psychosocial correlates (anger suppression, ambivalent feelings) which are associated with Defensive Hostility. Study II is a laboratory study on cardiovascular responses which incorporates two stressors and examines Defensive Hostile subjects' cardiovascular responses. It is hypothesized that Defensive Hostile subjects: (1) will exhibit

the greatest cardiovascular responses to stress; (2) will feel more ambivalent and conflicted about the expression of feelings, suppress their anger more frequently, will be characterized by other-deception rather than self-deception and will report the least number of social supports.

HYPOTHESES

Study I - Psychosocial Correlates

1.1 Defensive Hostility (measured by Cook-Medley Hostility Inventory and Marlowe-Crowne Social Desirability) will be associated with suppression of anger while High Hostility will be associated with expression of anger as measured by Spielberger's (1985) Anger Expression scale.

1.2 Defensive Hostile subjects in comparison to Low Hostile, High Hostile, and Defensive subjects, will exhibit the greatest ambivalence over emotional expression as measured by the Ambivalence over Emotional Expression questionnaire (King & Emmons, 1990).

1.3 Defensive Hostility will be associated with other-deception rather than self-deception as measured by the self- and other-deception self-report items (Paulhus, 1984).

1.4 Defensive Hostile subjects in comparison to Low Hostile, High Hostile, and Defensive subjects, will report the least number of social supports.

Study II - Laboratory Study

2.1 Defensive Hostile subjects will exhibit greater cardiovascular responses to stress than will Low Hostile, High Hostile, and Defensive subjects.

2.2 Men, in comparison to women, will exhibit greater SBP baselines, lower HR baselines, and greater SBP responses to stressors.

STUDY I - PSYCHOSOCIAL CORRELATES OF DEFENSIVE HOSTILITY

Overview and Design

This study examines the relationships between Defensive Hostility and other psychological traits. The design is a 2 x 2 factorial with high/low Cook-Medley Hostility Inventory and high/low Marlowe-Crowne Social Desirability scores as between factors. The psychological trait scores serving as dependent variables included: trait anger, Anger-in, Anger-out, total expression of anger, ambivalence over emotional expression, emotional expressiveness, Self-Deception, Other-Deception, Self-Monitoring and social support.

Experimental Protocol

Subjects. A total of 145 subjects (72 males and 73 females) were recruited by newspaper advertisement. Seventy-seven subjects completed solely a battery of questionnaires and 68 subjects completed the battery of questionnaires and also participated the laboratory session of Study II.

Questionnaires

The following questionnaires were completed by the subjects:

Cook-Medley Hostility Inventory. This is a fifty item true/false questionnaire. The questionnaire contains 5 subscales which reflect negative attitudes towards life: Cynicism, Hostile Affect, Hostile Attitude, Aggressive Responding and Social Avoidance (Barefoot et al, 1989). A Composite Hostile score is obtained from the summation of Cynicism, Hostile Affect, and Aggressive Responding.

Marlowe-Crowne Social Desirability Scale. This is a 33 item true/false questionnaire which measures Defensiveness. Items reflect socially desirable behaviors or cognitions which are virtually untrue of most people (Crowne & Marlowe, 1964). Defensiveness is defined as the conscious or unconscious tendency not to report socially undesirable aspects of oneself, the concern with a positive self-representation, and the need to be viewed in a positive manner by others (Crowne & Marlowe, 1964; Paulhus, 1984).

The study dependent measures consist of the following:

Trait Anger. This is a 15 item subscale from the State-Trait Anger Scale which measures individual differences in anger proneness as a personality trait (Spielberger et al, 1985). Scores can range from 15-60.

Anger Expression Scale. This 20 item questionnaire is comprised of two subscales: 1) Anger-in or how often angry feelings are experienced but not expressed (known as anger suppression) and 2) Anger-out or the extent that an individual engages in aggressive behaviors when motivated by angry feelings, or the expression of anger towards other persons or the environment (Spielberger et al, 1985).

Self-Deception and Other-Deception Questionnaire (SDQ and ODQ). This 20 item true/false questionnaire contains two factors of 10 items each, measuring 1) Self-deception - where subjects believe their positive self-reports and 2) Other-deception - where subjects are conscious of misrepresenting themselves in a positive

manner (Paulhus, 1984).

Ambivalence over Emotional Expression (AEQ). This is a 28 item questionnaire measuring ambivalence or conflict about the expression of feelings which reflect either positive or negative emotions. Items reflect both inhibition or wanting to express but not being able to, and rumination which encompasses expressing but then later regretting it. Scores for individual items range from 0 ("never feels this way") to 5 ("frequently feels this way") (King & Emmons, 1990).

Emotional Expressiveness Questionnaire (EEQ). A 16 item questionnaire which measures the actual expression of both positive and negative emotions. The rating scale for individual items range from 1 to 7, with 1 indicating no agreement and 7 indicating a strong agreement with the item (King & Emmons, 1990).

Self-monitoring of Expressive Behavior (SM). A 25 item true/false questionnaire. Items reflect self-presentation which are controlled by situational cues for social appropriateness (Snyder, 1974).

Social Support. A 40 item true/false questionnaire with items reflecting the perceived social resources or supports available to an individual (Cohen et al, 1985).

Power Analysis

To determine the sample size needed for this study, a power analysis was done based on existing studies using Cook-Medley Hostility and other questionnaires. The following studies

demonstrated moderate to large correlations between Cook-Medley Hostility and other psychosocial variables: Hostility and Spielberger's Anger-in (r=.48, Suarez and Williams, 1990; r=.29, Smith and Frohm, 1985); Hostility and Spielberger's Anger-out (r=.41, Suarez and Williams, 1990, r=.42 Smith and Frohm, 1985); Hostility and Spielberger's trait anger (r=.61, Smith & Frohm, 1985). No studies were found which evaluated Cook-Medley Hostility and ambivalence over emotional expression, emotional expressiveness, and self- and other-deception.

The use of a .40 correlation to calculate the sample size needed is a conservative estimate. A significance criterion of α = .05 and a eighty percent probability of rejecting the null hypothesis (power) was used to calculate the necessary number of subjects (Cohen, 1977). Using a .40 correlation as the criterion, a sample of 72 subjects has a 97 percent probability of rejecting the null hypothesis, whereas a .30 correlation as the criterion, has an 83 percent probability of rejecting the null hypothesis. To summarize, a minimum of 72 subjects allows for enough power to detect moderate associations of .30 or greater.

Statistical Analyses

To determine the psychosocial correlates of Defensive Hostility, a series of 2 x 2 x 2 multivariate analysis of variance (MANOVA) were conducted using the independent variables of high/low Hostility, high/low Defensiveness and gender as the between subjects factors. The dependent variables were trait anger, Anger-

in, Anger-out, self-deception, other-deception, ambivalence over emotional expression, expression of emotion, self-monitoring and social support. To evaluate possible interactions between Hostility, Defensiveness, and gender, a series of 2 x 2 x 2 (high/low Hostility, high/low Marlowe/Crowne and gender) ANOVA's were conducted on the dependent variables. In addition, the inter-relationships between Hostility, Anger-in and Anger-out were examined by Pearson Product moment correlations.

RESULTS - STUDY I

A total of 145 (72 male and 73 female) subjects completed a battery of personality questionnaires. These subjects either completed the questionnaires by mail (N=77: male = 38 and female = 39) or participated in the laboratory study on cardiovascular responses to stress (i.e. study II; N=68: male = 34 and female = 34). Recruitment differences occurred in that male and female subjects who were ineligible to participate in the laboratory study (Study II) were given the option to complete the battery of questionnaires (Study I). Subjects were excluded from the lab study if they smoked, were older than 45 years of age or were on any medications which could alter cardiovascular or affect ratings. In addition, females were excluded from the lab study if they were on birth control pills, could not be scheduled during days 5-11 of their menstrual cycle, or had a hysterectomy. Due to recruitment differences between Study I and Study II, additional analyses examined the two subsamples separately (See section entitled

"Internal Analyses of Study I").

Gender differences were initially examined for Cook-Medley Hostility and Marlowe-Crowne Social Desirability scores in the total sample of subjects. Gender differences were demonstrated for full-scale Hostility ($F[1,143]=7.6$, $p<.01$) and Composite Hostility ($F[1,143]=8.8$, $p<.01$), but not for Defensiveness. Inspection of the means (see below) indicated that male subjects reported greater Hostility and Composite Hostility scores in comparison to females.

To classify subjects into the four Defensive Hostility groups, the median score for each gender for Hostility and Defensiveness was used as a cutpoint. Male subjects with Cook-Medley Hostility scores greater than or equal to 22 comprised the high hostility group, and less than 22 comprised the low hostile group. Female subjects with Hostility scores greater than or equal to 18 were defined as high hostile, and less than 18 comprised the low hostile group. Marlowe-Crowne Social Desirability scores greater than or equal to 14 were classified as high defensive, and less than 14 low defensive. These cutpoints allowed each gender to be well-represented within each group: Defensive Hostile (DH - high Hostility and high Defensiveness), Low Hostile (LH - low Hostility and low Defensiveness), High Hostile (HH - high Hostility and low Defensiveness), and Defensive groups (Def - low Hostility and high Defensiveness).

Table 1A and 1B presents the demographic characteristics of the four groups. No significant differences between the groups were observed for age, gender, race (white versus other), education

(some college, college degree, graduate work), marital status (married versus single/divorced), regular exercise (Yes/No) and parental history of hypertension, coronary artery disease, diabetes and cancer.

Defensive Hostility and Other Personality Measurements

Three 2 x 2 x 2 MANOVA's were conducted with high/low Hostility, high/low Defensiveness, and gender as between-subjects factors. Based on the type of personality dimension being assessed, the personality measures were grouped in the following manner: measurements related to anger which included trait anger, Anger-in, Anger-out and total anger expressed; measurements related to the expression of emotion which included ambivalence over emotional expression, and the expression of positive, intimate and negative emotions; and measurements related to deception which included Self-Deception, Other-Deception, and Self-monitoring. Social supports was analyzed separately by univariate ANOVA. The mean personality scores for both male and female subjects for the four groups are presented in Table 2A.

For the anger measurements, results indicated significant main effects for Hostility ($F[1,136]=16.0$, $p<.01$) and Defensiveness ($F[1,136]=9.0$, $p<.01$), and a significant interaction for Hostility x anger measure ($F[3,408]=5.8$, $p<.01$). No other significant interactions occurred. For the expression of emotion measurements, results indicated significant main effects for Hostility ($F[1,136]=12.7$, $p<.01$), Defensiveness ($F[1,135]=5.3$, $p<.05$), and

gender ($F[1,136]=3.0$, $p<.09$) and significant interactions for Hostility x expression of emotions measure ($F[3,408]=8.7$, $p<.01$, Defensiveness x expression of emotions measure ($F[3,408]=12.5$, $p<.01$), and gender x expression of emotions measure ($F[3,408]=2.2$, $p<.09$). For the deception measures, a significant main effect occurred for Defensiveness ($F[1,136]=6.9$, $p=.01$) and a significant interaction for Defensiveness x deception measure ($F[2,272]=38.9$, $p<.01$). Due to the significant main effects and interactions found in the above analyses, individual univariate ANOVA's were conducted on the dependent measures using high/low Hostility, high/low Defensiveness and gender as between-subjects factors.

Significant main effects for Hostility were observed for AEQ ($F[1,136]=11.2$, $p<.01$), Neg ($F[1,136]=5.7$, $p<.05$), trait anger ($F[1,136]=22.9$, $p<.01$), Anger-out ($F[1,136]=8.1$, $p<.01$), Anger-in ($F[1,136]=10.6$, $p<.01$), SDQ ($F[1,136]=9.8$, $p<.01$), and ODQ ($F[1,136]=8.3$, $p<.01$). Inspection of these means indicated that subjects with greater hostility scores also reported greater ambivalence over emotional expression, greater trait anger, Anger-out and Anger-in, greater expression of negative emotion, and less Self-Deception and Other-Deception.

Significant main effects for Defensiveness were demonstrated for Other-deception ($F[1,136]=35.5$, $p<.01$), Self-Deception ($F[1,136]=8.8$, $p<.01$), trait anger ($F[1,136]=7.4$, $p<.01$), Anger-out ($F[1,136]=4.1$, $p<.05$), AEQ ($F[1,136]=5.4$, $p<.05$), and Int ($F[1,136]=4.2$, $p<.05$). Inspection of these means indicated that high defensive subjects reported greater other-deception, self-

deception, greater expression of intimate emotions, less ambivalence over emotional expression, less trait anger, and less Anger-out.

Significant main effects for gender were observed for ODQ ($F[1,136]=4.7$, $p<.05$), AEQ ($F[1,136]=3.3$, $p<.08$), Int ($F[1,136]=5.4$, $p<.05$), and Pos ($F[1,136]=11.3$, $p<.01$). Inspection of these means indicated that women in comparison to men expressed greater positive and intimate emotions, are less ambivalent over emotional expression, and are less deceptive of others.

A marginal Defensiveness x gender interaction occurred for SDQ ($F[1,136]=3.2$, $p<.08$). Inspection of these means indicated that there was no difference in SDQ scores for low and high defensive males, whereas in females there was a positive relationship between Defensiveness and self-deception. There were no other significant interactions. Pertinent to the research question examining personality characteristics of DH, no significant interaction between Hostility and Defensiveness was observed for any of the personality measures.

The analyses reported above included two groups of subjects: Those who only completed the battery of questionnaires by mail and those who participated in a laboratory study which involved assessment of cardiovascular responses as well as the personality questionnaires. As previously stated, the same recruitment criteria were not used to establish these two groups and recruitment differences may have affected the obtained results. In addition, obtained associations may be dependent on the scale score

cutpoints chosen to classifiy subjects as Defensive Hostile. Accordingly, the possibility of biases due to recruitment differences are evaluated in the section below.

Internal Analyses of Study I

The two groups (questionnaire only vs. laboratory participation) were evaluated for differences on demographic characteristics and the major independent variables of Cook-Medley Hostility and Marlowe-Crowne Social Desirability scores. In female subjects, a significant difference was demonstrated for subjects on birth control pills ($p<.01$) with 14 females on birth control pills participating in the questionnaire study and no females on birth control pills in the laboratory study. No other differences were found for race, marital status (married vs single/divorced), education (some college or less, college, some graduate or more), smoking, age, exercise regularly (yes/no), and the independent variables of Hostility and Defensiveness. In male subjects, significant or near significant differences were found for exercising regularly ($p=.04$), smoking ($p=.06$), age ($p=.09$), and Defensiveness scores ($p=.09$). Male subjects who participated in the laboratory study had a greater proportion of subjects who exercised regularly (77% versus 50%), did not smoke (0% versus 17%), were younger (28.4 versus 32.1 years), and reported lower Defensiveness scores (13.1 versus 15.0). No differences were found for race, marital status, education, and Hostility scores. These results suggest that there were differences between the two groups

in the demographic composition.

Due to the differences in the demographic characteristics of the two subsamples, the previously described analyses were repeated treating each subsample separately. In contrast to results obtained in the subsample of subjects who solely completed the questionnaires, several significant Hostility by Defensiveness interactions were observed in the analyses of the questionnaires of the subjects who participated in the laboratory study. These analyses are presented in the section below.

Defensive Hostility and other personality traits in the laboratory study sample. As in the case of the previous analyses, three 2 x 2 x 2 MANOVA's were conducted with high/low Hostility, high/low Defensiveness, and gender as between-subjects factor (See Study II for demographic characteristics and classification of subjects into Defensive Hostility groups). As before, the dependent personality measures were grouped into anger measurements, expression of emotion measurements, and deception measurements (See section above). The mean personality scores for both male and female subjects for the four groups are presented in Table 2B. The following analyses will only report those significant Hostility x Defensiveness interactions.

Results indicated a significant four-way interaction of Hostility x Defensiveness x gender x anger measure ($F[3,180]=5.5$, $p<.01$), and a significant Hostility x Defensiveness x gender x emotional expression measure ($F[3,180]=4.6$, $p<.01$). In order to understand these four-way interactions, individual univariate

ANOVA's for each questionnaire/subscale were undertaken. Only the significant or near significant Hostility by Defensiveness interactions are reported here as the significant main effects for Hostility and Defensiveness replicates the previous analyses on all subjects.

Significant or near significant Hostility x Defensiveness X gender interactions occurred for AEQ ($F[1,60]=5.1$, $p<.05$), total anger expressed ($F[1,60]=5.3$, $p<.05$), Anger-in ($F[1,60]=11.7$, $p<.01$), and Int ($F[1,60]=3.0$, $p=.09$). In order to understand these significant three-way interactions, males and females are evaluated separately.

Among male subjects, significant or near significant interactions between Hostility and Defensiveness were observed for AEQ ($F[1,30]=3.6$, $p<.07$), Pos ($F[1,30]=3.2$, $p<.09$), Int ($F[1,30]=6.5$, $p<.02$), Angtot ($F[1,30]=3.3$, $p<.08$), Anger-in ($F[1,30]=12.3$, $p=.001$) and reported number of social supports ($F[1,30]=6.6$, $p<.02$). Inspection of the means (see Table 2B) indicated that DH male subjects had the greatest ambivalence over emotional expression, expressed the least positive and intimate emotions, expressed the least total anger, reported greater suppression of anger and the least social supports. Unlike the results reported for males, no significant Hostility by Defensiveness interactions were observed in females.

These significant associations between Defensive Hostile groups and psychosocial variables in males who participated in the laboratory study suggests that either the demographic

characteristics of the sample or the cutpoints for Defensiveness may have affected the results. In the following section, the personality characteristics of the subjects in the total sample are reanalyzed using the cutpoints for Defensiveness and Hostility of the laboratory study in order to reclassify subjects into the four groups.

Reanalyses of Study I using different scale cutpoints. Subjects were re-classified into the four groups using the cutpoints of 13 and 21 for Defensiveness and Hostility, respectively. The three MANOVA's from the previous analyses were repeated using high/low Hostility, high/low Defensiveness and gender as between-subjects factors. The anger measurements, expression of emotion measurements, and deception measurements were the within-subjects factors. Only significant interactions between Hostility and Defensiveness are reported here. Results indicated significant interactions for Hostility x Defensiveness x gender x anger measure ($F[3,408]=5.8$, $p<.01$), and for Hostility x Defensiveness x gender x emotional expression measure ($F[3,408]=2.5$, $p=.06$). To further evaluate these interactions, individual univariate ANOVA's were conducted using high/low hostility, high/low Defensiveness and gender. The data indicated significant or near significant Hostility x Defensiveness x gender interactions for Anger-in ($F[1,136]=8.4$, $p<.01$), total anger expressed ($F[1,136]=6.1$, $p<.05$), and social support ($F[1,136]=3.0$, $p<.09$). Consequently, separate ANOVA's were conducted in males and females on the personality measures using high/low Hostility and

high/low Defensiveness as the between-subjects factors. Similar to the previous analyses, no significant Hostility by Defensiveness interactions were observed in women for any of the personality measurements.

By contrast, among males, several significant interactions between Hostility and Defensiveness were demonstrated when the cutpoints of Study II were used in Study I's sample of male subjects. Specifically, significant or near significant Hostility x Defensiveness interactions were observed for social support ($F[1,68]=4.6$, $p<.05$), Anger-in ($F[1,68]=5.8$, $p<.05$), total expressed anger ($F[1,68]=4.6$, $p<.05$), and expression of positive emotions ($F[1,68]=3.3$, $p<.08$). Inspection of the means indicated that DH males in comparison to HH, LH, and Def males, reported the least number of social supports, the least expression of total anger and positive emotion, and the greatest suppression of anger. Thus by using different cutpoints in Defensiveness and Hostility, the results obtained for males in the laboratory study were replicated, in part, in the total male sample of Study I.

DISCUSSION - STUDY I

The purpose of Study I was to determine the psychosocial characteristics associated with Defensive Hostility. The findings relevant to specific hypotheses for Study I are discussed below.

The present data only partially supported the hypothesis that Defensive Hostility is associated with suppression of anger while High Hostility is associated with expression of anger. Whether

such relationships are obtained appears to depend on the particular cut-points used for Defensive Hostility. Specifically, in males who participated in the laboratory study, and when the laboratory study's cutpoints for Defensiveness and Hostility were used in all male subjects, DH males reported the greatest suppression of anger in comparison to HH, LH, and Def men. Greater outward expression of anger was not exclusively found in HH men, but rather high Hostility scores were associated with high Anger-out scores, thus both DH and HH men demonstrated greater outward expression of anger in comparison to LH and Def men. This hypothesis was not supported in women.

The hypothesis that DH subjects in comparison to LH, HH and Def subjects, exhibit the greatest ambivalence over emotional expression was only supported by those males who participated in the laboratory study. However, because the interaction between Hostility and Defensiveness was only marginally significant in the analysis of the subsample of the laboratory study and was not significant in the total sample analyses, evidence for this hypothesis is equivocal.

The hypothesis that Defensive Hostility is associated with other-deception rather than self-deception was not supported by the present research.

The present data provided partial support for the hypothesis that DH subjects in comparison to LH, HH and Def subjects, report the least number of social supports. In women, no significant associations were observed for any of the psychosocial variables

and Defensive Hostility. In the men who participated in Study II and in the reanalysis of males in Study I, DH men in comparison to HH, Def and LH men, reported the least number of social supports.

Defensive Hostility and Other Psychosocial Variables

In the men who participated in Study II and in the reanalyses of men in Study I, it was demonstrated that DH males in comparison to LH, Def, and HH males, expressed less total anger, and possibly expressed less positive and intimate emotions. There were no significant personality differences for Defensive Hostility compared with LH, HH and Def subjects when male subjects who only completed the battery of questionnaires and all female subjects were examined.

The reasons for the discrepancy in the results between those males who participated in the laboratory study and males who only completed the questionnaires are not clear. The present data suggest that the cutpoints for Defensiveness and possibly Hostility are relevant for associations with personality measurements and that perhaps a threshold rather than a linear relationship is operating in the associations between Defensive Hostility and psychosocial variables.

Other demographic differences were also demonstrated in that males in the lab study, in comparison to males who solely completed the questionnaires, were younger, did not smoke and had a greater proportion of subjects who exercised regularly. It may be that factors such as age and lifestyle are related to the differential

results obtained in these two groups. In this regard, it should be noted that across the lifespan, personality (including Hostility) changes over time (Barefoot et al, 1991; Siegler et al 1990). An interesting extension of the latter finding may be that not only personality changes occur over time, but also that the relationships between Hostility, Defensiveness and other personality traits may change as an individual ages. A relationship between lifestyle and Hostility has been reported by Leiker & Hailey (1988). In this study, high hostile subjects, in comparison to low hostile subjects, exercised less and engaged in less self-care behaviors such as dental flossing (Leiker & Hailey, 1988). The present study suggests that the males in the lab study in comparison to males who solely completed the questionnaires, are more concerned with their general health as they exercise regularly and are non-smokers. These demographic differences between the subsamples may have differentially affected the psychosocial correlates of Defensive Hostility. Support for this proposition was found when male subjects were divided into those who exercise regularly (N=44) and those who do not exercise regularly (N=26). In the sample of men who exercise regularly, DH in comparison to LH, HH and Def males, reported the greatest suppression of anger and the least total expression of anger. These relationships, however, were not found among men who do not exercise regularly. Thus it is possible that exercising regularly may impact upon the association between Hostility and Defensiveness and other psychosocial measurements. Future research examining personality

correlates of Defensive Hostility at different lifestyles or different age groups may shed light on this issue.

Associations Between Hostility and Personality Traits

The present study also examined the psychosocial associations of Hostility. The present data are consistent with previous studies in which men were found to be more hostile than women (Barefoot et al, 1991; Blumenthal et al, 1987; Helmers et al, 1993). Other studies have found that high hostility is associated with increased frequency of angry episodes (Smith & Frohm, 1985; Hardy & Smith, 1988), both the suppression and expression of anger (Suarez & Williams, 1990; Smith & Frohm, 1985), and decreased social supports (Smith & Frohm, 1985; Hardy & Smith, 1988). Similarly, these data indicated that high hostility scores were associated with increased trait anger, Anger-in and Anger-out. Unlike previous studies, this study did not demonstrate an association between Hostility and social supports. A possible difference between this study and other studies may be the age of the subjects. Specifically, other studies used college students whereas in this study the subjects were in their late twenties (see Table 1A and 1B). It has been previously suggested that personality styles may not be fully developed until an individual is in their twenties and possibly thirties (Siegler et al, 1990). This explanation is suggested by a previous study on middle-aged women that also found no association between Hostility and social supports (Houston & Kelly, 1989). Thus, the present study's sample

population may have been more mature and developed in their personality which would account for differences between this study and studies using college students.

The present study also examined the interrelationships between Cook-Medley Hostility and Spielberger's Anger-in and Anger-out scales. Increasing hostility scores were associated with both Anger-in (r=.43) and Anger-out (r=.31), and there was no correlation between Anger-in and Anger-out (r=.02). Hence, Anger-in and Anger-out appear to be independent orthogonal factors replicating Spielberger's (1985) findings with high school students. In addition, results revealed gender differences for the associations between Hostility and anger expression. In males, Hostility was positively correlated with both Anger-in (r=.40) and Anger-out (r=.46), whereas in females there was only an association between Hostility and Anger-in (r=.45), but not Anger-out (r=.16). That is, high hostile males both suppressed and expressed their anger which was accounted for by a nonsignificant positive correlation between Anger-in and Anger-out (r=.18). These results are similar to Suarez and Williams' (1990) findings obtained in a group of healthy young males. These authors reported a positive correlation between Hostility and both Anger-in and Anger-out. In contrast to the results for males, high hostile females suppress their anger and do not express their anger which is accounted for by a nonsignificant negative correlation between Anger-in and Anger-out (r=-.17). In contrast, Smith and Frohm (1985) evaluated male and female undergraduates and reported positive associations

between Hostility and Anger-in and Anger-out. The reason for the discrepant results between this study and Smith and Frohm's (1985) study, may be related to the fact that female subjects were not evaluated separately from males.

Taken together, the present study suggests that men and women need to be evaluated separately as the associations between Hostility and the expression and suppression of anger are not similar for each gender. Men's hostility is associated with both the expression and suppression of anger, but women's hostility is mainly associated with suppression of anger.

Associations Between Defensiveness and Other Personality Traits

The present study also examined the associations between Defensiveness and other psychosocial variables. No differences were found between men and women for Defensiveness. However, the Marlowe-Crowne Social Desirability scale appears to measure two separate constructs: self-deception and the deception of others (Paulhus, 1984). The present study demonstrated gender differences in the associations between the Marlowe-Crowne Social Desirability scale and self-deception. It was demonstrated that both males and females who scored high on the Marlowe-Crowne Social Desirability scale also scored high on other-deception. In contrast, high defensive females also scored high on self-deception, but no relationship was found in males between Defensiveness and self-deception, but rather self-deception scores are moderately high for both low and high defensive males. These results indicate that the

Marlowe-Crowne Social Desirability scale may be measuring different constructs in males and females. In males, low defensiveness is associated with an unconscious need to behave in a socially desirable manner. Whereas in females, low defensiveness is not associated with an unconscious positive self-representation. Again, as in the case of previous measures, these results suggest that studies which utilize the Marlowe-Crowne scale as an independent variable should evaluate men and women separately.

Other significant finding with the Marlowe-Crowne Social Desirability scale were that high defensive subjects exhibited decreased trait anger, Anger-out, less ambivalence over emotional expression and greater expression of intimate emotions. In light of the association between self-deception and Defensiveness, it is postulated that high defensive subjects may be unaware of their trait anger which could result in lowered trait anger scores.

STUDY II - LABORATORY STUDY OF DEFENSIVE HOSTILITY AND CARDIOVASCULAR RESPONSES

Overview and Design

This study evaluated whether Defensive Hostile subjects exhibit greater cardiovascular responses to stress in comparison to Low Hostile, Defensive and High Hostile subjects. A 2 x 2 x 2 repeated measures design was conducted with Hostility (high vs. low Cook-Medley Hostility Inventory), Defensiveness (high vs. low Marlowe-Crowne Social Desirability Scale) and gender as between-subjects' factors. The repeated measures factor were two stressors (mental arithmetic and speech) administered in random order. The dependent measures were systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) during baseline and tasks.

Power Analyses

To determine the sample size needed for this study, a power analysis was based on previous studies in the literature. The following studies demonstrated moderate to large effect sizes between various personality traits and cardiovascular responses during stressors: r=-.40 between Anger-out and SBP (Mills et al, 1989), r=.47 and .29 between Spielberger Anger-in and resting SBP and DBP respectively (Spielberger et al, 1985), r=.51 and r=.36 between Hostility and SBP and HR change scores respectively (Dembroski et al, 1978). In conclusion, a moderate effect size is expected between personality traits and physiological measurements.

Therefore, using a .30 correlation to estimate the sample size is a conservative estimation of the needed sample size. A significance criterion of α = .05 and a eighty percent probability of rejecting the null hypothesis (power) was used to calculate the necessary number of subjects (Cohen, 1977). Using a .30 correlation, 64 subjects allows for a 79 percent probability of rejecting the null hypothesis, whereas a .40 correlation needs only 37 subjects to give a 80 percent probability of rejecting the null hypothesis. Furthermore, Jamner et al (1991) demonstrated significant interactions between Hostility and Defensiveness for cardiovascular responses in a field study of 33 paramedics. The research proposed is a laboratory study with controlled conditions, thus the magnitude of the association between Ho and MC is expected to be larger in a laboratory than a field study. To summarize, a sample size of 64 subjects should give ample power to test the relevant study hypotheses.

Experimental Protocol

Subjects were interviewed by telephone to determine eligibility for participation (See section on Subjects for eligibility requirements). Once subjects were judged eligible for participation, a detailed description of the study was given and they were scheduled for a laboratory session. Prior to their visit, a copy of the informed consent form and a set of questionnaires were mailed to the subjects to be completed and brought to the scheduled laboratory visit. Upon arrival to the

laboratory informed consent was obtained. Subjects completed a demographics questionnaire and then rested quietly for a minimum of 20 minutes or until three consecutive stable blood pressure and heart rates were obtained.

Two 5-minute stressors were administered in random order after a 20 minute resting baseline (see Stressors section). A second resting baseline lasting a minimum of 10 minutes was administered between the stressors. The two stressors were: (1) a mental arithmetic task; and (2) a public speech in which the subject was asked to speak about their personal faults. Both tasks were audio-taped and subjects were told they would be rated on their performance to further increase the relevance of the task. Measurements of self-reported affect were taken during the initial resting baseline and after each of the stressors. At the conclusion of the study, subjects were debriefed and paid $25.

Subjects

Sixty-eight subjects (34 men and 34 women) between 18 to 45 years of age were recruited through newspaper advertisements for a study examining "personality and physiological responses". Subjects were excluded for any major medical problems such as hypertension and coronary disease, if they were smokers, or if any medication was taken which may affect mood (e.g., anti-depressants or tranquilizers) or physiological responses (e.g., beta-blockers, birth control pills). All subjects were requested to refrain from drinking any caffeinated drinks two hours before their scheduled

appointment.

Studies evaluating phases of the menstrual cycle and cardiovascular reactivity demonstrate inconsistencies. Hastrup and Light (1984) demonstrated increased CVR during the luteal phase (days 17-21) in comparison to the follicular phase (days 7-11) using a shock avoidance paradigm. Conflicting results were demonstrated by Polefrone and Manuck (1984) in which the follicular phase (days 7-11) exhibited increased reactivity when compared to the luteal phase (17-22) during mental arithmetic and a difficult test of "concept-forming abilities". Other studies have found no differences for CVR during the menstrual cycle (Carroll et al, 1984; Collins et al, 1985). At this time, it is unclear whether the menstrual cycle has an effect on cardiovascular reactivity. As menses is a clear marker of the menstrual cycle, and the menstrual cycle can vary in length, all women were scheduled during days 6-11 of their menstrual cycle by their self-report. This ensured that all women would be in approximately the same phase of their menstrual cycle at the time of the laboratory session. Women completed a questionnaire on their menstrual cycle upon arrival to the study to validate phase of menstrual cycle.

The cut-off of 45 years of age was selected to ensure that most women who respond to the newspaper advertisement were pre-menopausal. Post-menopausal women are more physiologically reactive than pre-menopausal women and therefore were not eligible to participate (reviewed in Polefrone & Manuck, 1987). Menopausal status was determined during the telephone interview.

Stressors

The following stressors were administered in random order after an initial resting baseline. Between the tasks a second resting period of 10 minutes each was administered. The stressors were selected on the basis of the nature of the interpersonal interaction between the experimenter and the subject. It was speculated that Defensive Hostile subjects may be more reactive to an interpersonal situation than a non-interpersonal situation. Therefore, the speech task required the subject to give a speech to the experimenter whereas the math task was completed without the presence of the experimenter. In addition, it was previously suggested that the math task is a task which may be more personally relevant to men, and the speech task may be more personally relevant to women (Stoney et al, 1988).

Mental Arithmetic. Subjects were instructed via a standardized audiotape to subtract serial 7's from specified four digit numbers for five minutes (Krantz al, 1991). After instructions were given the experimenter left the room and the subjects responses were audiotaped. The subjects were told the audiotapes would be rated for their speed and accuracy of performance.

Interpersonal Speech. Subjects were asked to give a five minute speech to the experimenter about any personality traits or characteristics with which they are unhappy or would like to change. Subjects were given one minute to prepare the speech. This task was also audiotaped and subjects were told the speech

would be rated not only for content, but also for style and organization of the speech.

Measurement of Cardiovascular Responses

The blood pressure cuff was attached to the subjects' nondominant arm. The subjects were instructed to refrain from moving their arm while the cuff inflated. Blood pressure and heart rate measurements were taken every two minutes throughout the protocol (baseline, task 1, second resting level, task 2, and post-task 2).

Questionnaires

The questionnaires from Study I were mailed to the subject to be completed prior to the laboratory session (See Study I). Completion of questionnaires took approximately one hour.

Measurement of Affective State

During the initial baseline and after each of the stressors, the following measurement of affect was administered.

Visual Analog Scale. A paper and pencil questionnaire asking how depressed, bored, interested, angry, anxious, irritated, happy, restless and satisfied the subject is feeling. Subjects mark on a scale ranging from 0 cm ("not at all") to 10 cm. ("most ever") how they are feeling at that moment in time. This type of scale has previously been found to be a sensitive marker of changes in mood (Monk, 1989).

Statistical Analyses

Three 2 x 2 x 2 (high/low Hostility, high/low Defensiveness and gender) repeated measures ANOVA's were conducted to examine the repeated measures of HR, SBP and DBP responses to stress. Median splits for each gender on the Cook-Medley Hostility Scale and Marlowe-Crowne Scale were used as the cutpoint for high/low scores on each scale. When a significant three-way interaction between Hostility, Defensiveness and gender was evident, men and women were analyzed separately for the relevant cardiovascular measurement in a 2 x 2 (high/low Hostility and Defensiveness) repeated measures ANOVA.

For affect ratings, an initial MANOVA using high/low Hostility, high/low Defensiveness and gender as the between-subjects factors and all affect ratings as the within-subjects factor was conducted. Possible interactions were analyzed separately for men and women in 2 x 2 (high/low Hostility and Defensiveness) repeated measures ANOVA's for the dependent measures of affect during baseline and tasks.

RESULTS - STUDY II

A total of 68 subjects (34 men and 34 women) participated in the laboratory study. No gender differences were observed for Hostility, Composite Hostility, and Defensiveness. The median score for Cook-Medley Hostility and Marlowe-Crowne Social Desirability scores were used to classify into DH, HH, LH and Def groups. Subjects with Hostility scores greater than or equal to 21 comprised the high hostility group, and less than 21 were low hostile. Marlowe-Crowne Social Desirability scores greater than or equal to 13 were classified as high defensive, and less than 13 as low defensive. These cutpoints allowed each gender to be represented within each group. Table 1B presents the demographic characteristics of the four groups. No significant differences between the groups were observed for age, gender, race (white versus other), education (some college, college degree, graduate work), marital status (married versus single/divorced), exercise regularly (Yes/No) and parent history of hypertension, coronary artery disease, diabetes and cancer.

Effectiveness of Stress Manipulation

To establish that the stress manipulation was effective, we examined heart rate, blood pressure and affective responses during baseline and tasks (Table 3 presents average HR, SBP and DBP during baseline and the speech and math tasks). The effectiveness of the stress manipulation were analyzed by 2 x 2 x 2 repeated measures ANOVAs evaluating cardiovascular responses during baseline, speech

and math, using the between-subjects classification of high/low Hostility, high/low Defensiveness and gender. A significant stress effect was demonstrated for SBP, DBP, and HR (p's < .001) indicating that cardiovascular measurements increased during tasks compared to baseline. Furthermore, repeated measures ANOVAs conducted on change scores (task level minus baseline) during speech and math revealed significant task effects for SBP and DBP (p's < .001), but not for HR. Inspection of the means indicated that the speech task produced greater change scores in SBP and DBP than the math task, whereas there were no differences for HR change scores between speech and math tasks (See Table 3).

Means for the affect ratings during baseline, speech and math are presented in Figure 4. Repeated measures ANOVAs for affect levels indicated significant decreases from baseline in boredom, satisfaction, and happiness (p's <.001), and significant increases from baseline in frustration, irritation, and anger (p's <.001). Feelings of depression and anxiety were significant for tasks (p<.05), but inspection of the means indicated that depression and anxiety increased only during speech and not during math when compared to baseline. No significant task differences were demonstrated for interest and restlessness, indicating that equal amounts of interest and restlessness were maintained throughout the experimental protocol.

Taken together, the cardiovascular and affect results suggest that the stress manipulation was effective in increasing cardiovascular responses and altering affect during the speech and

math tasks.

Gender Differences

The literature suggests that there are gender differences in cardiovascular measurements and possibly in affective ratings of stress-related tasks (Stoney, Davis & Matthews, 1987). For this reason, repeated measures ANOVAs for cardiovascular measurements and affect ratings during baseline, speech and math were also evaluated for gender differences. Significant or near significant differences were observed for SBP $F[1,60]=17.2$, $p < .001$), and for HR ($F[1,60]=3.71$, $p<.06$). Inspection of SBP means indicated that males, in comparison to females, had greater SBP levels during baseline, speech, and math, whereas inspection of HR means indicated that females had greater HR levels during baseline, speech and math when compared to males. Repeated measures ANOVA's were also evaluated for cardiovascular change scores (task - baseline level) during speech and math tasks. No gender differences were found for SBP, DBP, and HR suggesting that the cardiovascular change scores to the tasks were equivalent between men and women.

Gender differences were also examined in a series of repeated measures ANOVAs for affect levels during baseline, speech and math. Women reported less satisfaction than men during baseline, speech and math tasks ($F[1,60]=6.41$, $p<.02$). No other gender differences for any of the other affect measures were observed. Taken together, these data indicate that in the study sample, gender

differences were observed for cardiovascular levels during baseline and tasks, but not for baseline affect ratings and stress-induced cardiovascular and affect changes.

Defensive Hostility and Cardiovascular Response Levels

In order to evaluate the hypothesis that Defensive Hostile subjects evidence greater hemodynamic levels, three 2 x 2 x 2 repeated measures ANOVAs were conducted. The between-subjects classification were high/low Hostility, high/low Defensiveness and gender (male/female). The repeated measures terms were cardiovascular responses (SBP, DBP, HR) during baseline, speech and math tasks. Main effects for task and gender have been discussed in the preceding sections and will not be repeated in this section.

Systolic blood pressure levels. For SBP, a significant three-way interaction of Hostility x Defensiveness x gender ($F[1,60]=11.63$, $p=.001$) was observed indicating a differential cardiovascular response for males versus females within the four groups (i.e. DH, LH, HH, & Def). No other significant results were found. For this reason, males and females were evaluated separately in a 2 (high/low Hostility) x 2 (high/low Defensiveness) repeated measures ANOVA. Figure 5 presents SBP levels during baseline, speech and math tasks for the experimental groups within each gender. In males, a significant Hostility x Defensiveness interaction ($F[1,30]=4.11$, $p=.05$) was demonstrated for SBP levels during baseline, speech and math tasks. Inspection of the means indicated that both DH and LH men had the greatest SBP levels

during baseline, speech and math (See Figure 5A). Duncan post-hoc comparisons indicated that during baseline levels, DH males were significantly different from Def and HH males, and LH males were significantly different from HH males. In females, significant Hostility x Defensiveness ($F[1,30]=7.6$, $p=.01$) and task x Hostility ($F[2,60]=3.42$, $p<.05$) interactions occurred for SBP levels during baseline, speech and math tasks. The task x Hostility interaction indicated that high hostile females had greater SBP levels, particularly during the speech task. Inspection of the means for the Hostility x Defensiveness interaction indicated that in contrast to the results for the males, LH females had the lowest SBP levels and DH females had intermediate SBP levels (See Figure 5B). Duncan post-hoc comparisons indicated that LH females had significantly lower SBP levels than Def and HH females during baseline and LH were significantly lower than Def during the math task.

Diastolic blood pressure levels. As in the case of SBP, a significant three-way interaction of Hostility x Defensiveness x gender occurred for DBP ($F[1,60]=8.45$, $p=.005$). No other main effects or interactions were significant. Figure 6 presents DBP levels during baseline, speech and math tasks for the four experimental groups within each gender. To disentangle the nature of the triple interaction, males were analyzed separately from females. In males, results indicated a significant Hostility x Defensiveness interaction ($F[1,30]=5.5$, $p<.05$). Inspection of the DBP means indicated that DH and LH groups had the greatest DBP

levels during baseline, speech and math (See Figure 6A). Duncan post-hoc comparisons indicated that LH males had significantly greater DBP responses during baseline in comparison to Def and HH males. No other significant effects were found for males. In females, a marginally significant Defensiveness effect occurred ($F[1,30]=4.1$, $p<.06$), with high defensive females exhibiting greater DBP levels. In addition, a marginal Hostility x Defensiveness interaction occurred ($F[1,30]=3.3$, $p<.08$). In contrast to males, inspection of the means indicated that LH females had the lowest DBP's when compared to the other experimental groups (See Figure 6B). Duncan post-hoc comparisons indicated that LH females demonstrated significantly lower DBP during baseline and math in comparison to Def females.

Heart rate levels. For HR, no significant main effects were observed for Hostility and Defensiveness, nor were any significant Hostility x Defensiveness interactions observed. In general, for both males and females, the four Defensive Hostile groups had similar heart rate levels regardless of the experimental condition.

Taken together, analyses of cardiovascular levels revealed an interaction between gender and personality characteristics related to Defensive Hostility. For males, higher SBP and DBP levels during baseline, speech and math tasks were observed for the DH and LH individuals in comparison to the HH and Def individuals. A different pattern was observed in females: lower SBP and DBP levels were observed in LH women in comparison to HH, DH and Def women.

Defensive Hostility and Cardiovascular Change Scores.

To evaluate the hypothesis that DH subjects evidence greater cardiovascular reactivity, three 2 x 2 x 2 repeated measures analyses of covariance (ANCOVA) were conducted. As in the case of analyses of cardiovascular levels, the between-subjects classifications were high/low Hostility, high/low Defensiveness, and gender (male/female). The repeated measures were cardiovascular change scores (task level minus baseline for SBP, DBP & HR) during speech and math, covarying for baseline values. Main effects for task and gender have been discussed in the preceding sections on Effectiveness of Stress Manipulation and Gender Differences and will not be repeated in this section.

Systolic blood pressure change scores. For SBP, a significant Hostility x gender x task interaction occurred ($F[1,60]=5.30$, $p=.03$). No other main effects or interactions were demonstrated. When males were analyzed separately from females, no significant main effects or interactions were demonstrated. For females, a significant Hostility x task interaction occurred ($F[1,30]=5.6$, $p<.05$) indicating that high hostile females exhibit greater SBP change scores during speech and low hostile females exhibit greater SBP change scores during math. No other significant effects were demonstrated.

Diastolic blood pressure change scores. No significant main effects or interactions were demonstrated for the 2 x 2 x 2 repeated measures ANCOVA of diastolic blood pressure covarying for baseline DBPs. Consequently, no further analyses within each

gender were conducted.

Heart rate change scores. For HR, results indicated a significant Defensiveness x task interaction ($F[1,60]=4.45$, $p=.04$). Inspection of the means indicated that high defensive subjects had greater HR change scores during math, whereas high defensive subjects were indistinguishable from low defensive subjects during speech. No other significant main effects or interactions were found.

To summarize the results of the change score analyses, there were no interactions between gender, Defensiveness and Hostility. These results suggest that the differences observed for the four Defensive Hostile groups evident at baseline are maintained throughout the experimental protocol. That is, the four groups did not demonstrate differential cardiovascular reactivity to stress.

Defensive Hostility and Affective Ratings

The present results suggest differential cardiovascular responses when men and women are evaluated in the four groups. A plausible explanation for this effect may be differential affective responses during baseline and stressors. Such differences may, in turn, mediate cardiovascular responses to the stressors. To evaluate this possibility, an initial MANOVA using the between subjects factors of high/low Hostility, high/low Defensiveness and gender on all of the affect ratings was conducted. Results indicated significant main effects for Hostility ($F[1,59]=3.93$, $p=.05$) and for affect ratings ($F[9,531]=51.9$, $p<.01$), and

significant interactions for Hostility x affect ratings ($F[9,531]=2.18$, $p<.05$) and Hostility x Defensiveness x affect ratings ($F[9,531]=4.98$, $p<.01$). The MANOVA analysis was repeated for negative affect ratings (anger, frustration, irritation, boredom, anxiety, depression and restlessness) and positive affect ratings (interest, satisfaction and happiness). Analyses of negative affect ratings revealed a significant Hostility x Defensiveness x gender x affect ratings interaction ($F[6,360]=2.1$, $p=.05$), in addition to significant or near significant effects for Hostility ($F[1,60]=3.6$, $p<.06$), negative affect ratings ($F[6,360]=53.9$, $p<.01$), and Hostility x negative affect ratings ($F[6,360]=2.9$, $p<.01$). Analyses of positive affect ratings revealed significant interactions for Hostility x Defensiveness ($F[1,59]=9.8$, $p<.01$) and gender x positive affect ratings ($F[2,118]=3.6$, P,.05). These results suggest that the Defensive Hostile groups report affects differentially and that gender may also impact the ratings of affect in the Defensive Hostile groups.

In order to understand these significant interactions, 2 x 2 repeated measures ANOVA's were conducted on each of the affect ratings for males and females. The between-subjects factors were high/low Hostility and high/low Defensiveness. The repeated measures were affect ratings taken for baseline, speech, and math tasks.

Affect ratings for males. Affect ratings for males during baseline, speech and math are presented in Table 4A. A marginally significant main effect for Hostility was observed for ratings of

anxiety ($F[1,30]=3.4$, $p<.08$) with high hostile subjects reporting greater anxiety during baseline, speech and math. No other main effects for Hostility and Defensiveness were observed.

Relevant to the main research question, significant Hostility x Defensiveness interactions were observed for anger ($F[1,30]=4.7$, $p<.04$), irritation ($F[1,30]=4.8$, $p<.05$), happiness ($F[1,30]=6.2$, $p<.02$), and depression ($F[1,30]=6.7$, $p<.02$). Figure 7 presents the latter means for the four experimental groups. Inspection of the means indicated that DH males reported the highest ratings for anger, irritation, and depression and the lowest ratings of happiness during baseline, speech and math. LH males, who also demonstrated SBP and DBP levels similar to DH males, also had anger and irritation ratings equivalent to DH males during speech, had the second greatest depression ratings during baseline and speech, and had the lowest ratings of happiness during speech and math (See Figure 7).

Affect ratings for females. Affect ratings for females during baseline, speech and math are presented in Table 4B. A significant main effect for Hostility was demonstrated for anxiety ($F[1,30]=5.3$, $p<.05$) with high hostile females reporting greater anxiety during baseline, speech and math tasks. Significant interactions for Hostility x task occurred for anger ($F[2,60]=4.0$, $p<.05$), frustration ($F[2,60]=3.5$, $p=.<.05$), irritation ($F[2,60]=3.8$, $p<.05$), and happiness ($F[2,58]=3.3$, $p<.05$). Inspection of the means suggested that low hostile females reported the greatest anger, frustration, and irritation and the least

happiness during speech, whereas high hostile females reported the greatest anger, frustration, and irritation and the least happiness during math.

A significant main effect for Defensiveness was observed for interest ($F[1,30]=4.7$, $p<.05$) and depression ($F[1,30]=5.0$, $p<.05$). Inspection of these means indicated that high defensive females reported greater interest and the least depression during baseline, speech and math tasks in comparison to low defensive females.

In regard to the main research question, significant Hostility x Defensiveness interactions occurred for interest ($F[1,30]=9.5$, $p<.01$), boredom ($F[1,30]=6.0$, $p<.05$), and happiness ($F[1,29]=5.2$, $p<.05$). Figure 8 presents the latter means for the four experimental groups. Inspection of these means indicates that LH females in comparison to the other groups (Def, HH, and DH) reported the least interest and happiness during baseline, speech and math, and reported the greatest boredom during baseline and math.

In general, DH and LH men reported the greatest anger, irritation, and depression and the lowest happiness ratings during the tasks in comparison to HH and Def. LH females in comparison to the other experimental groups reported the least interest and happiness and the greatest boredom during the tasks. Results for happiness ratings are conflicting and unclear. The lowest happiness ratings were reported by LH and DH males who exhibited the greatest SBP and DBP levels in comparison to LH females who also reported the lowest happiness ratings but exhibited the lowest

SBP and DBP levels. Thus, in males, affective responses of anger, irritation and depression may be associated with the cardiovascular responses, whereas in females, interest and boredom may be associated with the cardiovascular responses to stress.

Use of Composite Hostility Rather than Full-scale Hostility Scores

Finally, it was suggested in the Introduction that the Composite Hostility score may be a better predictor of cardiovascular responses than the full-scale Cook-Medley Hostility scale. Accordingly, the primary 2 x 2 repeated measures ANOVAs for SBP, DBP, and HR during baseline, speech and math were rerun using median splits for Composite Hostility and Defensiveness. No significant interactions were demonstrated between Composite Hostility and Defensiveness for males and females when analyzed separately. Inspection of the means does suggest a similar trend for the four Defensive Hostile groups for both SBP and DBP levels during baseline, speech and math (See Figures 9a, 9b, 10a, and 10b).

DISCUSSION - STUDY II

The main finding of Study II was that the personality styles of DH, LH, HH, and Def subjects were differentially related to cardiovascular levels during baseline and stressors in both males and females. The hypotheses for Study II are discussed below.

Partial support was obtained for the hypothesis that DH subjects exhibit greater cardiovascular responses to stressors than

will LH, HH and Def. Specifically, DH men in comparison to HH and Def men, exhibited greater SBP and DBP levels during baseline and tasks. However, unexpectedly, the SBP and DBP levels evidenced by LH men were indistinguishable from those of DH men. In females, no support was obtained for this research hypothesis. LH women exhibited the lowest SBP and DBP levels and DH women were intermediate in their SBP levels during baseline and tasks compared with HH and Def subjects.

The hypothesis that men, in comparison to women, exhibit greater SBP baselines, lower HR baselines, and greater SBP responses to stressors was partially supported by the present research. Men exhibited greater SBP's during baseline, speech and math, whereas women exhibited greater HR's during baseline, speech and math. However, men did not have greater SBP responses to stress, but rather men and women had equivalent SBP change scores in response to stress.

Comparison of Present Results to Other Studies

At present, only two other studies have examined the relationship between the personality style of Defensive Hostility and various physiological parameters. Jamner et al (1991) reported in a field study of 33 male paramedics that DH men in comparison to LH, HH, and Def men had the greatest heart rate and possibly diastolic blood pressure at the hospital, but not during the ambulance run and when waiting at the station. However, upon examination of the heart rate data (See Figure 3), DH subjects had

greater heart rates than LH, Def and HH subjects not only at the hospital, but also during the ambulance run and at the station. These results are similar to the present study in that DH males, in comparison to Def and HH males, had consistently higher SBP's and DBP's during baseline and tasks. Unlike the present study in which LH men also had greater SBP's and DBP's than Def and HH men, in Jamner's study, heart rates for LH paramedics were indistinguishable from HH and Def paramedics.

The reason for the discrepant results in the LH men between the present study and Jamner's study are not clear. Both the present study and Jamner et al's study used similar median splits for Cook-Medley Hostility scores (21 and 22 respectively). However the median split for the Marlowe-Crowne Social Desirability Scale was different (13 for the present study and 18 for Jamner et al, 1991). It is possible that these different cutoffs could have affected the results. Due to the small number of male subjects within each Defensive Hostile group in Study II, Jamner's cutoffs for Defensiveness could not be used in the present study. Therefore, it was not possible to examine whether the difference in the median split for Defensiveness is related to the inconsistency between the two studies. However, in Study I a lower cutpoint rather than the median cutpoint in Defensiveness gave significant associations between the Defensive Hostility groups and psychosocial variables in the total sample of subjects. Thus, perhaps the differences in the cutpoints may be related to discrepant results for LH men in the present study and Jamner et

al's study.

Another difference between the two studies was that a third of Jamner's subjects were smokers, whereas smokers were excluded from the present study. It has already been noted that Hostility may be differentially related to lifestyle in that high hostile subjects exercised less and engaged in less self-care behaviors (Leiker & Hailey, 1988). Thus, these differences in sample characteristics may also account for the discrepant results for LH subjects between the present study and Jamner's study, but this issue can only be resolved by future research.

A previous study in our laboratory evaluated Defensive Hostility and myocardial ischemia in two groups of CAD patients (Helmers et al, 1991). In the first group, male CAD patients participated in a laboratory protocol similar to the present study: a speech task on personal faults and a math task with harrassment by an experimenter. Similar median splits for both Cook-Medley and Marlowe-Crowne were used (21 and 16 respectively). Results indicated that DH and LH, in comparison to HH and Def CAD patients, had the worst wall motion scores (indicative of ischemia) during both math and speech tasks (See Figure 1). A second group of CAD patients underwent thallium exercise testing and inspection of Figure 2 demonstrates that DH patients had the worst perfusion defects (indicative of ischemia) and LH patients had intermediate perfusion defects compared with HH and Def patients. Finally a subgroup of these coronary patients underwent ambulatory EKG monitoring. Once again DH and LH patients had the greatest total

minutes of ischemia during 24 hours and the most frequent episodes compared with Def and HH patients (See Figure 2).

The present study and the two previous studies (Jamner et al, 1991; Helmers et al, 1991) suggest that the interaction between Hostility and Defensiveness differentiates groups of male subjects as to their cardiovascular and ischemic responses to stress. Healthy DH males evidence increased SBP and DBP levels in a laboratory study and increased heart rates during a field study, and DH CAD patients demonstrated increased ischemia in both a laboratory and a field study. In addition, healthy LH males demonstrated increased SBP and DBP levels in a laboratory study and LH coronary patients demonstrated greater evidence of cardiac ischemia in a laboratory and in a field study.

Affect Ratings and Cardiovascular Responses

The present study demonstrated gender differences in cardiovascular responses to stress in the four Defensive Hostile groups. In addition, gender differences were demonstrated for affect ratings during baseline and tasks for the four Defensive Hostility groups. Specifically, DH and LH men in comparison to HH and Def men, rated the baseline and tasks with greater anger, irritation, and depression and less happiness. A different pattern emerged for women when affect ratings were examined. LH women in comparison to HH, DH and Def women, expressed the least interest and happiness during baseline and tasks and the greatest boredom during baseline measurements. It may be that these gender

differences in affect ratings of the four groups may have mediated the cardiovascular responses. However, the present research was not designed to evaluate whether affect mediated the cardiovascular responses within each group as no attempt was made to manipulate affect levels or cardiovascular levels in the groups (cf. Schachter & Singer, 1962). At this point it can only be stated that the interaction between Hostility and Defensiveness differentially affects both cardiovascular responses and affect ratings, and it is possible that affect ratings may mediate the cardiovascular responses. Future research specifically designed to evaluate the hypothesis of mediation of affect would shed light on this issue.

Cardiovascular Responses in Women

This dissertation is the only study which has evaluated Defensive Hostility in women. Contrary to the research hypotheses, the Defensive Hostility personality style in women in comparison to LH, HH, and Def women, was not differentially related to cardiovascular responses and personality measures. However, congruent with theories on hostility and cardiovascular responses, it was demonstrated that LH women had the lowest SBP and DBP levels in comparison to Def, HH and DH women. LH women had lower SBP and DBP levels particularly when compared to Def women who also score low on Hostility, but high on Defensiveness (See figures 2B and 3B). Thus, the Marlowe-Crowne Social Desirability scale may be useful in differentiating women who score low on Hostility into two groups of low and high Defensiveness: LH women who have low SBP and

DBP levels and Def women who in comparison have high SBP and DBP levels.

The differentiation of women who score low on Hostility into two groups of low and high Defensiveness may be analagous to Weinberger, Schwartz & Davidson's (1979) study on anxiety. In their study, male undergraduates who scored low on anxiety were divided into two groups based on their Defensiveness scores. Results indicated that repressors (low anxiety, high MC) in comparison to low anxious (low anxiety, low MC) had greater HR responses to stressors but reported lower anxiety levels. Weinberger et al (1979) concluded that repressors repress their personality trait of anxiety, but have physiological responses similar to those who score high on anxiety. Based on Weinberger et al's (1979) data, it may be postulated that in the present study, Defensive women may repress their hostility but have cardiovascular responses similar to High Hostile women. By expanding the repressor hypothesis from anxiety to hostility, it would be expected that Def women would rate the tasks with the least anger, irritation and perhaps frustration. In this regard, it should be noted that Def women report lower anger and irritation in comparison to LH women (See Table 4B). Future research needs to further evaluate the cardiovascular responses of Def and LH women, as well as whether Def women are repressing their hostility.

The literature has suggested that there are gender differences in cardiovascular responses to stress. In a meta-analytic review, Stoney, Davis and Matthews (1987) concluded that men have greater

SBP baselines and greater SBP changes to stress, whereas women have greater HR baselines and exhibited marginally greater HR changes to stress. The present study found similar results: men exhibited greater SBP's during baseline, speech and math, whereas women exhibited greater HR's during baseline, speech and math. Unlike Stoney, Davis and Matthew's (1987) conclusions, the present study did not demonstrate a differential response to stress between men and women. That is, the cardiovascular changes to stress were equivalent between men and women. A possible difference between the present study and those studies reviewed by Stoney, Davis and Matthews (1987) may be the methodology of the experimental protocol. In the present study, all women were scheduled for their laboratory visit during the follicular phase (days 6-11) of their menstrual cycle. It has been postulated that cardiovascular reactivity may change with the phases of the menstrual cycle. Polefrone and Manuck (1984) demonstrated that the follicular phase (days 6-11) exhibited increased reactivity when compared to the luteal phase (days 17-22). Thus the present study may have evaluated women at the height of their cardiovascular responses and this may account for the similar responses to stress exhibited by women compared with men.

It has also been hypothesized that the relevance of the task may account for the attenuated cardiovascular responses in women as compared to men. It has been suggested that the math task may be a male stressor and the speech task a female stressor (Stoney et al, 1988). The present study does not support this hypothesis.

There were no gender differences in the cardiovascular responses to the tasks: both men and women had greater responses to the speech task in comparison to the math task, and within each task the responses were equivalent between men and women. It is suggested that future research on women and cardiovascular responses use the follicular phase of the menstrual cycle which may give a group of women whose cardiovascular responses may be more homogeneous and at the height of their cardiovascular responses.

Findings for Low Hostile and Defensive Hostile Men

The differentiation of Hostility scores according to level of Defensiveness classifies subjects into four groups. It was hypothesized that Defensive Hostile subjects would exhibit greater cardiovascular responses during baseline and tasks. Results indicated that not only did Defensive Hostile male subjects exhibit greater cardiovascular responses, but Low Hostile male subjects were indistinguishable from DH males with respect to cardiovascular levels during baseline and tasks.

The relationship between cardiovascular responses and DH males may be related to the unique personality profile of these individuals. There is some support for the assertion that Defensive Hostility in males is associated with the greatest suppression of anger, the least total expression of anger and possibly positive emotions, and the least social supports. Furthermore, Defensive Hostile males may also express less intimate emotions and may be more ambivalent about emotional expression.

Their high hostility and their need to be viewed in a positive manner may lead to increased cardiovascular levels during baseline and tasks.

These findings allows for a more descriptive personality profile of the DH male. DH men are socially aware of themselves, they knowingly attempt to deceive others in the interest of maintaining a positive or socially desirable personality. Their high hostility and their need to be viewed in a positive or socially desirable manner may create inner conflicts which may be reflected by their greater ambivalence over emotional expression. This ambivalence over emotional expression may lead to the suppression of anger, and it also appears to be generalized to the suppression of positive and intimate thoughts or feelings as well. In addition, it should be noted that in spite of their attempts to maintain a positive image, Defensive Hostile males report the least number of social supports.

The results for the LH males are inconsistent with current theories on hostility and CVR, and are inconsistent with the theoretical framework of this dissertation. Two possible explanations for the perplexing results of the LH men will be examined. The first explanation may be that LH men are relaxed and calm in most situations, they arrange their life so that there is minimal conflict, and they rarely challenge themselves. Upon participation in the laboratory protocol, LH men found themselves in a challenging situation and their performance during the stressors was to be evaluated by raters. Thus the novelty and

challenge of the laboratory protocol may have resulted in the high cardiovascular levels exhibited by LH men. To evaluate this possibility, future research could have subjects rate how challenging they found the experimental protocol and it would be expected that LH men in comparison to HH, Def, and DH would rate the tasks as more challenging.

Another explanation may be that LH men are extremely aware of themselves, are very socially conscious and do not acknowledge their high levels of Hostility and Defensiveness. Thus these subjects may recognize, but do not endorse questionnaire items which reflect Hostility, which is not condoned by society. In addition, LH men may also recognize but do not endorse questionnaire items which reflect behaving in a socially desirable manner, because society emphasizes individuality and independence. Society does place emphasis upon the control of one's anger, and LH men reported the second greatest suppression of anger scores. It may be speculated that LH men are actually Defensive Hostile but have gone a step further by suppressing all Hostility and Defensiveness in order to be viewed as a "normal healthy subject". This suppression of their personality traits would require enormous energy and would lead to increased cardiovascular levels. Support for this supposition may be found in the affect ratings of LH men. LH men were similar to DH men in that both groups rated the baselines and tasks with greater anger, irritation, and depression and less happiness. These affect ratings were obtained by asking the subject to mark on a scale ranging from 0 cm ("not at all") to

10 cm ("most ever") how they were feeling at that moment in time. Even if DH and LH men attempted to give a more socially desirable affect rating, these subjects most probably did not have experience with this type of a rating scale and did not know the mean of the rating scale, and thereby had higher ratings when compared to HH and Def men. Thus it is possible that LH men may actually be high on Hostility and Defensiveness similar to DH men, but do not endorse these personality traits.

That LH men are actually similar to DH men but are suppressing or repressing the endorsement of negative personality traits is similar to Weinberger, Schwartz, and Davidson's (1979) theory on repressors. In their study, repressors report low anxiety and high defensiveness but have HR levels similar to high anxious subjects. To extend this theory to the present data set, repressors were classified as Defensive subjects and should exhibit greater cardiovascular responses in comparison to LH subjects. This was not demonstrated in the data set for males (nor in the CAD patients, Helmers et al, 1991), but was found in the data set for females. Thus for male subjects, there was no support for the repressor theory as suggested by Weinberger, Schwartz and Davidson (1979) and it may be LH males who suppress both their Hostility and Defensiveness. Future research needs to replicate the findings that LH men similar to DH men, demonstrate high cardiovascular levels during baseline and tasks, and that they rate the tasks with greater anger, irritation, and less happiness.

CONCLUDING REMARKS

The differentiation of Hostility scores according to level of Defensiveness holds promise for future research into the relationship between personality and cardiovascular responses and other physiological measurements such as ischemia. It can be speculated that the greater baseline and task blood pressures demonstrated by DH and LH men could over the years result in the progression of atherosclerosis and the ensuing diagnosis of coronary artery disease. The evidence at this time indicates that the personality style of Defensive Hostility is related to cardiovascular responses only in men. In women, the interaction of Hostility and Defensiveness appears to differentiate women who score low on Hostility into two groups. Specifically, LH women have lower SBP's and DBP's than Def women. Due to the small number of men and women in Study II, the obtained associations between Hostility, Defensiveness and cardiovascular responses need to be replicated.

The relationship between cardiovascular responses and DH males may be related to the unique personality profile of these individuals. There is some support for the assertion that Defensive Hostility in males is associated with the greatest suppression of anger, the least total expression of anger and possibly positive emotions, and the least social supports. Furthermore, Defensive Hostile males may also express less intimate emotions and may be more ambivalent about emotional expression. Thus their high hostility and need to be viewed in a socially

desirable manner may create inner conflicts which may be associated with high cardiovascular levels for baseline and tasks. It was conjectured that LH men may have suppressed their Hostility and Defensiveness, and may in reality (but is not acknowledged) be very similar to DH men with respect to their personality profile. The affect ratings and cardiovascular levels during baseline and tasks are very similar between LH and DH men which provides some support for this conjecture.

By contrast, among females there were no associations between Defensive Hostility and any of the psychosocial measurements. Nevertheless, gender differences were demonstrated on a number of the psychosocial measurements. It was demonstrated that women were less hostile than men, and hostility was associated with the suppression of anger in women, whereas in men hostility was associated with both the expression and suppression of anger. In women, high defensiveness consisted of both the constructs of high self-deception and other-deception, whereas men's defensiveness appears to only be related to other-deception. Because the Defensive Hostile personality uses Defensiveness as an independent variable, it is conceivable that the gender differences in the Marlowe-Crowne Social Desirability Scale may account for the lack of any significant findings for Defensive Hostility in women. The associations in women among self-deception, other-deception and Marlowe-Crowne Social Desirability suggests that in women, the personality characteristics associated with Defensive Hostility are qualitatively different from those associated with DH men.

Unlike previous studies (Smith & Allred, 1989; Suarez & Williams, 1989; Weidner et al, 1989), the present study did not find any associations between hostility per se and cardiovascular responses to stress. Instead, it was the unique combination between Hostility and Defensiveness in both men and women which allowed for the differentiation of high/low cardiovascular responders. It should be further noted that there exists in the literature reports of non-significant associations between Hostility and cardiovascular responses (Anderson et al, 1984; Smith & Houston, 1987; Houston, Smith & Cates, 1989; Sallis et al, 1987). It may be that these null findings are related to different levels of Defensiveness that masked or cancelled the putative associations between Hostility and cardiovascular responses. For example, it may be that those previous studies with null findings used a group of high hostile subjects who were also low on Defensiveness which would then result in a nonsignificant or possibly negative association between Hostility and cardiovascular responses.

From the present study and other studies (Helmers et al, 1993; Haynes et al, 1980) it appears clear that results exhibited by men are not necessarily generalizable to women. Psychosocial associations are not equivalent for men and women, and the associations between personality styles and cardiovascular responses are different for men and women. In the past, very few studies have used women as subjects: for example, of the cardiovascular reactivity and Hostility studies, only two out of twelve studies reviewed used women as part of their subject pool.

Future research needs to evaluate women separately from men in studies on cardiovascular reactivity as well as studies on CAD.

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Table 1A
Demographic Characteristics of Defensive Hostile Groups
in Subjects Who Solely Completed
the Battery of Questionnaires

	Low Hostile	Defensive	High Hostile	Defensive Hostile
Gender				
Male (N)	9	10	12	7
Female (N)	7	12	14	6
Age (Years ± S.D.)				
Male	34.2±12.9	27.8± 4.8	29.7±8.1	39.0± 8.3
Female	24.9± 6.2	28.9±11.5	29.7±8.7	31.0±11.0
Race				
White (N)	16	18	21	9
Other (N)	0	2	4	3
Education				
Some college (N)	6	4	9	9
College (N)	6	9	9	1
Graduate (N)	6	9	8	3
Marital Status				
Single (N)	10	15	13	5
Married (N)	6	7	13	8
Independent Variables				
Hostility				
Males	15.8±4.7	17.8±3.4	28.4±6.9	26.7±2.0
Females	13.4±4.5	10.9±3.9	24.4±4.2	21.3±4.8
Defensiveness				
Males	12.8±2.4	20.2±2.7	9.8 ±3.5	18.0±2.6
Females	10.0±2.9	19.1±2.6	8.9 ±3.9	19.0±3.2

Table 1B
Demographic Characteristics of Defensive Hostile Groups
in Laboratory Study

	Low Hostile	Defensive	High Hostile	Defensive Hostile
Gender				
Male (N)	8	8	7	11
Female (N)	5	15	7	7
Age (Years ± S.D.)				
Male	27.4±7.5	30.5±10.1	26.1±6.4	29.0±8.9
Female	28.4±5.5	30.0± 7.1	30.0±8.1	25.2±9.3
Race				
White (N)	11	18	12	12
Other (N)	2	5	2	6
Education				
Some college (N)	4	5	6	8
College (N)	4	9	1	3
Graduate (N)	5	9	7	7
Marital Status				
Single (N)	9	12	12	14
Married (N)	4	11	2	4
Independent Variables				
Hostility				
Male	15.7±2.1	14.4±5.6	26.4±3.1	25.8±4.6
Female	16.8±3.8	12.7±3.6	27.7±2.6	25.8±3.7
Defensiveness				
Male	9.9±2.4	17.8±2.5	7.7±2.9	15.4±2.0
Female	6.8±3.9	18.2±2.6	6.5±3.8	15.8±2.7

Table 2A
Summary of Personality Characteristics
for the Four Groups
in Study I (N=145)

	Low Hostile	Defensive	High Hostile	Defensive Hostile
AEQ				
Male	76.0±07.5	74.5±17.0	87.0±21.0	82.4±15.7
Female	69.0±08.6	57.2±16.1	84.9±15.6	68.3±09.7
SDQ				
Male	06.9±01.6	07.1±01.9	05.9±01.8	07.8±00.9
Female	07.0±01.9	07.7±01.7	05.4±02.2	07.2±01.6
ODQ				
Male	04.2±01.6	06.5±01.2	03.8±01.9	04.7±01.4
Female	04.6±01.3	05.7±01.3	03.7±01.9	06.3±02.0
Trait Anger				
Male	28.9±01.9	26.0±03.5	32.1±09.4	32.0±11.5
Female	27.9±05.8	25.8±03.4	36.4±05.6	31.8±05.5
Pos				
Male	32.0±10.7	29.8±10.1	29.8±07.7	29.7±08.4
Female	36.0±06.1	40.0±04.7	35.1±05.9	33.5±11.3
Neg				
Male	15.8±04.4	14.1±04.3	17.3±04.6	15.0±04.0
Female	13.7±04.3	17.4±03.7	16.7±05.2	16.8±04.7
Int				
Male	26.7±06.7	25.7±04.5	23.7±05.6	26.1±03.8
Female	27.6±03.9	29.8±04.0	25.5±06.9	27.7±04.9
Social Support				
Male	34.3±04.0	33.9±04.2	34.3±05.1	35.1±04.7
Female	37.8±02.5	35.2±07.4	34.5±04.8	33.2±06.4
Self-Monitoring				
Male	08.7±03.6	08.2±02.7	11.2±04.2	08.0±03.6
Female	08.8±01.7	10.3±09.0	08.3±03.5	08.2±03.4
Total Expressed Anger				
Male	48.4±03.9	46.3±07.4	49.1±05.9	48.1±08.5
Female	47.3±05.9	46.9±06.3	48.0±06.2	46.3±06.4
Anger-in				
Male	13.9±02.8	15.2±03.6	17.6±04.9	14.3±03.9
Female	15.9±03.6	14.5±03.8	18.8±04.3	17.3±03.8
Anger-out				
Male	14.6±03.7	14.7±02.8	17.7±04.8	14.8±03.9
Female	14.6±05.1	13.7±02.8	17.2±03.3	16.2±05.6

Note: AEQ = Ambivalence over emotional expression; SDQ = self-deception questionnaire; ODQ = other-deception questionnaire; Pos = expression of positive emotion; Neg = expression of negative emotion; Int = expression of intimate emotion.
Interactions for hostility x defensiveness: ** $p<.05$, * $p<.10$

Table 2B
Summary of Personality Characteristics
for the Four Groups
in the Laboratory Study (N=68)

	Low Hostile	Defensive	High Hostile	Defensive Hostile
AEQ				
Male *	82.4±11.6	65.6±18.6	82.4±18.6	86.3±13.9
Female	78.4±12.3	72.7±18.3	98.5±15.7	75.8±18.4
SDQ				
Male	06.6±01.9	07.3±02.1	06.3±02.7	05.7±02.3
Female	05.6±01.5	07.8±01.3	03.3±02.1	06.8±01.6
ODQ				
Male	03.4±01.7	05.9±01.5	03.4±02.2	04.6±01.7
Female	04.2±01.3	06.5±01.5	03.7±01.4	05.1±01.6
Trait Anger				
Male	31.9±05.0	26.7±11.3	32.7±05.6	31.3±04.5
Female	37.4±10.9	26.6±04.0	36.6±06.4	34.9±08.2
Pos				
Male *	32.0±05.5	37.9±05.5	31.6±05.6	29.8±07.3
Female	31.2±09.4	33.9±07.4	35.1±10.0	36.1±05.5
Neg				
Male	14.2±04.8	15.5±02.8	17.4±04.3	16.6±04.0
Female	15.2±04.2	14.8±03.5	18.0±04.4	17.6±04.3
Int				
Male **	23.9±03.2	29.0±05.9	23.1±02.3	21.4±03.3
Female	25.0±05.0	27.4±07.6	22.4±05.1	27.0±04.0
Social Support				
Male **	34.9±02.9	37.5±03.0	35.1±04.8	29.4±06.4
Female	31.6±08.4	34.8±04.6	30.1±07.9	34.0±06.5
Self-Monitoring				
Male	11.0±03.5	10.0±03.3	10.0±04.3	09.3±02.4
Female	08.0±04.2	08.3±02.5	10.4±03.6	09.3±04.7
Total Expressed Anger				
Male *	46.0±07.1	45.6±04.1	51.8±07.5	43.7±05.6
Female	52.2±08.6	47.8±06.3	44.7±07.0	47.4±05.0
Anger-in				
Male **	18.7±04.1	13.6±04.0	16.0±02.8	20.0±03.9
Female	16.4±02.0	14.7±03.8	21.3±04.4	16.0±03.1
Anger-out				
Male	15.7±03.6	13.1±01.4	17.8±05.0	16.3±03.3
Female	18.4±05.9	14.9±03.0	15.4±02.6	15.4±01.9

Note: AEQ = Ambivalence over emotional expression; SDQ = self-deception questionnaire; ODQ = other-deception questionnaire; Pos = expression of positive emotion; Neg = expression of negative emotion; Int = expression of intimate emotion.
Interactions for hostility x defensiveness: ** $p<.05$, * $p<.10$

Table 3
Means for Task Effects on Physiological Variables

	Baseline	Speech	Math	Speech Change Scores	Math Change Scores
SBP -					
Male	114.1±9.6	132.2±11.7	125.9±11.0	18.1±10.6	11.9±8.6
Female	103.2±9.7	124.3±14.6	118.3±11.5	21.1±10.7	15.1±7.9
DBP -					
Male	64.9±9.4	81.9± 9.4	76.2± 8.2	17.1±9.6	11.4±6.6
Female	65.4±9.0	80.7±10.8	76.1±10.4	15.2±8.7	10.7±6.2
HR -					
Male	72.6±6.6	80.5±8.9	80.4±10.7	7.9±6.3	7.8±7.4
Female	73.8±8.2	84.3±9.9	84.7± 9.9	10.5±7.6	10.9±7.2

Table 4A
Affect Ratings for Males
during Baseline, Speech and Math Tasks

	LH n=8			DEF n=8			HH n=7			DH n=11		
	BL	SP	MA	BL	SP	MA	BL	SP	MA	BL	SP	MA
Interest	52.0	39.5	40.4	48.4	56.5	57.0	50.1	50.8	51.2	58.4	45.1	48.9
Anger **	3.8	21.5	11.1	8.1	6.1	10.4	4.8	7.7	9.1	12.2	19.0	24.2
Frustration	7.0	42.4	39.0	7.8	14.3	37.0	7.7	37.7	53.0	18.0	36.7	58.4
Restlessness	36.0	33.6	29.1	20.1	22.8	19.5	26.1	35.4	39.5	37.7	45.6	44.4
Irritation **	5.6	32.0	36.6	7.6	7.8	26.7	7.5	12.7	36.0	14.2	35.9	54.0
Anxiousness	28.0	55.0	47.5	23.8	35.3	38.8	36.0	49.3	57.7	36.9	55.8	59.0
Boredom	46.2	15.1	18.1	47.3	18.5	18.6	36.3	15.3	19.1	43.7	17.0	25.5
Happiness **	54.1	28.6	29.0	55.1	47.8	43.8	54.0	46.3	39.3	49.5	27.9	35.5
Depression **	17.9	22.7	11.0	6.4	11.9	5.5	4.6	6.1	14.4	24.5	30.2	23.0
Satisfaction	55.5	31.5	32.8	60.7	44.7	39.1	44.8	42.0	42.5	50.4	38.2	36.1

Abbreviations: LH = Low Hostile, DEF = Defensive, HH = High Hostile, DH = Defensive Hostile
BL = Baseline, SP = Speech Task, MA = Math Task.
** Hostility x Defensiveness $p<.05$

Table 4B
Affect Ratings for Females
during Baseline, Speech and Math Tasks

	LH n=5			DEF n=15			HH n=7			DH n=7		
	BL	SP	MA	BL	SP	MA	BL	SP	MA	BL	SP	MA
Interest **	38.4	32.2	37.2	61.3	63.4	66.9	57.5	60.8	43.8	54.0	56.7	45.0
Anger	7.0	18.2	19.4	4.4	10.5	10.3	7.6	11.3	27.0	9.3	8.7	32.0
Frustration	8.8	46.2	41.0	6.1	33.2	48.7	7.7	31.4	70.3	13.0	37.1	62.5
Restlessness	31.8	35.8	26.0	29.0	31.3	32.1	23.1	37.0	52.6	22.9	27.0	45.3
Irritation	8.6	25.2	25.4	6.4	15.5	25.6	7.3	13.3	51.6	5.6	17.3	38.7
Anxiousness	21.6	38.8	44.6	20.1	54.4	56.0	33.6	66.4	72.8	34.7	41.0	74.7
Boredom **	61.2	13.2	36.8	27.1	11.5	10.4	36.3	11.0	27.0	37.0	21.4	24.9
Happiness **	36.8	20.2	21.2	54.7	38.2	43.9	51.6	44.0	28.7	45.1	41.0	23.7
Depression	12.6	38.0	23.2	9.1	15.3	8.8	15.1	15.6	16.4	9.3	10.4	11.7
Satisfaction	46.0	21.6	23.6	51.3	37.5	34.0	51.1	36.7	19.7	49.7	26.1	16.7

Abbreviations: LH = Low Hostile, DEF = Defensive, HH = High Hostile, DH = Defensive Hostile
BL = Baseline, SP = Speech Task, MA = Math Task.
** Hostility x Defensiveness $p<.05$

Figure 1. Wall motion scores during mental stress of coronary artery disease patients

Helmers et al. (1991)

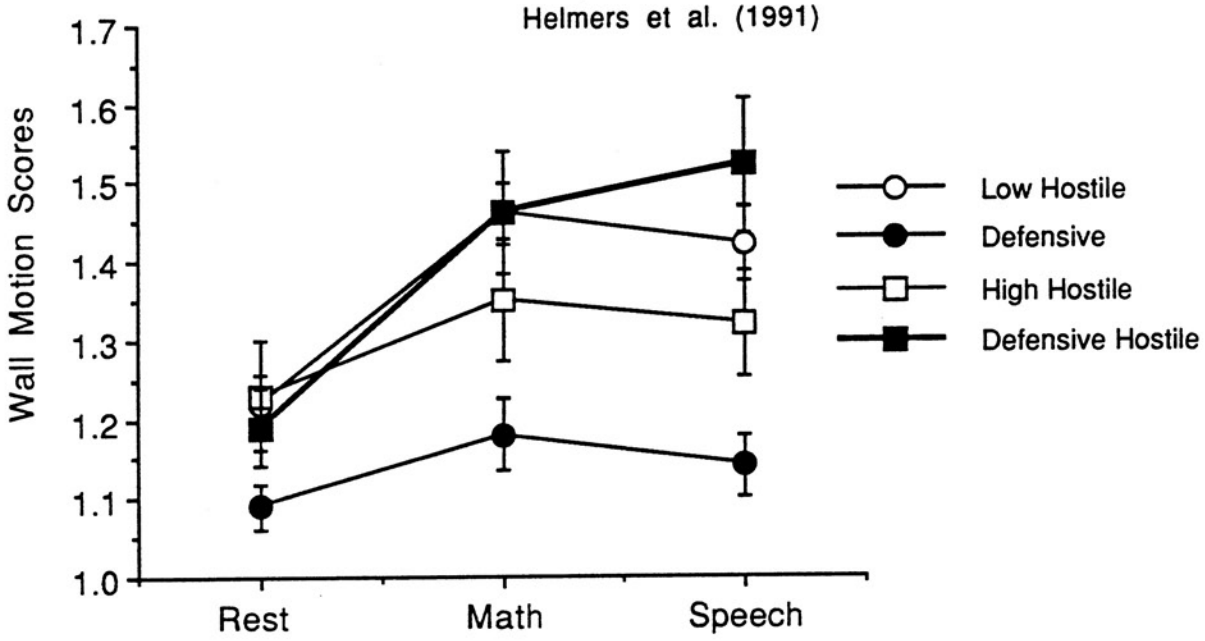


Figure 2a. Thallium exercise ischemia of coronary artery disease patients
Helmers et al. (1991)

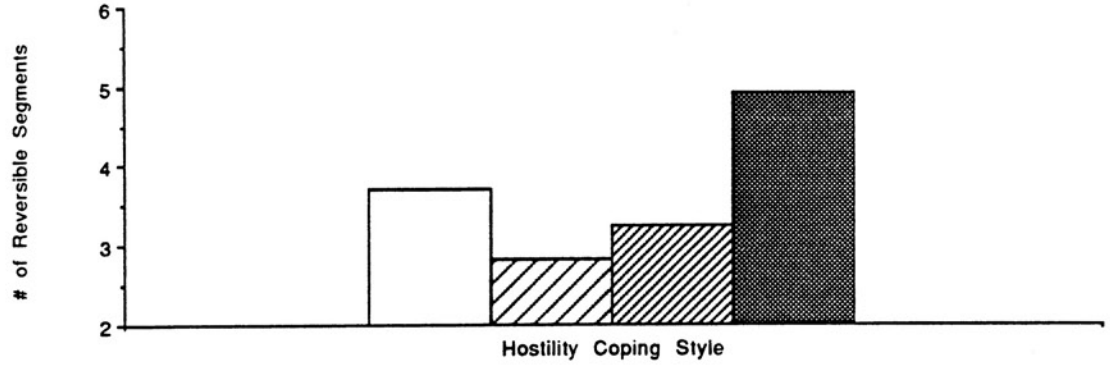


Figure 2b. Total minutes of ischemia of coronary artery disease patients
Helmers et al. (1991)

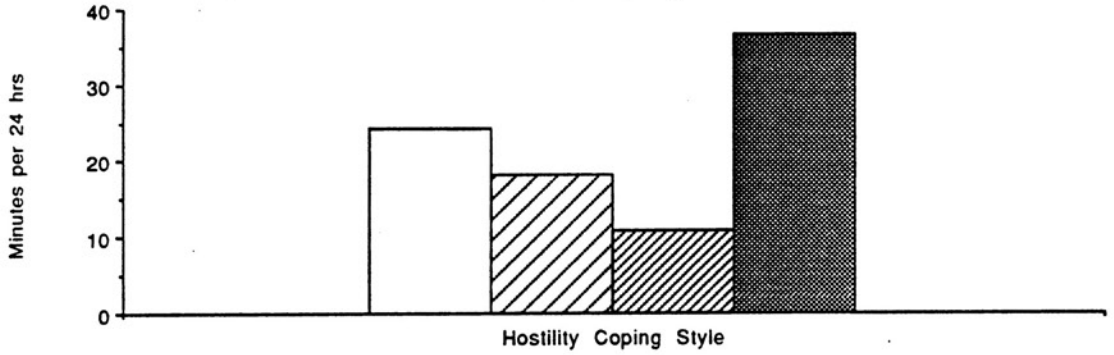


Figure 2c. Frequency of ischemic episodes of coronary artery disease patients
Helmers et al. (1991)

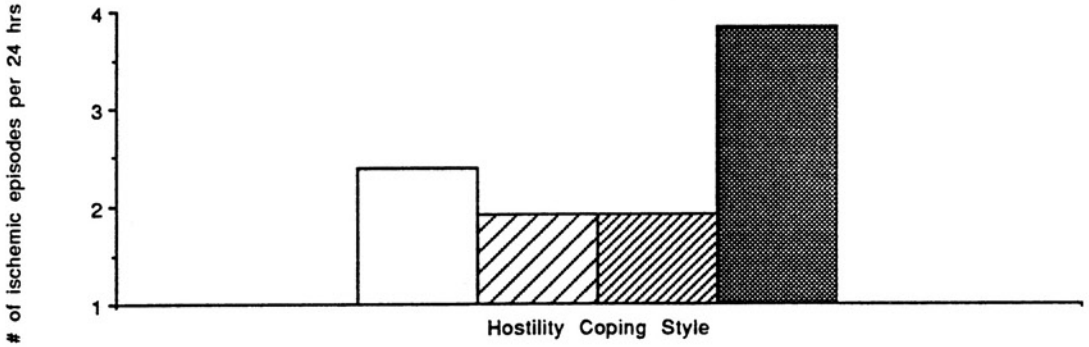


Figure 2d. Maximum ST depression of coronary artery disease patients
Helmers et al. (1991)

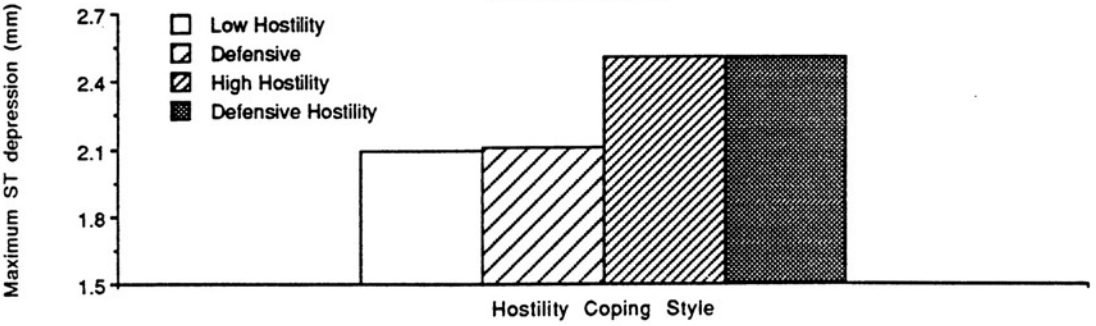


Figure 3. Heart rate levels of paramedic males
Jamner et al. (1991)

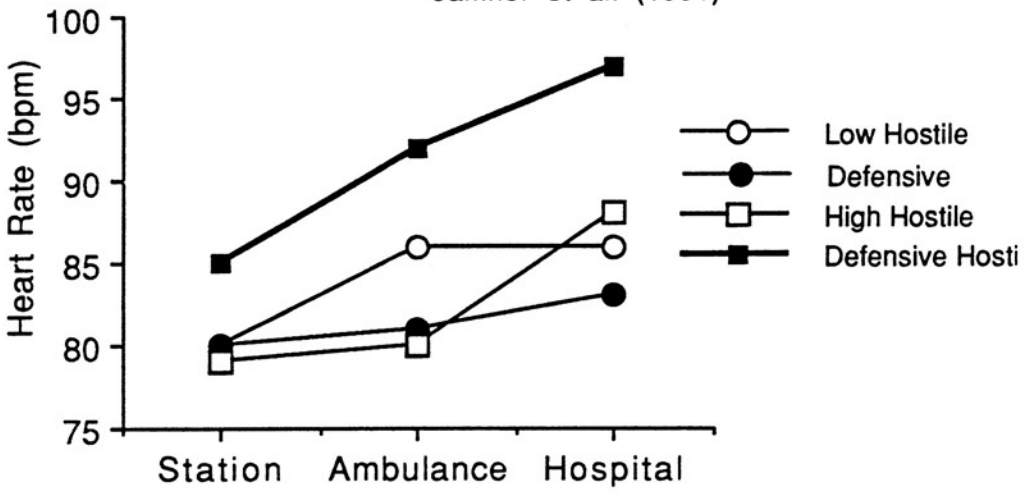


Figure 4. Affect ratings for baseline, speech and math tasks

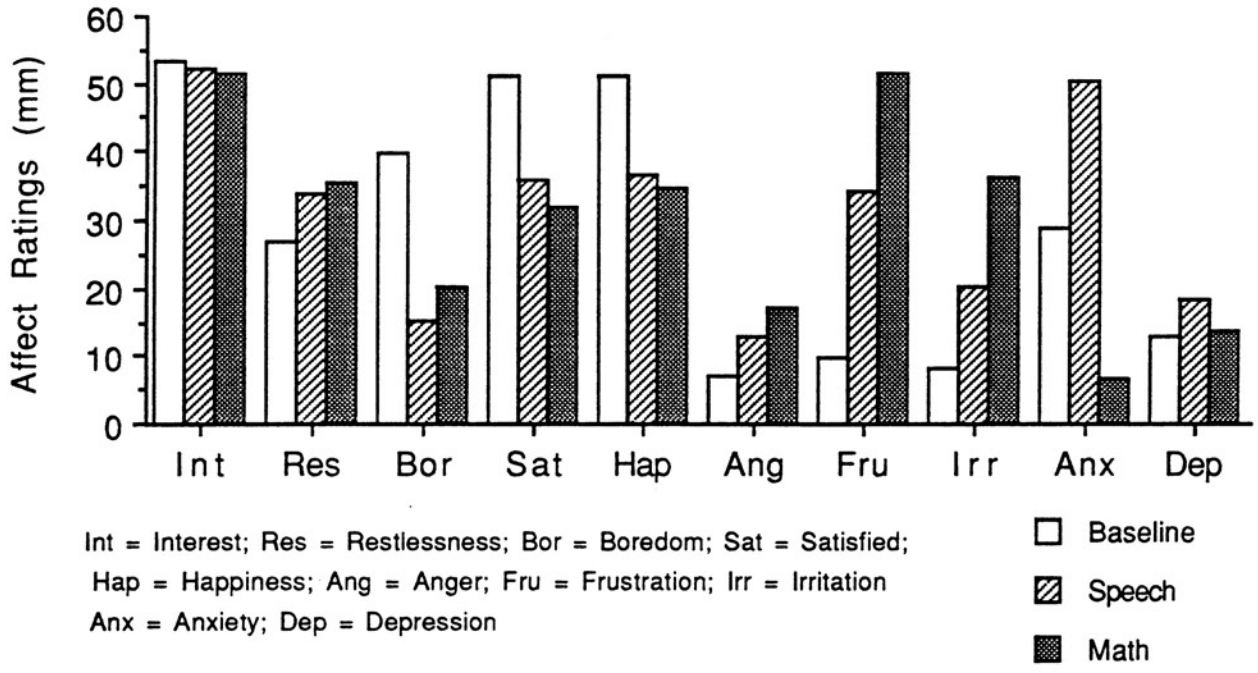


Figure 5a. SBP levels during tasks in male experimental groups

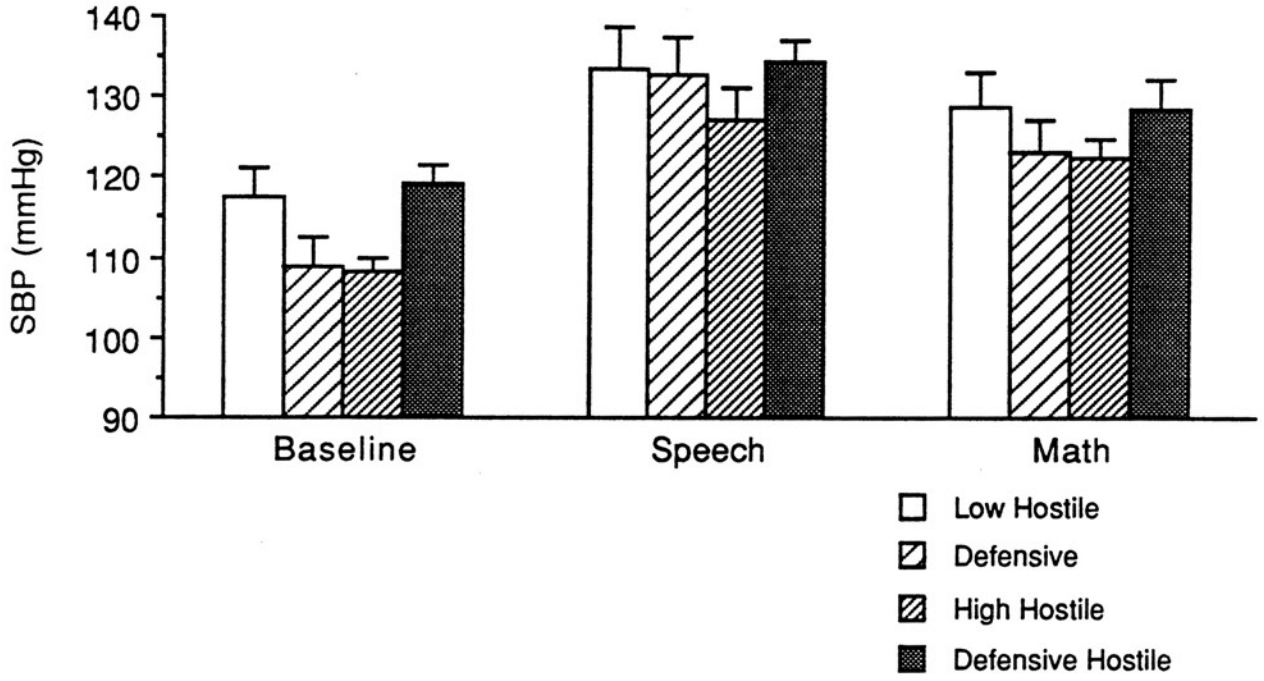


Figure 5b. SBP levels during tasks in female experimental groups

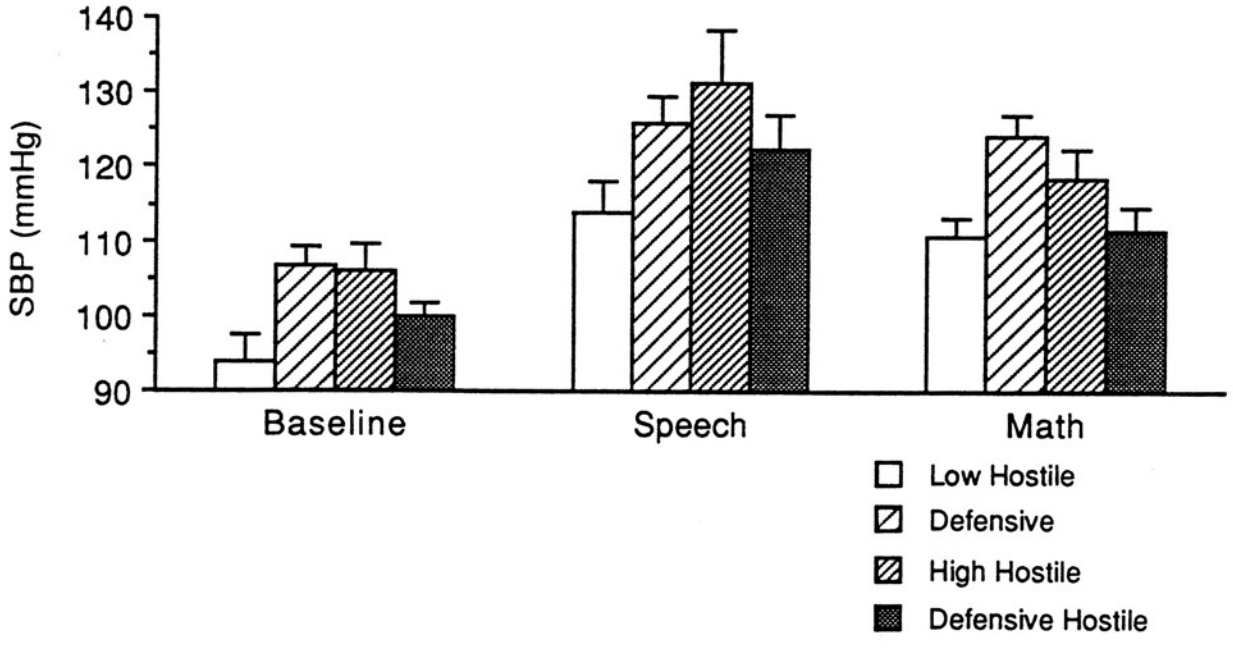


Figure 6a. DBP levels during tasks in male experimental groups

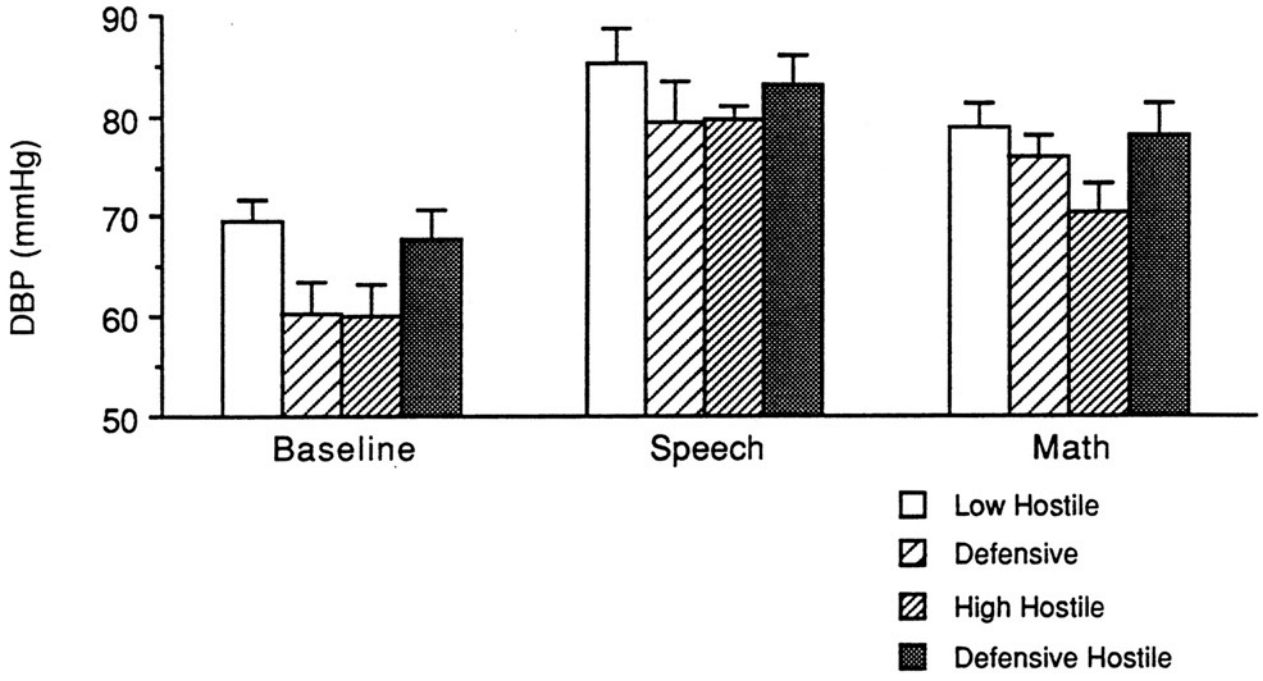


Figure 6b. DBP levels during tasks in female experimental groups

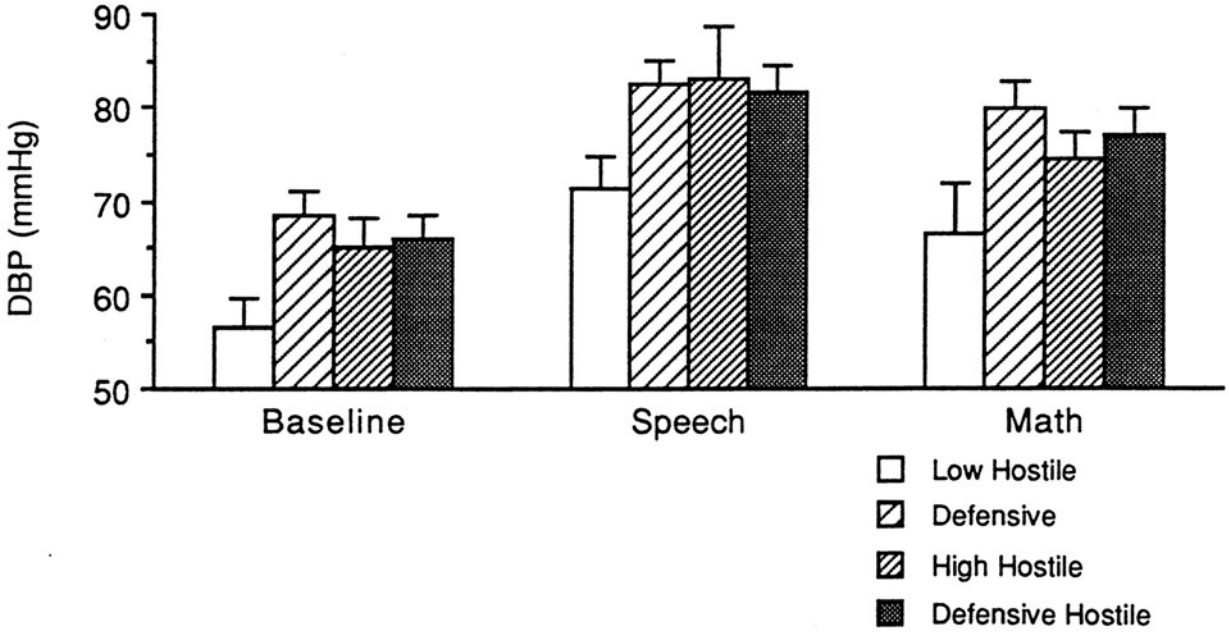


Figure 7a. Anger ratings for males

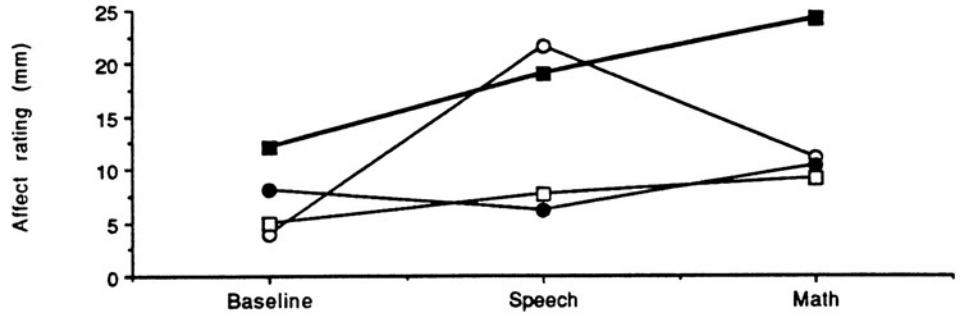


Figure 7b. Irritation ratings for males

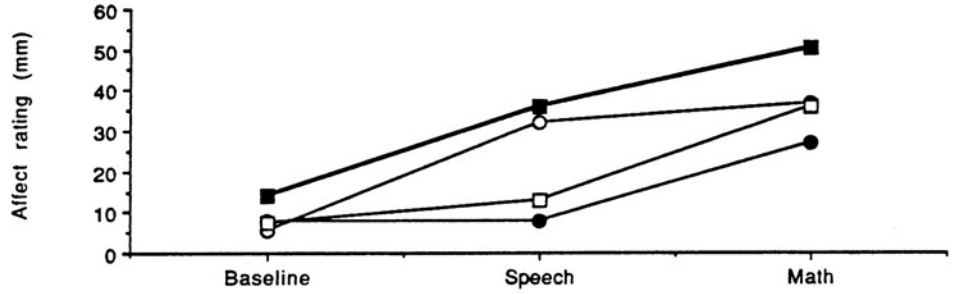


Figure 7c. Depression ratings for males

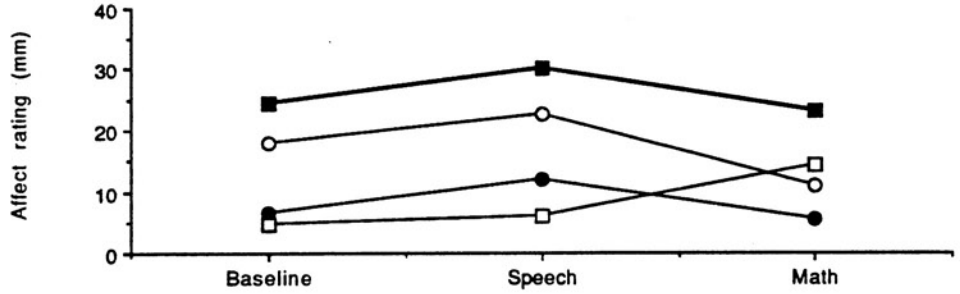


Figure 7d. Happiness ratings for males

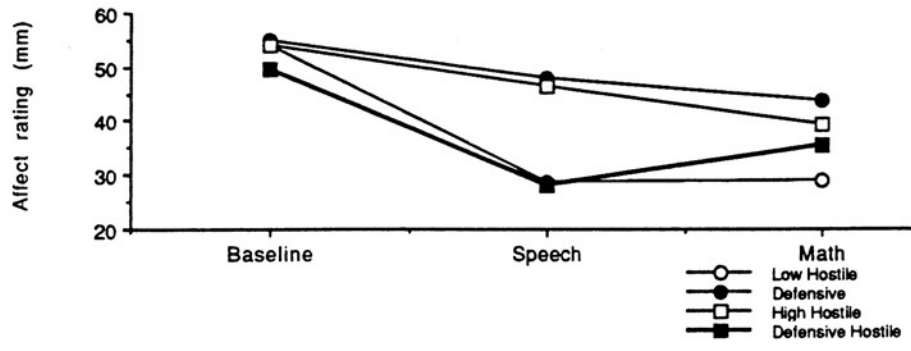


Figure 8a. Interest ratings for females

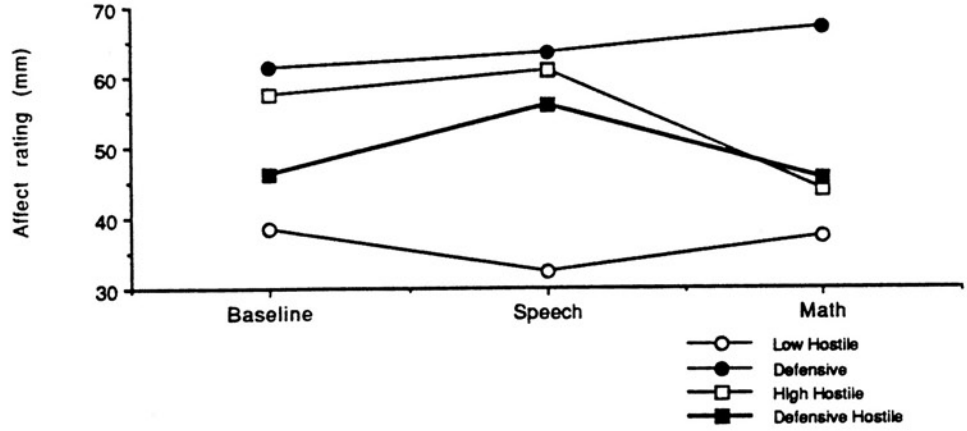


Figure 8b. Boredom ratings for females

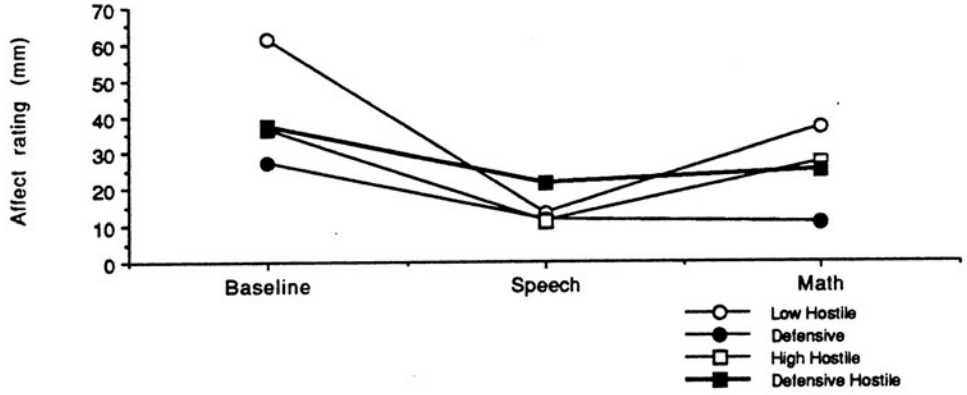


Figure 8c. Happiness ratings for females

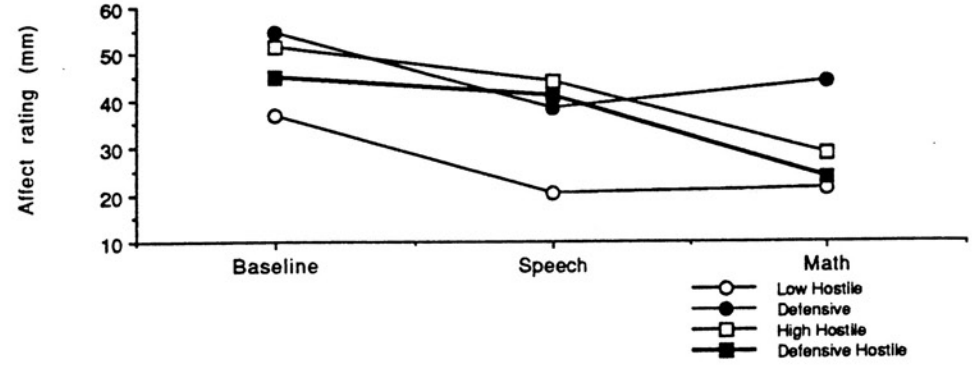


Figure 9a. SBP levels during tasks in males using composite hostility

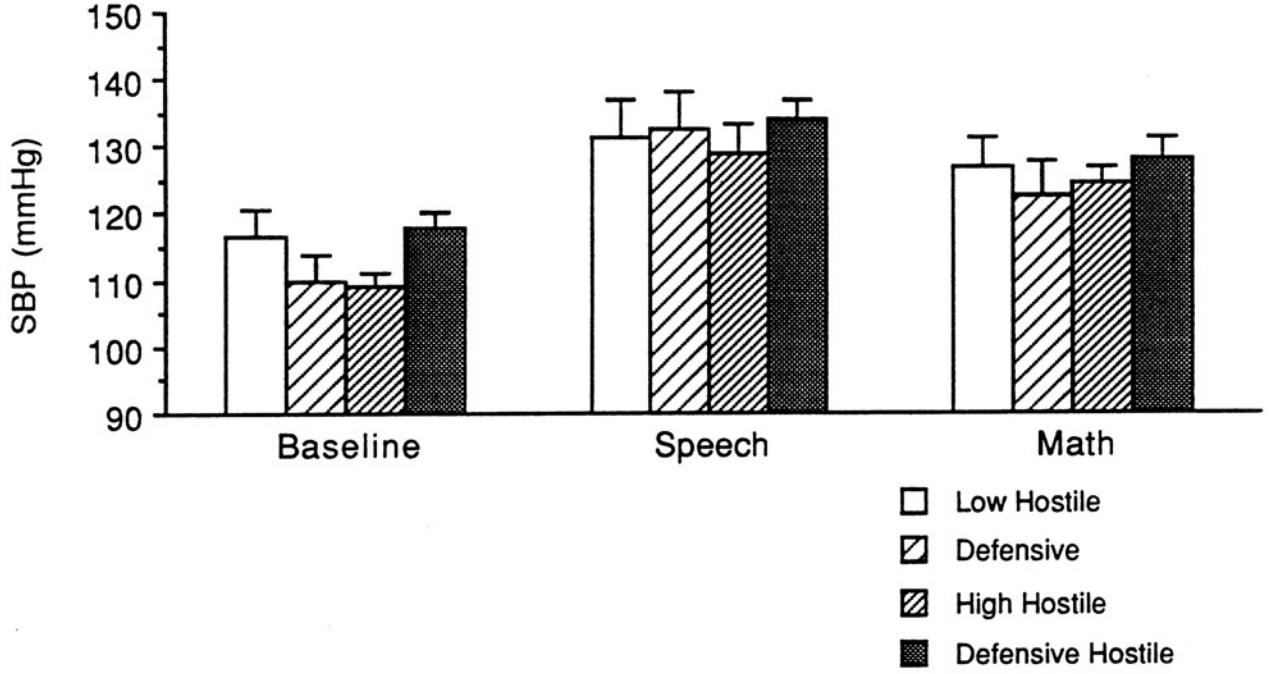


Figure 9b. SBP levels during tasks in females using composite hostility

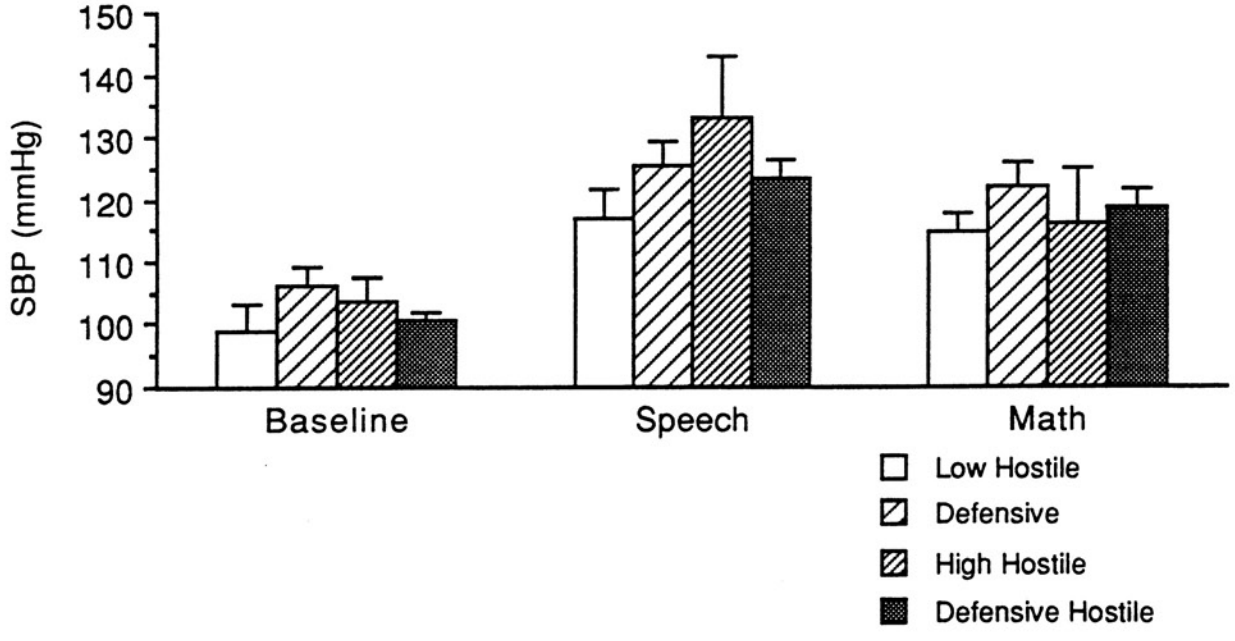


Figure 10a. DBP levels during tasks in males using composite hostility

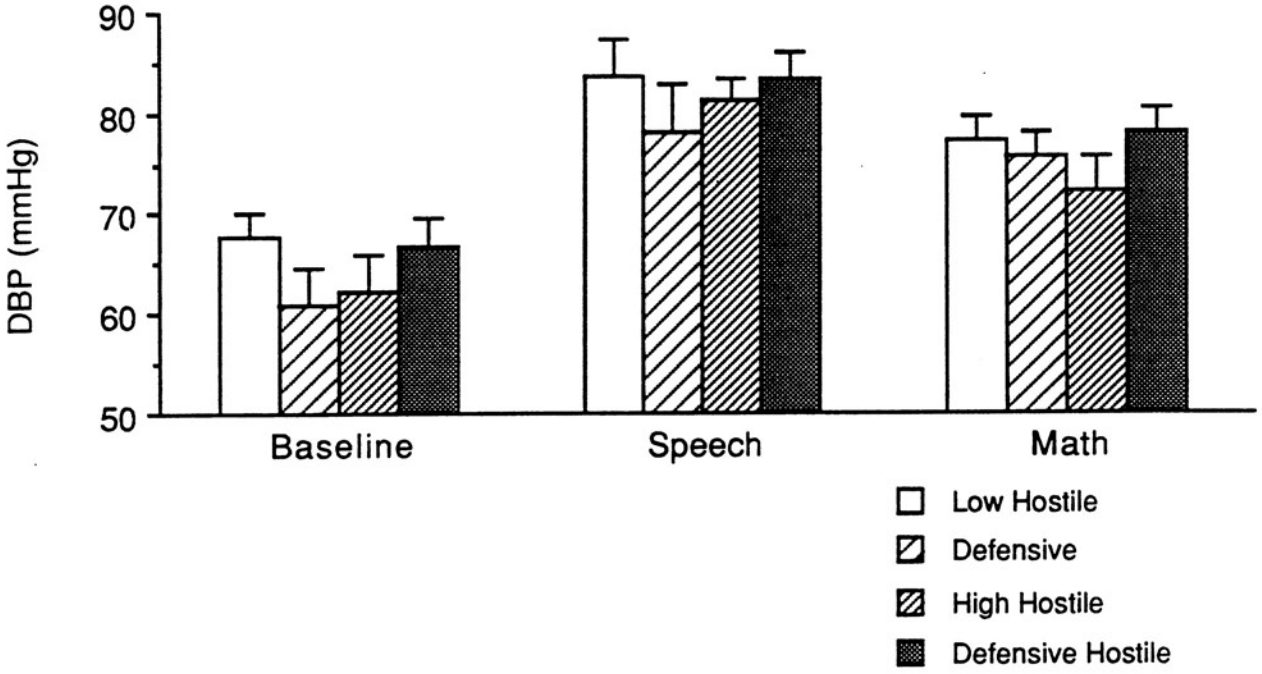
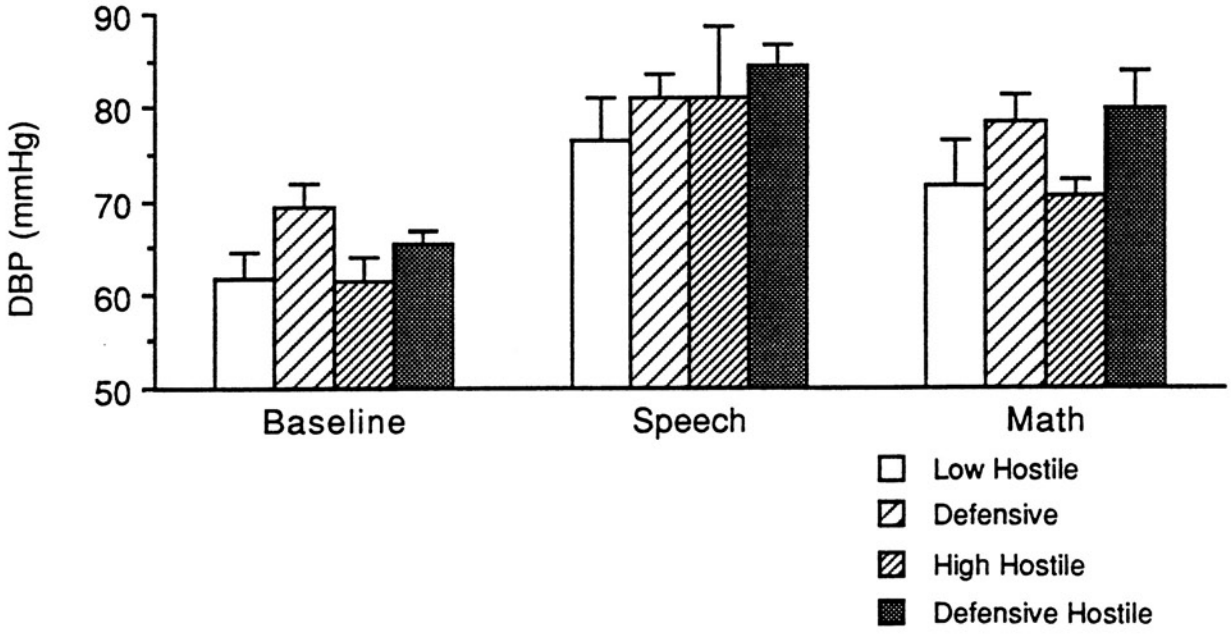


Figure 10b. DBP levels during tasks in females using composite hostility



CONSENT FORM FOR RESEARCH PARTICIPATION

Please Read Carefully

Title of Study: Personality and Physiological Responses

You are invited to participate in a research study on the association between personality and blood pressure responses to different types of tasks. We hope to learn more about this topic in our investigation. We will be scheduling you for a laboratory session and will send you a packet of personality questionnaires to complete at home. You will bring the completed questionnaires to your scheduled laboratory session. During the laboratory session you will complete a few more questionnaires and will then undergo two mental tasks while we simultaneously measure your blood pressure and heart rate.

We ask that you refrain from smoking or ingesting any caffeinated drinks (coffee, tea, most sodas) for two hours before your scheduled appointment. The completion of the questionnaires should take approximately 1.5 hours, and the laboratory session will take approximately 1.5 hours for a total of 3 hours of participation. You will be compensated with $25 for your time.

You will be given a subject number which will appear on your questionnaires. The consent form will have both your name and subject number on it and will be kept in a locked filing cabinet, to which only the investigator will have the key. Confidentiality is protected to the best extent provided under the law.

Possible inconvenience or discomfort from this study involves the measurement of your blood pressure. No other discomfort is expected. If at any time during the study you should choose not to participate in some part of the study, you may do so without penalty.

If you decide to participate, you may withdraw or discontinue participation at any time, for any reason without prejudice. If you have any questions, we expect you to ask us.

This study does not entail any physical or mental risk beyond those described above. If, however, you become uncomfortable during the study, tell us. We do not expect this to occur, but if, for any reason, you feel that continuing would constitute a hardship for you, please tell us and we will end the session.

If you believe that you have suffered any injury or illness as a result of participating in this research, please contact the office of Research Administration, 295-3303, at the University. This office can review the matter with you and may be able to identify resources available to you. Information about judicial avenues of compensation is available from the University's Office of Legal Counsel, 295-3028.

If you desire additional information about this experiment, either about the rationale for it or its findings, you may call the Department of Medical Psychology, 295-3270, to obtain information about it. In this way, you can make your participation in our research a more informative, educational experience. We welcome your comments and suggestions, and appreciate your willingness to help us.

You are making a decision whether or not to participate. Your signature indicates that, having read the above information, you have decided to participate.

I certify that I have received a copy of this consent form.

	_____ Subject Initials
_____ Date Signed	_____ Signature of Subject
	_____ Subject Social Security No.
	_____ Subject Printed Name/Status
_____ Witness Signature	_____ Investigator Signature
_____ Printed Name/soc.sec.#	_____ Printed Name/ Soc. Sec. #

CONSENT FORM FOR RESEARCH PARTICIPATION

Please Read Carefully

Title of Study: Personality Correlates

You are invited to participate in a research study on personality variables. We hope to learn more about this topic in our investigation. We are sending you a packet of personality questionnaires to complete at home, and to be returned in the enclosed envelope. The completion of the questionnaires should take approximately 1.5 hours. Upon receipt of your signed consent form and packet of questionnaires we will send you a check for $10.

You will be given a subject number which will appear on your questionnaires. The consent form will have both your name and subject number on it and will be kept in a locked filing cabinet, to which only the investigator will have the key. Confidentiality is protected to the best extent provided under the law.

No discomfort is expected. If at any time during the study you should choose not to participate, you may do so without penalty. If you decide to participate, you may withdraw or discontinue participation at any time, for any reason without prejudice. If you have any questions, we expect you to ask us.

This study does not entail any physical or mental risk beyond those described above. If, however, you become uncomfortable during the study, tell us. We do not expect this to occur, but if, for any reason, you feel that continuing would constitute a hardship for you, please tell us and we will end the session.

If you believe that you have suffered any injury or illness as a result of participating in this research, please contact the office of Research Administration, 295-3303, at the University. This office can review the matter with you and may be able to identify resources available to you. Information about judicial avenues of compensation is available from the University's Office of Legal Counsel, 295-3028.

If you desire additional information about this experiment, either about the rationale for it or its findings, you may call the Department of Medical Psychology, 295-3270, to obtain information about it. In this way, you can make your participation in our research a more informative, educational experience. We welcome your comments and suggestions, and appreciate your willingness to help us.

You are making a decision whether or not to participate. Your signature indicates that, having read the above information, you have decided to participate.

I certify that I have received a copy of this consent form.

	_____ Subject Initials
_____ Date Signed	_____ Signature of Subject
	_____ Subject Social Security No.
	_____ Subject Printed Name/Status
_____ Witness Signature	_____ Investigator Signature
_____ Printed Name/soc.sec.#	_____ Printed Name/ Soc. Sec. #

Subject number _____

Date _____

Time _____

Instructions: Below are words which describe the feelings people have. Please read each one carefully and rate how much you have had that feeling during the past 10 minutes, including now. You may mark anywhere on each line.

	Not at all	Extremely
Happy	_____	
Bored	_____	
Anxious	_____	
Satisfied	_____	
Depressed	_____	
Interested	_____	
Angry	_____	
Frustrated	_____	
Restless	_____	
Irritated	_____	

Subid _____

Date _____

Age _____ Height _____

Sex _____ Weight _____

Race _____

Marital Status
- Single ___
- Married ___
- Divorced ___
- Widowed ___

Occupation _____

Education
- Some High School ___
- Finished High School ___
- Some College ___
- Finished College ___
- Some Graduate ___
- Master's Degree ___
- Ph.D. ___

Family History (indicate Yes or No)

Hypertension:	Mother ____	Father ____
Heart Disease:	Mother ____	Father ____
Diabetes:	Mother ____	Father ____
Cancer:	Mother ____	Father ____

Are you currently taking any medication? Yes ___ No ___

If yes, what are you taking? _____

Do you exercise on a regular basis? Yes ___ No ___

If yes, please describe_____

Do you smoke? Yes ___ No ___

If yes, how many cigarettes per day? _____

Date of your last menstrual period _____

Are you taking birth control pills? Yes ___ No ___

Subject # _____

Instructions: Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you personally.

	True	False	
1.	○	○	1. Before voting I thoroughly investigate the qualifications of all the candidates.
2.	○	○	2. I never hesitate to go out of my way to help someone in trouble.
3.	○	○	3. It is sometimes hard for me to go on with my work if I am not encouraged.
4.	○	○	4. I have never intensely disliked someone.
5.	○	○	5. On occasion I have had doubts about my ability to succeed in life.
6.	○	○	6. I sometimes feel resentful when I don't get my way.
7.	○	○	7. I am always careful about my manner of dress.
8.	○	○	8. My table manners at home are as good as when I eat out in a restaurant.
9.	○	○	9. If I could get into a movie without paying and be sure I was not seen, I would probably do it.
10	○	○	10. On a few occasions, I have given up doing something because I thought too little of my ability.
11.	○	○	11. I like to gossip at times.
12.	○	○	12. There have been times when I feel like rebelling against people in authority even though I new they were right.
13.	○	○	13. No matter who I'm talking to, I'm always a good listener.
14.	○	○	14. I can remember "playing sick" to get out of something.
15.	○	○	15. There have been occasions when I took advantage of someone.
16.	○	○	16. I'm always willing to admit it when I make a mistake.
17.	○	○	17. I always try to practice what I preach.
18.	○	○	18. I don't find it particularly difficult to get along with loud mouthed, obnoxious people.
19.	○	○	19. I sometimes try to get even, rather then forgive and forget.
20.	○	○	20. When I don't know something I don't at all mind admitting it.
21.	○	○	21. I am always courteous, even to people who are disagreeable.
22.	○	○	22. At times I have really insisted on having things my own way.
23.	○	○	23. There have been occasions when I felt like smashing things.
24.	○	○	24. I would never think of letting someone else be punished for my wrongdoings.
25.	○	○	25. I never resent being asked to return a favor.
26.	○	○	26. I have never been irked when people expressed ideas very different from my own.
27.	○	○	27. I never make a long trip without checking the safety of my car.
28.	○	○	28. There have been times when I was quite jealous of the good fortune of others.
29.	○	○	29. I have almost never had the urge to tell someone off.
30.	○	○	30. I am sometimes irritated by people who ask favors of me.
31.	○	○	31. I have never felt I was punished without cause.
32.	○	○	32. I sometimes think when people have a misfortune they only got what they deserved.
33.			
34.	○	○	33. I have never deliberately said something that hurt someone's feelings.

Subject # _____

Instructions: For each item listed below, think about how it applies to your own beliefs and/or behaviors. Indicate whether the statement is more true or false for you by filling in the appropriate circle. Please answer each statement.

	True	False	
1.	◯	◯	1. When someone does me a wrong I feel I should pay him/her back if I can, just for the principle of the thing.
2.	◯	◯	2. I prefer to pass by school friends, or people I know but have not seen for a time, unless they speak to me first.
3.	◯	◯	3. I have often had to take orders from someone who did not know as much as I did.
4.	◯	◯	4. I think a great many people exaggerate their misfortunes in order to gain sympathy and help from others.
5.	◯	◯	5. It takes a lot of argument to convince most people of the truth.
6.	◯	◯	6. I think most people would lie to get ahead.
7.	◯	◯	7. Someone has it in for me.
8.	◯	◯	8. Most people are honest chiefly through fear of being caught.
9.	◯	◯	9. Most people will use somewhat unfair means to gain profit of an advantage rather then to lose it.
10.	◯	◯	10. I commonly wonder what hidden reason another person may have for doing something nice for me.
11.	◯	◯	11. It makes me impatient to have people ask for my advice or otherwise interrupt me when I am working on something important.
12.	◯	◯	12. I feel I have been punished without cause.
13.	◯	◯	13. I am against giving money to beggars.
14.	◯	◯	14. Some of my family have habits that bother and annoy me very much.
15.	◯	◯	15. No one cares much what happens to you.
16.	◯	◯	16. My relatives are nearly all in sympathy with me.
17.	◯	◯	17. My way of doing things is apt to be misunderstood by others.
18.	◯	◯	18. I don't blame anyone for trying to grab everything he/she can get in this world.
19.	◯	◯	19. Most people make friends because friends are likely to be useful to them.
20.	◯	◯	20. I am sure I am being talked about.
21.	◯	◯	21. I am likely not to speak to people until they speak to me.
22.	◯	◯	22. Most people inwardly dislike putting themselves out to help other people.
23.	◯	◯	23. I tend to be on my guard with people who are somewhat more friendly than what I expected.
24.	◯	◯	24. I have sometimes stayed away from another person because I feared doing or saying something I might regret afterwards.
25.	◯	◯	25. People often disappoint me.
26.	◯	◯	26. I like to keep people guessing what I am going to do next.
27.	◯	◯	27. I frequently ask people for advice.
28.	◯	◯	28. I am not easily angered.
29.	◯	◯	29. I have often met people who were supposed to be experts who were no better than I.

Subject # _____

True	False	
30. ◯	◯	30. I would certainly enjoy beating a crook at his/her own game.
31. ◯	◯	31. It makes me feel like a failure when I hear of the success of someone I know well.
32. ◯	◯	32. I have at times had to be rough with people who were rude or annoying.
33. ◯	◯	33. People generally demand more respect for their own rights than they are willing to allow for others.
34. ◯	◯	34. There are certainly people whom I dislike so much that I am inwardly pleased when they are catching it for something they have done.
35. ◯	◯	35. I am often inclined to go out of my way to win a point with someone who has opposed me.
36. ◯	◯	36. I am quite often not in on the gossip and talk of the group I belong to.
37. ◯	◯	37. The man who had the most to do with me when I was a child (such as my father, stepfather, etc.) was very strict with me.
38. ◯	◯	38. I have often found people jealous of my good ideas, just because they had not thought of them first.
39. ◯	◯	39. When a man is with a woman he is usually thinking of her sex.
40. ◯	◯	40. I do not try to cover up my poor opinion or pity of a person so that he/she won't know how I feel.
41. ◯	◯	41. I have frequently worked under people who seem to have things arranged so that they get credit for good work but are able to pass off mistakes onto those under them.
42. ◯	◯	42. I strongly defend my own opinions as a rule.
43. ◯	◯	43. People can pretty easily change me even though I thought my mind was made up on a subject.
44. ◯	◯	44. Sometimes I am sure that other people can tell what I am thinking.
45. ◯	◯	45. A large number of people are guilty of bad sexual conduct.
46. ◯	◯	46. In a new job, I want to know who to get next to.
47. ◯	◯	47. Strangers look at me critically.
48. ◯	◯	48. I can be friendly with people who do things which I consider wrong.
49. ◯	◯	49. It is safer to trust nobody.
50. ◯	◯	50. I do not blame a person for taking advantage of someone who lays himself/herself open to it.

SUBJECT # _____ ■■

Instructions: The following lists a number of statements describing how people may feel about expressing themselves. Using the scale given, approximate how well each statement describes your own thoughts or experiences. Consider the overall meaning of each item. That is, if an item consists of two thoughts, rate that item according to how both ideas apply to you. Please fill in the appropriate circle to the left of each statement.

I never feel this way ① ② ③ ④ ⑤ I frequently feel this way

①②③④⑤ 1. I want to express my emotions honestly, but I am afraid that it may cause me embarrassment or hurt.

①②③④⑤ 2. I try to control my jealousy toward my partner even though I want to let them know I'm hurting.

①②③④⑤ 3. I make an effort to control my temper at all times even though I'd like to act on these feelings at times.

①②③④⑤ 4. I try to avoid sulking even when I feel like it.

①②③④⑤ 5. When I am really proud of something I accomplish I want to tell someone, but I fear I will be thought of as conceited.

①②③④⑤ 6. I would like to express my affection more physically, but I am afraid others will get the wrong impression.

①②③④⑤ 7. I try not to worry others, even though sometimes they should know the truth.

①②③④⑤ 8. Often I'd like to show others how I feel, but something seems to be holding me back.

①②③④⑤ 9. I strive to keep a smile on my face in order to convince others I am happier than I really am.

①②③④⑤ 10. I try to keep my deepest fears and feelings hidden, but at times I'd like to open up to others.

①②③④⑤ 11. I'd like to talk about my problems with others, but at times I just can't.

①②③④⑤ 12. When someone bothers me, I try to appear indifferent even though I'd like to tell them how I feel.

①②③④⑤ 13. I try to refrain from getting angry at my parents even though I want to at times.

①②③④⑤ 14. I try to show people I love them, although at times I am afraid that it may make me appear weak or too sensitive.

①②③④⑤ 15. I try to apologize when I have done something wrong, but I worry I will be perceived as incompetent.

①②③④⑤ 16. I think about acting when I'm angry but I try not to.

①②③④⑤ 17. Often I find that I am not able to tell others how much they really mean to me.

①②③④⑤ 18. I want to tell someone when I love them, but it is difficult to find the right words.

①②③④⑤ 19. I would like to express my disappointment when things don't go as well as planned, but I don't want to appear vulnerable.

①②③④⑤ 20. I can recall a time when I wish that I had told someone how much I really cared about them.

①②③④⑤ 21. I try to hide my negative feelings around others, even though I'm not being fair to those close to me.

①②③④⑤ 22. I would like to be more spontaneous in my emotional reactions, but I just can't seem to do it.

①②③④⑤ 23. I try to suppress my anger, but I would like other people to know how I feel.

①②③④⑤ 24. It is hard to find the right words to indicate to others how I am feeling.

①②③④⑤ 25. I worry that if I express negative emotions such as fear and anger, other people will not approve of me.

①②③④⑤ 26. I feel guilty after I have expressed anger to someone.

①②③④⑤ 27. I often cannot bring myself to express what I am really feeling.

①②③④⑤ 28. After I express anger at someone, it bothers me for a long time.

Subject ID _____
Date _____

Directions: The following are a number of statements which may or may not be true for you. There are no right or wrong answers. Read each statement and then circle the answer which describes you.

1.	Do you tell the truth?	Yes	No
2.	Have you ever been uncertain as to whether or not you are homosexual?	Yes	No
3.	I always apologize to others for my mistakes.	Yes	No
4.	Have you ever thought that your parents hated you?	Yes	No
5.	Would you declare everything at customs, even if you knew that you could never be found out?	Yes	No
6.	Have you ever enjoyed your bowel movements?	Yes	No
7.	When you take sick-leave from work or school, are you as sick as you say you are?	Yes	No
8.	Have you ever doubted your sexual adequacy?	Yes	No
9.	Have you ever thought of committing suicide in order to get back at someone?	Yes	No
10.	People often disappoint me.	True	False
11.	I never attend a sexy show if I can avoid it.	True	False
12.	In a group of people I have trouble thinking of the right things to talk about.	True	False
13.	I am sometimes irritated by people who ask favors of me.	True	False
14.	Once in a while I laugh at a dirty joke.	True	False
15.	Life is a strain for me most of the time.	True	False
16.	I have several times given up doing something because I thought too little of my ability.	True	False
17.	I am always courteous, even to people who are disagreeable.	True	False
18.	Sometimes at elections I vote for candidates I know little about.	True	False
19.	I worry quite a bit over possible misfortunes.	True	False
20.	I sometimes try to get even rather than forgive and forget.	True	False

SELF-ANALYSIS QUESTIONNAIRE (STAS FORM T)

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

		Almost Never	Some-times	Often	Almost Always
1.	I am quick tempered	1	2	3	4
2.	I get annoyed when I am singled out for correction	1	2	3	4
3.	I am a hotheaded person	1	2	3	4
4.	I have a fiery temper	1	2	3	4
5.	I feel angry	1	2	3	4
6.	I feel irritated	1	2	3	4
7.	I get angry when I'm slowed down by others' mistakes	1	2	3	4
8.	I feel annoyed when I am not given recognition for doing good work	1	2	3	4
9.	I fly off the handle	1	2	3	4
10.	When I get mad, I say nasty things	1	2	3	4
11.	People who think they are always right irritate me	1	2	3	4
12.	When I get frustrated, I feel like hitting someone	1	2	3	4
13.	I feel infuriated when I do a good job and get a poor evaluation	1	2	3	4
14.	It makes my blood boil when I am pressured	1	2	3	4
15.	It makes me furious when I am criticized in front of others	1	2	3	4

EEQ

Directions: The following list describes some ways people may feel about expressing themselves. Using the scale below, please indicate how well each statement describes your own thoughts or experiences. There are no right or wrong answers.

1 = do not agree
7 = strongly agree

1.	I often tell people that I love them.	1	2	3	4	5	6	7
2.	When I am angry people around me usually know.	1	2	3	4	5	6	7
3.	I often touch friends during conversations.	1	2	3	4	5	6	7
4.	I laugh a lot.	1	2	3	4	5	6	7
5.	People can tell from my facial expressions how I am feeling.	1	2	3	4	5	6	7
6.	When ever people do nice things for me, I feel "put on the spot" and have trouble expressing my gratitude.	1	2	3	4	5	6	7
7.	When I really like someone they know it.	1	2	3	4	5	6	7
8.	I apologize when I have done something wrong.	1	2	3	4	5	6	7
9.	Watching television or reading a book can make me laugh out loud.	1	2	3	4	5	6	7
10.	If someone makes me angry in a public place, I will "cause a scene".	1	2	3	4	5	6	7
11.	I often laugh so hard that my eyes water or my sides ache.	1	2	3	4	5	6	7
12.	If a friend surprised me with a gift, I wouldn't know how to react.	1	2	3	4	5	6	7
13.	When I am alone, I can make myself laugh by remembering something from the past.	1	2	3	4	5	6	7
14.	I always express disappointment when things don't go as I'd like them to.	1	2	3	4	5	6	7
15.	My laugh is soft and subdued.	1	2	3	4	5	6	7
16.	I show that I like someone by hugging or touching that person.	1	2	3	4	5	6	7

SELF-ANALYSIS QUESTIONNAIRE (AX)

Directions: A number of statements which people have used to describe themselves when they feel angry or furious are given below. Read each statement and then circle the appropriate answer to indicate how often you feel or act in the manner described. There are no right or wrong answers. Do not spend too much time on any one statement. Circle the items which seems to best describe how you generally act or feel when you are angry or furious.

WHEN ANGRY OR FURIOUS . . .	Almost Never	Some-times	Often	Almost Always
1. I control my temper	1	2	3	4
2. I express my anger	1	2	3	4
3. I keep things in	1	2	3	4
4. I make threats I don't really mean to carry out	1	2	3	4
5. I pout or sulk.	1	2	3	4
6. I withdraw from people	1	2	3	4
7. I make sarcastic remarks to others	1	2	3	4
8. I keep my cool	1	2	3	4
9. I do things like slam doors	1	2	3	4
10. I boil inside, but I don't show it	1	2	3	4
11. I argue with others	1	2	3	4
12. I tend to harbor grudges that I don't tell anyone about	1	2	3	4
13. I strike out at whatever infuriates me	1	2	3	4
14. I am secretly quite critical of others	1	2	3	4
15. I am angrier than I am willing to admit	1	2	3	4
16. I calm down faster than most other people	1	2	3	4
17. I say nasty things	1	2	3	4
18. I am irritated a great deal more than people are aware of	1	2	3	4
19. I lose my temper	1	2	3	4
20. If someone annoys me, I am apt to tell him or her how I feel	1	2	3	4

Please read each of the following statements. If it is generally true for you circle "T" for true, if it is generally not true for you circle "F" for false.

T F 1. I am able to do things as well as most other people.

T F 2. There are several different people with whom I enjoy spending time.

T F 3. I regularly meet or talk with members of my family or friends.

T F 4. If I needed a quick emergency loan of $100, there is someone I could get it from.

T F 5. I am closer to my friends than most other people.

T F 6. I feel that I'm on the fringe in my circle of friends.

T F 7. There is someone I can turn to for advice about handling hassles over household responsibilities.

T F 8. If I had to mail an important letter at the post office by 5:00 and couldn't make it, there is someone who could do it for me.

T F 9. There is really no one who I feel comfortable going to for advice about sexual problems.

T F 10. If I needed a ride to the airport very early in the morning, I would have a hard time finding anyone to take me.

T F 11. I don't often get invited to do things with others.

T F 12. If for some reason I were put in jail, there is someone I could call who would bail me out.

T F 13. There is someone who will give me suggestions about activities for recreation or entertainment.

T F 14. There is no one I could call on if I needed to borrow a car for a few hours.

T F 15. I am more satisfied with my life than most people are with theirs.

T F 16. In general, people don't have much confidence in me.

T F 17. There is someone I could turn for advice about changing my job or finding a new one.

T F 18. If I decide on a Friday afternoon that I would like to go to a movie that evening, I could find someone to go with me.

T F 19. No one I know would throw a birthday party for me.

T F 20. If I got stranded 10 miles out of town, there is someone I could call to come get me.

T F 21. If a family crisis arose few of my friends would be able to give me good advice about handling it.

T F 22. If I wanted to go out of town (e.g., to the coast) for the day I would have a hard time finding someone to go with me.

T F 23. I have someone who take pride in my accomplishment.

T F 24. If I wanted to have lunch with someone, I could easily find someone to join me.

T F 25. Most of my friends are more interesting than I am.

T F 26. If I were sick, there would be almost no one I could find to help me with my daily chores.

T F 27. When I need suggestions for how to deal with a personal problem I know someone I can turn to.

T F 28. If I had to go out of town for a few weeks, someone I know would look after my house (the plants, pets, yard, etc.).

T F 29. Most people I know don't enjoy the same things that I do.

T F 30. Most of my friends are more successful at making changes in their lives than I am.

T F 31. I think that my friends feel that I'm not very good at helping them solve problems.

T F 32. I feel that there is no one with whom I can share my most private worries and fears.

T F 33. When I feel lonely, there are several people I could call and talk to.

T F 34. If I needed some help in moving to a new home, I would have a hard time finding someone to help me.

T F 35. There is really no one who can give me objective feedback about how I'm handling my problems.

T F 36. There are very few people I trust to help solve my problems.

T F 37. Most people I know think highly of me.

T F 38. There is at least one person I know whose advice I really trust.

T F 39. If I were sick and needed someone to drive me to the doctor, I would have trouble finding someone.

T F 40. I have a hard time keeping pace with my friends.

The following statements concern your personal reactions to a number of different situations. No two statements are exactly alike, so consider each statement carefully before answering. If a statement is **TRUE** or **MOSTLY TRUE** as applied to you, circle the space marked "T" on the answer sheet. If a statement is **FALSE** or **NOT USUALLY TRUE** as applied to you, circle the space marked "F."

It is important that you answer as frankly and as honestly as you can. Your answers will be kept in the strictest confidence.

T F 1. I find it hard to imitate the behavior of other people.

T F 2. At parties and social gatherings, I do not attempt to do or say things that others will like.

T F 3. I can only argue for ideas which I already believe.

T F 4. I can make impromptu speeches even on topics about which I have almost no information.

T F 5. I guess I put on a show to impress or entertain others.

T F 6. I would probably make a good actor.

T F 7. In a group of people I am rarely the center of attention.

T F 8. In different situations and with different people, I often act like very different persons.

T F 9. I am not particularly good at making other people like me.

T F 10. I am not always the person I appear to be.

T F 11. I would not change my opinions (or the way I do things) in order to please someone or win their favor.

T F 12. I have considered being an entertainer.

T F 13. I have never been good at games like charades or improvisational acting.

T F 14. I have trouble changing my behavior to suit different people and different situations.

T F 15. At a party I let others keep the jokes and stories going.

T F 16. I feel a bit awkward in company and do not show up quite as well as I should.

T F 17. I can look anyone in the eye and tell a lie with a straight face (if for a right end).

T F 18. I may deceive people by being friendly when I really dislike them.