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MICROSTRESSORS, ANXIETY STYLES, AND MULTIPLE RISK FACTORS
IN THE OCCURRENCE OF ESSENTIAL HYPERTENSION

The University of Arizona

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MICROSTRESSORS, ANXIETY STYLES, AND MULTIPLE RISK FACTORS
IN THE OCCURRENCE OF ESSENTIAL HYPERTENSION

by

Thomas Michael Zazekis

A Dissertation Submitted to the Faculty of the
DEPARTMENT OF PSYCHOLOGY
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Final Examination Committee, we certify that we have read
the dissertation prepared by Thomas Michael Zazeckis

entitled Microstressors, Anxiety Styles and Multiple Risk
Factors in the Occurrence of Essential Hypertension

and recommend that it be accepted as fulfilling the dissertation requirement
for the Degree of Doctor of Philosophy.

Ronald K. Paul

2-24-83
Date

Robert Lansing

2-24-83
Date

Richard Coan

2-24-83
Date

Ralph Stewart

2/24/83
Date

Date

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Dissertation Director

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SIGNED:

A handwritten signature in cursive script, appearing to read "Thomas B. Jozala", is written over a horizontal line.

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ABSTRACT

A study was done to investigate the contribution of small units of stress, anxiety, and demographic factors in the occurrence of various stress-related diseases. Three groups of thirty subjects each, having three distinct medical diagnoses categories (hypertensives, stress-related disorders, and general medical problems), were compared using a variety of anxiety and stress questionnaires. Subjects were matched in terms of sex, age, race, military history, and place of treatment. Devices administered to the subjects and used to compare the three groups included: A Sociodemographic Questionnaire; The State-Trait Anxiety Inventory; The Cognitive-Somatic Anxiety Questionnaire, and The Hassles and Uplifts Scales. A comparison of groups via demographic factors indicated distinctive similarities between groups on most items except for educational background, obesity ratio, and family history of hypertension. Groups were not found to be significantly different from each other in terms of anxiety styles, and reported stressors and reinforcers on a discriminant function analysis. A multiple regression analysis of the hypertensive group revealed that age; reported stressors and reinforcers; family history of hypertension; cigarette smoking, and obesity contributed to this disease. Measures of actual stressors were proven to be more accurate than anxiety

measures in predicting hypertension. Descriptive analysis of the three groups indicated that hypertensives reported a higher number of anxiety type stressors than the other two groups, and that the stress-related groups reported more health-related complaints. Theories for the lack of significance between groups are provided as well as suggestions for future studies and applications.

INTRODUCTION

The concept that physical ailments can be generated by psychological or physical stressors has been well substantiated (Selye, 1950). These illnesses are assumed to be produced directly from a reaction to a certain environmental stressor or indirectly from the interpretation (perceived stress) by the individual of the environmental stimulus.

What is important to consider is that whatever impinges upon the organism has the effect of upsetting the internal balance of the systems of the organism. Selye (1950) reviewed the historical development of this point. He attributed the first modern published occurrence of this idea to the French physiologist Claude Bernard who had stressed the necessity of maintaining the "milieu interieur" in a constant way in spite of environmental changes in order to maintain life. Selye goes on to note that this idea developed into the concept of "homeostasis" (a la Walter Cannon) and later his own theory of the "general-adaptive-syndrome" and the "diseases of adaptation."

Wittkower and Dudek (1973) reviewed the historical theories which have led up to the current conceptualizations in psychosomatic or stress-related disorders. Beginning with the early theorizing about the mind-body problem which was of interest to the Greek, Egyptian, Chaldean, and Indian medical practitioners, they noted that these groups emphasized the somato-psychic aspects of the problem.

Hippocrates (460-375 B.C.) established a rationalistic, mechanistic approach to the problem that emphasized the role of adaptive factors in health and disease. Hippocrates stressed not only the importance of the environment but also the interaction between the physician and the patient. They noted further that Galen (131-201) emphasized the concept of adaptive biology although he also viewed the disturbances in the harmony of the body in terms of the four "humors" which were a popular concept at the time. The theories which led to the modern conceptualization did not gain acceptance widely until the discovery of the microscope and the acceptance of the microbe as a generator of disease. Scientists then began to look solely for physical factors which could explain the incidence of disease. After the known physical factors were exhausted, physicians were left with unexplained sources of disease. With the advent of modern psychiatry, clinicians such as Charcot and Freud began to notice that certain ailments (e.g., hysterical paralysis) could be treated in a non-biological way--suggesting the importance of psychological factors in the development of disease.

Physiological investigators began to look at biological concomitants to emotional states and to theorize about the possible mechanisms which could be etiological in the generation of stress-related disorders. Wittkower and Dudek (1973) stressed the works of Hughlings-Jackson, Sherrington, and Cannon as the major contribution to the acceptance of emotional progenitors in the etiology of disease. The contributions of these individuals led to the acquiescence by the medical community that there may be a necessity to amend Virchow's

principle, which specifies that disease produces alteration in structure, to include the idea that emotional factors may lead to alterations of structure which lead to disease. Sherrington, in his work with the simple reflex arc, demonstrated that even this relatively simple process is subject to continuous alteration and even reversal under the influence of the activities of the central nervous system (CNS) which are subject to modification by external stimuli and cognitive/emotional factors. This point was relied upon heavily by the radical behaviorists such as Skinner (1953) in the development of behavioral theory.

The work of Cannon in the development of the thalamic theory challenged the earlier developed James-Lange theory which stated basically that the perception of muscular and visceral discharge constituted the emotional experience. Hohmann (1966) differentiated this theory to note that James primarily considered changes in smooth muscles, glands, and striated muscles as emotions, whereas Lange considered feeling or perception of visceral events as epiphenomena and suggested that emotion was primarily changes in the circulatory system. Cannon (1929) contended that the discharge of a pattern of excitation in the thalamus when communicated to the higher brain centers gave rise to the experience of emotions. Hohmann (1966) noted that later investigators criticized the criticisms of Cannon to other theories and after a review of the literature he concluded that at present there is no generally accepted theory of emotion nor is there any generally accepted definition of emotional behavior.

In spite of the disagreements over the definition of emotion, research has been done to demonstrate the effects of emotions. Cannon (1929) emphasized the role of emotions as energizers which prepared the body for emergency function primarily through the innervation of the automatic nervous system. This was referred to as the "fight or flight" reaction and was found to cause specific changes in the body. These changes were primarily the inhibition of salivation, gastric motility, secretion of gastric juices and peristalsis, thus stopping or retarding the digestive process, accelerating the heartbeat, redistributing blood to the musculature and brain stem from the viscera, increasing blood pressure and preparing the body for active muscular involvement. When the emotional reactions become extreme and cause an alteration in the homeostasis of the body, a functional alteration occurs and eventually structural damage and disease result.

Selye (1950) showed how the pituitary adrenocortical system responds to stressors of both a physical and emotional nature to cause a release of ACTH into the bloodstream causing the stimulation of the adrenal cortex to secrete various hormones eventually initiating the diseases of adaptation. The work of the above investigators demonstrates that stress does indeed produce some generalized systemic changes in the body. This produces a problem, which will be discussed in detail below, in that it becomes necessary to explain organ selection in the development of specific diseases.

Animal models have yielded some concrete evidence that a generalized stressor can produce radical changes in specific organs.

Peters (1977) noted that in some species there is a strong local vascular response to agonistic encounters. He noted that a tree shrew may die after repeated exposure to such encounters due to uremia caused by severe and lasting constriction of the renal arteries. Miller and Weiss (1969) demonstrated that rats developed ulcers and weight loss along with brain deficits when administered uncontrollable shock in a yoked experiment. Weiss (1971) followed this phenomenon further in controlled situations where rats were assigned to positions of being in control of the administration of shock, yoked to others administering the shock and no shock groups. It was discovered that the highest incidence of ulcers occurred in rats who were yoked and had no control of the shock occurrence. These findings were in direct refutation of Brady (1959) whose "executive monkey" studies revealed the monkey in charge of the shocking developed the most ulcer disease. Seligman (1975) reported that the studies by Brady were confounded due to poor selection of subjects in that the more emotional monkeys were assigned to executive slots. The difficulty in generalizing disorders from animal analogues to man or to other species is that the effects may be species specific, but to date animal studies have yielded the most clear-cut evidence of the effects of stress in the generation of disease.

In reference to diseases of human beings, Selye (1950, 1956) wrote extensively of illnesses that he purported to be generated by exposure to stress. The illnesses that Selye noted ranged from ulcers, asthma, and anemias to a variety of illnesses which affect virtually

every system in the body. Selye made broad-reaching claims based on empirical and experimental analysis. Many of his claims have been refuted by experimentally controlled studies and his work has lost value in the eyes of many current investigators. Seligman (1975) reviewed many works involving the adaptation to stress in the environment and concluded that a wide range of disorders occur as a result of exposure and maladaptation to stress, including: ulcers, hypertension, depression, and complete collapse of the general system resulting in death. Seligman attempted to forward his theory of "learned helplessness" and although much of the animal research he reported was well conducted and acceptable, his applications to human beings has been largely anecdotal.

Dohrenwend and Dohrenwend (1978) have noted a study by Fritz and Marks (1954) which found that after a rural section of Arkansas was hit by a severe tornado, 90 percent of the population reported: "... some form of acute emotional, physiological, or psychosomatic after-effect." This study appears to be largely empirical and studies of this sort rarely account for pre-morbid status or long-lasting effects in longitudinal analysis. A more convincing study of this sort which looked at the effects of traumatic stress in a controlled way was by Logue and Hansen (1980). They studied 396 flood victims in a pairwise matching technique and did find an incidence of hypertension higher than could be expected by chance. Although this study involved following the subjects for five years, it still has not answered adequately the problem of pre-morbid condition or tendency to develop the disease.

Thus, there appears to be some indication that stress can result in the development of disease, but the evidence is not as convincing as it was once hoped to be. One of the major difficulties has been to produce an accurate and comprehensive definition of stress.

Definition of Stress

The concept of stress has been thought about by theorists and experimenters and has come into popular belief as a source of disease, but has not been conclusively determined to the extent that working resolutions via stress reductions have been universally effective. One of the problems is finding a working definition of stress. Applebaum (1981) noted that: "Stress arises when there is a deviation from optimum conditions that the individual cannot correct easily, resulting in an imbalance between demand and capacity ." This does not serve as a very useful operational definition. He continues: "For serious stress to occur, the individual must view as serious the consequences of failure to have demands met." This statement introduces the concept of perception and cognitive processes as important in the generation of a pathological situation, but again, is not clear-cut enough to define the specific nature of stressor.

Coleman (1973) attempted to elaborate upon the specificity of stress as it applies to human beings. He contended that stress may be of three types when considering the psycho-social relevance of the term. The three types are: frustration, conflict, and pressure. Frustration refers to the situation where the ability to achieve a desired goal is impeded or blocked as particularly in the case of physical

handicaps which may restrict life activities or satisfaction. Conflict refers to the case where a choice must be made between two or more goals. Pressure refers to a situation in which the person is forced to speed up or intensify his or her efforts and often stems from aspirations, standards, and values. Coleman (1973) noted that it is often difficult to differentiate between physiological and psychological stress and so he offers a definition that relies heavily upon psychological factors. He contended that severity is primarily determined by three factors: the characteristic of the adjustment demand, the characteristics of the individual, and the external resources and supports available to him or her.

In terms of the first factor, Coleman noted, it is important to consider the duration and multiplicity of demands. The longer a stress operates, the more severe the effects are likely to become. In addition, the more severe the number of stressors operating on a system, the more cumulative are the effects postulated. He refers to this phenomenon from systems theory as "overloading." The best evidence to date for this phenomenon is the midtown Manhattan study of Langer and Michael (1963). This study which examined, naturalistically, the lives of individuals in an American community, found that the adjustment demand was increased by multiple stressors in a pyramiding effect. In other words, the effects of stress followed a somewhat geometric progression until overload was established.

In terms of the second factor (individual characteristics), Coleman noted, that this refers to the individual's stress tolerance

and the way he or she evaluates the stress situation. Stress tolerance deals with the overall state of health, sex differences, and "weak spots" or particular vulnerabilities to specific types of stress. The perception of stress is of key importance because it includes the cognitive reaction to the environmental demand. This includes the wide body of personality factors which may influence the individual's perception of the reality of the severity of the situation. This calls to mind the painful existence of the neurotic who lives in fear of situations or objects which are commonly dealt with by the "normal" individual. Support systems, as the third factor, are extremely important to consider in that the effects of stress tend to be exacerbated in those individuals who have no resources available to them in their social existence to ameliorate the effects of stress.

The above considerations are useful in helping operationalize the concept of stress, but they are mainly cognitive in their approach. Lazarus (1980) noted that the early conceptions of stress dealt primarily with the factors which disrupted skilled performance. In the era around 1950, anxiety was viewed as a major drive source of pathological modes of adaptation and stress (or anxiety) was thought to generate inherently pathological defense mechanisms that led to distortions of reality. Lazarus noted that a second shift occurred in psychology to turn away from drive and tension-reduction concepts and toward cognitive processes as central in human adaptation. The current approach, as defined by him, is one of being explicitly cognitive-phenomenological. This involves an interaction (similar to Bandura's social learning

approach) between cognitions and emotions in that emotions may further alter cognitions. An interchange also exists between the person and the environment.

The above considerations reveal that there does not yet exist a good operational definition of a stressor. The ideas do reveal, however, that when analyzing the stress in a given case, care must be taken to assess the intensity, number, and perception of severity by the individual. This would entail using devices which would allow an individual to report not only how many things have stressed him or her in a given period of time, but also how severely.

Stress Disorders

Stress has been viewed commonly as a generalizing phenomenon (Syme and Torfs, 1978). The conceptualization has been that a given set of environmental stimuli will cause the activation of the autonomic nervous system and this activation, without the ability to utilize the innervation in an appropriate way, causes a degeneration of susceptible target organs or systems. This flight/fight--degeneration process is the usual explanation for various stress-related disorders such as hypertension. The difficulty comes when individuals are examined in common situations and it is seen that some have developed one type of disorder and others another.

The usual explanation for the variety seen in stress disorders is that the particular individual who developed a particular disease had a propensity toward that disease. That is to say that the given

organ or system had a weakness due to genetic, environmental, or historical (developmental) factors. The genetic weakness or tendency has been demonstrated by analysis of identical twins separated at birth (Feinleib et al, 1973). Twins separated at birth develop similar disorders at a significantly similar frequency, indicating that in dissimilar environmental situations there is a similar biological malfunction. Environmental factors (e.g., diet, noise) and historical factors (e.g., increasing age) have been demonstrated to be of importance in the development of diseases such as hypertension (Page, 1976). The concept that some other form of stress interacts with the propensities to develop a disease, or stress-diathesis hypothesis, is in vogue but does not account for all psychological factors which influence the process.

The question of how a stress-related disorder for a specific organ or system is developed goes beyond the common Nature/Nurture argument. The issue is not so much whether the disease in question is directly inherited, or whether it has developed as a direct result of environmental factors, but rather a more subtle one. In the case of hypertension and cardiac disease, genetic, biological and environmental stress factors have been able to account for only a small amount of the variance (Rosenman et al., 1976). The conclusion is that the majority of the jeopardy comes from psychological tendencies or possibly from unknown biological factors yet undiscovered by our technology. Thus, the assumption is made that these diseases are "psychosomatic" simply because no biological mechanism has been discovered. This, of course, is a natural and logical conclusion. It may or may not be correct.

Before the discovery of microorganisms, individuals who developed diseases were seen as being cursed by the gods. Insanity was once thought to be the result of possession by evil spirits. Unknown biological factors cannot be eliminated as possible causes. The problem then becomes what direction to turn in terms of the understanding of a disease, especially the justification for research in the psychological correlates of a disease when all the time and energy could be devoted to discovering the unknown biological factors.

When personality or psychological tendency is considered as a possible contributor to the development of a disease, a line of thinking arises. Behavior and personality factors have been shown to be extremely stable over time (Epstein, 1979), and personality may even be somewhat permanently formed at birth. Personality is an integral part of the organism. There is the possibility that some individuals develop disorders not because of a biological factor yet undiscovered, but because of the way they react, psychologically, to the environment. There is no question that biological (including genetic) and environmental factors play a part in the etiology of any disease simply because they are an integral part of the organism's world. What is necessary to determine is to what extent each of these factors contribute in the generation of a given disease.

We know that certain disorders are directly inherited and also certain environmental factors can lead directly to some disorders (e.g., black lung disease in coal miners). There has been the assumption that certain disorders are the result of psychological factors

(such as some cases of ulcer disease). The "proving" of a psychological cause of a disease is not as simple in some cases as the discovery of a direct biological cause. However, until it can be demonstrated unequivocally that there is a biological cause for a given stress-related disorder, there is justification for the investigation of psychological factors.

Our style of living is dictated largely by our personality tendencies and the environmental forces upon us. An inappropriate style of living can lead to disorders. Changing the tendency to put undue stress on the system may not only reduce the severity of some disorders but also produce a recovery. Discovering that certain tendencies lead to the development of disorders would be useful in primary prevention. Even in the cases of diseases that have been demonstrated to have a biological cause and which are treatable by medication, alternate forms of treatment would be useful because of the ever-present side effects of medication. The primary goal of any treatment is to do maximum good with minimal harm. Research is essential to determine the extent psychological tendencies have in the generation of the stress-related disorders in order to prevent and treat these disorders.

Coping Styles

The manner in which a person copes in a situation must be important in the development of specific diseases such as hypertension, if indeed the interaction between the behavioral and visceral processes is relevant in the etiology of such diseases. This interchange would

predicate research along the lines of discovering more precisely the physiological concomitants of various emotional or coping states.

Obrist (1976), in his presidential address for the Society of Psychophysiological Research, examined current psychophysiological issues which have relevance to the concepts of coping styles, somatic activity, blood pressure control mechanisms, and cardiodynamics. He noted that the cardiovascular reaction in coping situations appears to be metabolically unjustified because the heart is pumping blood in excess of what tissues need. In order to demonstrate this in his laboratory, dogs were catheterized in the aorta and right ventricle so that arterial and venous blood oxygen could be determined. In addition, flow probes were placed on the ascending aorta so that cardiac output could be determined. When dogs were exposed to two procedures: exercise on a treadmill and a signaled shock avoidance, oxygen consumption was recorded. By working the dog on a treadmill to a pace to equal the other dog's avoidance heart rate, cardiac output is matched. Obrist determined that the oxygen consumption is less during avoidance than during exercise. The experimenters concluded that the stressor had exaggerated the cardiac output.

Obrist (1976) noted that earlier experimenters (Ax, 1953; Funkenstein, 1957) have discovered that affective states like fear and anger evoke differential cardiovascular effects similar to what he had found. Fear, which he refers to as an active coping process, precipitates an epinephrine-like effect with blood pressure more under cardiac than vascular control. Fear or active coping produces a sympathetic

nervous system reaction independent of somatic activity and results in increased cardiac output. In contrast, passive coping, as in the case of classical aversive conditioning, results in an increase in peripheral resistance via the innervation of the norepinephrine system.

The implication of this analysis as drawn by Obrist (1976) is that if the stresses of life are relevant in the etiology of cardiovascular diseases like hypertension, the mobilization responses associated with active coping would prove to be more significant. Obrist makes this contention based upon the finding of Frohlich et al. (1970), that the mobilization processes are more apt to initiate compensatory changes in the vascular system which act to perpetuate the disease process. Obrist also noted that the cardiovascular system is designed to handle deficiencies such as a drop in blood pressure or cardiac output more efficiently than an excessive output. Disease may generate from these tendencies.

The above line of thinking becomes important when we begin to examine individuals for psychological tendencies which might initiate compensatory changes in the vascular system. One method of doing this would be to examine the various individuals' reaction to stress. This could be done via a controlled setting in which a person was subjected to an experimentally set amount or type of stress and then measured physiologically. The same end might also be accomplished by using an adequately constructed survey which would measure the reported amount of stress in the everyday existence of a person along with their style of coping as measured by an index such as the anxiety type. The

present study approaches this issue in such a manner. Of course any implications as to etiology of the disease will be retrospective, but this type of analysis may yield insights to psychological patterns which cause specific innervations of the vascular system in a pathological way which could lead to the generation of a disease such as essential hypertension.

Essential Hypertension

Cryptogenic or essential hypertension is a serious and dangerous medical disease. Ask-Upmark (1967) noted that high blood pressure is an important etiological factor in cerebral-vascular lesions such as cerebral thromboses (infarctions, ramollitions) and cerebral hemorrhages; in cardiac lesions (rheumatic fever, rheumatic heart disorder, diseases of the peripheral arteries); and in renal lesions. He noted that hypertension has been cited as responsible for one cause of death out of four in the United States. In the malignant form represented by a diastolic pressure greater than 130 mm of mercury, eyeground changes of 3° or 4°, and by organic afflictions of the kidneys, heart or brain, a mortality rate of 900% or more is expected as compared with normal ranges. Generally, a young male with the above symptoms is expected to live for less than a year if left untreated (Ask-Upmark, 1967).

Mechanically, the factors which induce high blood pressure are: 1) an increase in cardiac output, 2) a change in the arterial windkettle, 3) resistance of the peripheral arterioli, and 4) changes in the blood volume (Ask-Upmark, 1967). Many mechanisms have been postulated

for these changes including: pathologies of the heart (baroreceptor changes), kidney (renin and angiotensin abnormalities), salt mechanism (antidiuretic hormone level changes), adrenal gland (adrenocortical disease), and nervous system disorders (Weiner, 1979). These mechanisms are usually examined in the case of symptomatic hypertension because known diseases affecting each of the above systems can initiate hypertension.

The difficulty with the disease of essential hypertension is that it is usually only detected after it has reached an advancing stage because it rarely occurs in younger children. The occurrence of the disease to the point where it causes concern may be when the person has reached his or her thirties or older. This detection usually occurs when a person has an insurance physical or has his or her blood pressure taken when being treated for some other problem. Usually a person is not severely bothered by a moderately elevated blood pressure because they feel fine. The common symptoms, when they manifest, are: 1) headaches, epistaxis, vertigo, cerebral fatigue (becoming tired while thinking or studying); 2) cardiac symptoms: tachycardia, arrhythmia, dyspnea, coronary pains); 3) general fatigue; 4) "rheumatic" muscle pains, and 5) sometimes craving for salt (Ask-Upmark, 1967). When these symptoms are mild or absent, the person may not be aware of having anything wrong with them. The situation exists, therefore, which makes it difficult to do longitudinal studies of people from early onset or pre-morbid states in order to determine the etiology. Retrospective studies thus become the norm and a necessary way of analyzing the disease.

Research in the Etiology of Hypertension

Research has been conducted correlating the incidence of hypertension in the presence of various physical factors. Weiner (1979) reviewed an article by Simonson and Brozek (1959) which discussed findings on essential hypertension in Russia. They noted, he reported, that persons exposed chronically to high levels of noise developed a greater incidence of hypertension. Of course incidence is not always a direct indicator of causal relationships, but in a controlled study which examines extraneous variables and accounts for historical factors, it can be heuristic in generating laboratory studies to examine the effects of an environmental factor.

One such laboratory study done by Peterson, Augenstein, Tanis, and Augenstein (1981) found that rhesus monkeys exposed continuously to realistic patterns and levels of noise for nine months exhibited sustained elevations in blood pressure that did not return to baseline after the noise ended. Extrapolation of this evidence to humans must be done with caution, but this study provides an example that in primates a physical factor may be contributory or directly causal in the development of the disease of hypertension.

Page (1976) noted that "Much evidence suggests that the development of arterial hypertension is strongly dependent on environmental factors." He noted that there is a direct relationship with upward gradients of blood pressure and age and he saw this factor as a necessary prerequisite to primary hypertension. He also noted that because

there is evidence that acculturation of traditionally "low blood pressure populations" produces rises in the incidence of hypertension that these groups are "not genetically protected from rising arterial pressure." Page further noted that studies indicate that salt intake may be a major factor in genetically susceptible young individuals in the generation of hypertension, but that other important environmental factors include weight gain with age, race, general health and nutrition, and the ratio of dietary sodium to other electrolytes and minerals.

Studies have demonstrated that in a seemingly generalized stress situation hypertension can develop over other stress-related disorders. An example of this finding is the study by Cobb and Rose (1973) that discovered that air traffic controllers develop hypertension at a rate 5.6 times as frequently as age-matched second class airmen. What is important to note is that hypertension is the primary disease developed by this group. This occurrence may be possibly explained by noting that the specific task of air traffic controllers involves extreme diligence without the ability to escape for long periods of time. This type of activity no doubt innervates the sympathetic nervous system and may possibly lead to pathology.

Kaplan (1978) explained the physiological basis of hypertension in this way: "The probable pathway involves activation of the sympathetic nervous system and thereby an increase in peripheral resistance." This provides a theoretical basis for why a reaction to environmental stress may begin to deteriorate a specific target system

in spite of the genetic or historical tendencies. More specific physiological studies are needed to investigate whether one system indeed is being stressed to such an extreme over time that it deteriorates over other systems or organs which are also stimulated.

Bastiaans (1970) noted that "Patients suffering from hypertension suppress the instinctual tendency to exaggerate the use of their normal alarm signals, but in doing so they exaggerate the normal use of preferred defense mechanism." This further emphasizes the specificity of a physiological reaction to a generalized stressor and also emphasizes the importance of individual psychological differences. Not only are the actual psychological characteristics important, but also the perception of the stress indicates the level of severity of stress. Coleman (1970) noted that the severity of the stress was determined by the "individual's stress tolerance and the way he perceives the stress situation." This tendency to perceive in a certain way may be a characteristic of the personality and therefore should be examined. The present study looks at the concept of perception of severity of stress. This perception may also be directly related to how the stressor affects the body differentially and thus be a possible explanation for the differential generation of disease.

Weiner (1979) reviewed the literature surrounding the concomitant personality patterns and central psychological conflicts found through research in essential hypertension. His review is often done uncritically without attention to the quality of the specific study. His summary is presented here merely as a report of the historical

findings that have been associated with psychological factors and hypertension.

Weiner noted overall that clinical psychiatric traits and psychological states have been found in some but not all hypertensive patients. He also noted that the findings have been so diversified that he is led to believe that there is a psychological heterogeneity among the subjects. Thus, there is the possibility that there may be subgroups of hypertensives that respond psychologically in different ways. This would be a possibility worth studying by a future research project.

The early studies Weiner reviewed had findings which paralleled the conceptual trends in vogue at the time in psychiatry. He noted that these studies concluded that patients with essential hypertension had been reported to have lifelong and largely unconscious conflicts about the expression of hostility, aggression, resentment, rage, rebellion, ambition, or dependency. Patients were noted to be perfectionistic; had difficulties with authority, and were marked by superficial friendliness and self-control to cover up their anger.

Anger and aggression were focal traits in some studies. Hypertensive patients were found to be angry but lacking in the psychological capacity to integrate, handle, or resolve their conflicts about aggression. Latent hostility was hypothesized to be a mechanism which alerted these patients and prepared them to take offensive action against other people.

The above findings are criticizable because they are largely based upon subjective impression. Clinical observation and inference have their place in scientific discovery but cannot stand with the improved objectivity of psychometric analysis of large groups. Even with careful study via psychological tests, it is difficult to draw conclusions about the pathogenesis of a disease process. A psychological device tends to give a picture of a person as he or she is at the time of the administration of the test. Personality traits, which are long-standing, may be inferred from these tests and this may be useful in generating ideas about the psychological tendencies necessary to produce an illness, but longitudinal studies which measure individuals in their pre-morbid and post-morbid states would be more useful.

A series of studies that Weiner (1979) felt held promise because they studied subjects in a longitudinal way are those by Thomas (1957, 1958, 1961, 1964, 1967). In these studies, 1,200 medical students and their parents were analyzed via psychological tests starting in 1953. This type of prospective study holds more promise for the discovery of etiological factors. No striking differences were noted between the offspring of parents dying of hypertension and the offspring of parents dead of other diseases. The findings did reveal, however, that the children of hypertensive parents tended to be more aggressive and hostile and to feel more inadequate and had compulsive character traits. These findings tended to confirm the retrospective observations found by other studies, thus lending credence to this type of study. Studies of this sort, which follow the subjects over a

longer period of time until the sample could be differentiated into a subset of individuals who developed hypertension, would be more convincing.

Attempts to connect known physiological responses to psychological tendencies have been done. Grace and Graham (1952) and Graham et al. (1962) noted that when hypertensive subjects successfully maintained their distance from others and avoided relationships, their blood pressure levels remained unchanged, but when these defenses failed, critical elevations of blood pressure occurred. The conclusion of these researchers was that the characteristic attitude of the hypertensive patient consisted of an "awareness of threat of bodily harm, without any possibility of running away or fighting back." This conclusion nicely fits the mechanism of "fight or flight" that would generate elevated blood pressures.

The analysis necessary at this time is to discover tendencies which are lasting and not transitory in the development of hypertension. Most psychological devices do not attend with the specificity needed to account for prolonged elevations of blood pressure necessary to produce a pathological change. Thus, studies are needed which look both at the general personality traits which are lasting and also at the behaviors which are emitted in reaction to the environment. When the classification "anxious personality type" is given to a person it tells something about their general tendencies but not much about the daily behaviors and reactions to the environment which would be necessary to generate a disease such as hypertension. The study by Banahan

et al. (1979) which used the STAI (State-Trait Anxiety Inventory) found that hypertensives tended to be more reactive to situations with anxiety than to be generally anxious types. An anxiety-trait personality may develop an adaptive homeostasis without damage to the vascular system, unlike a person who has excessive reactions to a variety of daily occurrences.

This leads to the necessity of analyzing the coping styles of individuals with hypertension in everyday life events. If it can be demonstrated that persons with hypertension are more reactive to daily stress than others and have different coping styles, further studies could be developed which would relate this reactive stress style to various measures of the circulation. The present study examines the question of daily reaction to stress and specific coping styles analyzed by an analysis of anxiety styles.

The issue of reactions to stress with the population of hypertensives has been analyzed in the past via the Social Readjustment Rating Scale of Holmes and Rahe (1967). This is a survey designed to analyze liabilities in the development of stress-related diseases in terms of major life events. A total point score is given based upon the major life experiences which have occurred in the individual's life weighted according to severity (e.g., death of a personal family member would be a heavily weighted occurrence). Kanner, Coyne, Schaefer, and Lazarus (1981) have raised some objections to the use of major life events, in the form of the Social Readjustment Rating Scale, as a measure of stress related to the generation of disease. They claim that

these major life events correlate weakly with health outcomes and do nothing to tell the investigator about what is occurring in day-to-day living. They, therefore, have developed the Hassles and Uplifts scales based on a twelve-month study of stress, coping, and emotions with 100 subjects. This carefully developed and controlled survey appears to be a more applicable device in the analysis of the psychological reactions necessary to generate changes in the physiology to the degree that pathology ensues. The present study, therefore, utilizes this survey.

Another area which must be considered in the analysis of hypertension is the analysis of risk factors associated with high blood pressure. Simpson, Waal-Manning, Bolli, and Spears (1979) studied 1200 people in Milton, New Zealand in an attempt to generate a list of risk factors. They found that there was a positive regression of blood pressure with age, Quetelet's index (i.e., weight/height²), and heart rate but not on 24-hour sodium excretion. They also found that women on contraceptives (oral) had a slightly but significantly higher mean systolic pressure than controls not taking contraceptives. On psychometric testing (Hostility and Direction of Hostility Questionnaire) they found no relationship between blood pressure and the personality trait of hostility. They also failed to find a relationship between blood pressure and salt intake.

Since the above study reveals a limited analysis of factors and because the findings are conflictual with other studies, especially in the area of salt intake (Weiner, 1979), it is necessary for a study to be generated which will be more inclusive in terms of sociodemographic

information, psychological factors, and reaction to stress. The present study approaches this issue by use of a statistic which will rank order the factors contributing to the association with the disease of hypertension.

PURPOSE

The above review of literature lends to some conclusion about research in the area of stress-related disorders, especially as related to the research in the area of hypertension. One of the major problems that can be seen is that experimenters have tended to select psychometric devices which are compatible with the current trends in thinking in the field of psychology as opposed to selecting devices which have empirical or face validity as applied to the disease in question. What this means is that researchers tended to investigate the characteristics of individuals in a global or theoretically biased way rather than from an approach which lends to an analysis via physiological methods. The research was important to lay a foundation for future research but has not yielded much in terms of direct intervention or understanding of the disease process. When a researcher discovers that a hypertensive individual has latent conflicts about dependency, for example, the finding is interesting but does not lead easily to an understanding of the mechanism that may be acting to cause biological harm. This type of finding is also too broad to generate a non-medical treatment regime.

Other factors that can be investigated have more face validity in the study of stress-related disorders. Anxiety reactions cause observable and measurable changes in the physiology. Therefore, it becomes logical to investigate the anxiety styles of individuals who

have diseases which have physiological consequences similar to those of anxiety reactions. It is especially important to investigate the specific type of anxiety since recent studies have determined that anxiety may be very specific, especially when considering cognitive or somatic reactions and trait versus state styles of anxiety (Schwartz et al., 1978). The most obvious factor that can be investigated with stress-related disorders would be the differences in coping styles and reaction to stressors in the environment. Since measuring this factor in the environment itself would be technically very difficult, it would be necessary to begin by looking at self reports of these reactions. As noted above, major life stressors may occur too infrequently or the reaction to them may be transitory. There is a need, therefore, to analyze reactions to more frequently occurring stressors such as daily life events (vis a vis microstressors or hassles). There is a good reason, also, to investigate these daily life events because they are indicative of behaviors which can be changed via behavioral therapies.

Another limitation of previous studies that can be noted is that often these studies were poorly controlled. Often patients were analyzed via clinical impressions and were not compared objectively to other appropriate criteria groups. Matching was often not done and so the studies have not been controlled for extraneous variables, possibly confounding the main effects. The comparison groups chosen often were simply individuals without the disease in question which yielded no insights into the possible differences in reactions or makeup of individuals with different stress-related diseases. It is important to

look at this issue because of the problem that individuals react differently and develop different disorders when exposed to the same stressors.

Risk factors are important to investigate. Previous studies (as noted above) have attempted to investigate the physical and psychological factors associated with the etiology of the disease of essential hypertension. The problem with these studies is that they have not included enough relevant factors or have not controlled for extraneous factors and so have confounded their findings. Of course to truly analyze risk factors a study must be constructed in such a way that individuals who are in a pre-morbid state are studied in a longitudinal way and compared to similar individuals who do not develop the disease. In the case of hypertension where the onset of the disease is not typically visible until the third decade of life, this type of study is prohibited by practical concerns.

The statistics utilized to compare groups in prior studies are very often simplistic. Correlational analysis appears to be the most common methodology used. Correlation, of course, yields no direct evidence for causality and also is often misleading in terms of trend analysis. The correlational statistic also does not reveal contributory variance when many factors are analyzed. Univariate analyses often exclude the relative contribution of extraneous factors. A statistic must be used which will: 1) indicate significance overall of differences between criteria groups; 2) provide a rank ordered listing of factors which serve to differentiate groups, and 3) give an

indication of the variance accounted for by each of the factors analyzed.

The present study attempted to answer the above objections and limitations in a number of ways. First, the factors chosen to analyze have face validity as to the mechanisms which are necessary to generate a disease such as hypertension. The types of questionnaires used look at aspects of the person beyond simple personality propensities. In terms of anxiety, which has direct relevance to the possible physiological mechanism of hypertension, the present study analyzes the differences in anxiety styles between normals, hypertensives, and other stress-diseased patients. One measure of anxiety, the State-Trait Anxiety Inventory (STAI) looks at the differences between an endogenous trait of the personality toward anxiety and a reactive personality style. As noted above, the study by Banahan et al. (1979) has previously found that hypertensives tend to possess the reactive (state) type of anxiety as compared to normals. The present study determined if other individuals with different stress-related disorders are different from hypertensives along this dimension. This is an important factor to determine in terms of looking at the specific anxiety reactions to life that may be causing specific diseases. Another approach to analyzing anxiety was to question the differences in cognitive and somatic processes in the generation of anxiety as suggested by the Cognitive-Somatic Anxiety Questionnaire (CSAQ) as developed by Schwartz, Davidson, and Goleman (1978). This is used to determine if

people with stress-related disorders tend to somaticize their anxiety and thus cause physical distress.

Besides anxiety, another major factor that was analyzed by the present study is the difference between the criteria groups' reaction to microstressors in the environment. The hypothesis here is that individuals with a more pronounced reaction to daily stress will have more of a tendency to develop a stress-related disorder. The important difference from other studies is to note the reactions on a more minutely temporal basis than infrequently occurring life events. For this purpose the Hassles/Uplifts survey as developed by Kanner et al. (1981) was utilized. This survey looks at both the frequency and intensity of microstressors (vis a vis Hassles) and reinforcers (vis a vis Uplifts) in the daily life of individuals along a number of dimensions (e.g., work, health, family and the environment). Differences are expected not only in the general direction of ratio of Hassles to Uplifts but also in the types of problems each of the three groups have.

In terms of the controls this study provides, there are several improvements over previous studies. First of all, the subjects were matched on extraneous variables (e.g., age, sex, race, history of military service, place of treatment) in order to control these variables and maximize the differences on the other variables. Although this has a tendency to reduce generalizability, it is important to do because some of the variables the subjects are matched upon are known to be important in the disease process of hypertension. For instance, it is

a well-known fact that blood pressure rises with age and that hypertension is not typically diagnosed until the individuals are older, and so it is important to control for this factor to eliminate its contribution to the differentiation between groups. Another design improvement of this study over others was the selection of comparison groups. In the past, hypertensives have been compared largely only to normotensives. This study used an additional comparison group composed of other stress-diseased subjects (e.g., ulcers, irritable bowel syndrome, and neurodermatitis). Again, this comparison is important in order to understand the specific differences between mechanisms of the hypertensive disease process and other stress-related diseases.

The risk factors associated with hypertension have been studied (Simpson et al., 1979), but as noted above these studies have had limitations. This present study answers the above objections by including many items to choose from as possible risks and by controlling for extraneous factors. The sociodemographic questionnaire used is one which has been used in previous studies and it was expanded to make it a more meaningful device.

Lastly, the present study answers the objection of statistical simplicity by utilizing a discriminant function analysis for the data. This statistic utilizes appropriate weighting coefficients which can transform multiple scores to single scores so that groups can be differentiated. Thus, with this statistic, it is possible to determine if the groups selected are different on many dimensions. This technique also yields an analysis of the weight of the variance contributed to

the differentiation between groups for each variable chosen. Tests of significance of multivariate mean differences can also be applied to discriminant-analysis results if further analysis is required (Overall and Klett, 1972). This statistic answers the three criteria established above for analysis.

Objectives

The study at hand had several major objectives. The first objective was to determine if individuals with different stress-related disorders can be differentiated from each other and from others without these diseases on the basis of their psychological tendencies, specifically related to the factor of anxiety. The two measures used for this purpose (the State-Trait Anxiety Inventory and the Cognitive-Somatic Anxiety Questionnaire) look at the specific anxiety styles of each of the three groups chosen as subjects.

The second objective was to differentiate the coping styles of the three criteria groups on the basis of microstressors and reinforcers in their environment. This was done using the Hassles/Uplifts survey. Differences in overall frequency, intensity (severity), and items selected most commonly are noted.

The third objective was to generate a list of risk factors for hypertension from the sociodemographic material selected and psychological tests selected, using a multiple regression analysis.

The above objectives yield several hypothesis noted below.

Hypotheses

It is predicted that hypertensives will show significant differences in anxiety styles from other patients with stress-related disorders and general medical patients. Specifically, it is predicted that hypertensives will be more reactive in their anxiety styles and more somatic than normal patients. No differences are expected between hypertensives and other stress-disorder patients in terms of somatization.

It is predicted that hypertensives will reveal a greater response in frequency and intensity on the Hassles survey indicative of a greater reaction to daily stress than normal medical patients. It is also predicted that there will be a decrease in the scores on the Uplifts survey in terms of frequency and intensity for the hypertensive group versus the general medical group. The other stress-related group is expected to have a similar trend but the descriptive content of their problem areas is expected to be different.

It is predicted that the hypertensive group will yield a different list of risk factors than the other stress-related disease group.

METHOD

Subjects

The subjects used in this study were all patients treated in the various clinics at the Veterans Administration Medical Center (TVAMC) in Tucson, Arizona. All subjects were white males, over the age of 40, and from the similar background of having served in the Armed Forces, and treated at the Tucson Veterans Hospital. Three groups of subjects were recruited, each consisting of 30 subjects: 1) hypertensive patients with a diastolic blood pressure of 90mm Hg or above and systolic blood pressure of 140mm Hg or above; 2) stress-related disease patients with no history of hypertension, and 3) general medical patients with no history of hypertension and no stress disorders. The hypertensive group were selected from the hypertension clinic on the basis of their medical histories. Patients with no reports of the blood pressure levels indicated above were eliminated, as well as patients with renal disease or other known medical causes of high blood pressure. The second group, stress-related disorders, are primarily patients recruited from the G.I. (gastrointestinal) clinic with ulcer disease. Other patients were recruited with suspected stress-related diseases such as asthma, irritable bowel, and neurodermatitis. The "normal" group was recruited from the General Medical Clinic (primarily unscheduled appointments). These subjects were used

as a control and were screened for the diseases appearing in the other two groups and eliminated if there was any indication that they had these diseases.

Instruments

A Sociodemographic Questionnaire as developed by Banahan et al. (1979) was modified to fit the population used in this study. Additional items were included from the government sponsored General Social Surveys by Davis, Smith, and Stephenson (1980). Demographic items to be assessed included: age, sex, weight, height, race, education, income range, and marital status. An attempt was also made to assess the patients' smoking pattern and possibly their daily use of alcoholic beverages. Medical history questions were also included to check the reports in the medical records and to try to ascertain family history of hypertension. These questions were related to the prior detection and treatment the subjects received as well as their awareness of their current condition and treatment.

The State-Trait Anxiety Inventory (STAI) as developed by Spielberger et al. (1966) is used as a self-report measure of state and trait anxiety. This inventory was selected in order to examine the subjects' reactions to the stressors reported in their daily lives and to differentiate different anxiety styles.

The Cognitive-Somatic Anxiety Questionnaire (CSAQ) as developed by Schwartz, Davidson, and Goleman (1978) is used as a means of differentiating the anxiety reported in terms of a cognitive or a somatic

reaction. This 14 item test has not been as widely used or substantiated as the STAI has and was, therefore, used as an experimental device to generate information.

The Hassles and Uplifts Scales as developed by Kanner et al. (1981) is used to assess the microstressors (Hassles) and reinforcers (Uplifts) commonly encountered by the three groups selected. This is a well developed survey consisting of 135 items in the Uplifts section and 117 items in the Hassles section. It is scored in terms of frequency and intensity (severity) and both these measures were recorded for each of the scales. The scales measure life experience in the areas of work, health, family, friends, the environment, practical considerations and chance occurrences.

Procedure

Subjects were tested in the waiting room while they were waiting for their scheduled or unscheduled appointments in their respective clinics, or allowed to mail their forms to the experimenter. Patients were requested to sign a release form and were briefed as to the nature of the study. Subjects were issued a number so that their reports will remain anonymous for purposes of confidentiality. Patients were usually available to fill out questionnaires while they were waiting for their scheduled and non-scheduled appointments and they were requested to use this time to do so. They were also requested to return to finish the questionnaires after the appointment if they were unable to complete them before, or to mail the completed form in the envelope provided.

Blood pressures were taken as the patients arrived for their appointments. In order to standardize this process, the same instrument, which is an automatic device, was used to screen the non-hypertensive patients for aberrations in blood pressure as well as a brief review of their medical records. Patients currently taking medications which might be masking a possible hypertensive disease were also eliminated. Hypertensive patients with other diseases (as found from their medical records) known to be stress-related, were excluded.

A brief explanation of the study as well as insurance of confidentiality was provided to each subject. All instruments to be administered were paper and pencil types and included self-explanatory directions. This information was scored on sheets which were read by scanners and thus computer scored. Results will be made available to all interested individuals who have participated in the study.

Administration time was 60 minutes or less for the average subject. A member of the staff was available during administration in order to answer any questions regarding the surveys or the study.

Data analysis was done via a discriminant function analysis as described by Overall and Klett (1972). This statistical procedure utilized appropriate weighting coefficients which transformed the multiple scores achieved on the variety of the tests into a single score so that a determination could be made if the groups were significantly different on all of the measures. This technique also yields an analysis of the weight of the variance contributed to by each of the factors used to differentiate the groups. An advantage of this statistic is

that all of the factors (including sociodemographic material) can be compared to each other and used to separate groups. Individual tests of significance do provide a better indication of statistical differences when each element is compared separately. This statistic was chosen, even with this disadvantage, because it provides the best view of the information collected in terms of the goals of the project. Tests of significance of multivariate mean differences can also be applied to discriminant analysis results and this provides an added advantage. Individual item analyses of variance were also performed. A standard SPSS program is available for this statistic and so the data was recorded on magnetic tape to be made available for computer analysis. This enables alternate methods of analysis once the data is key punched. A multiple regression analysis was also done on the data provided from hypertensive subjects in order to examine the factors which were most salient in predicting their elevated blood pressure.

A descriptive item analysis was done to generate the ten most frequently selected items on the Hassles and Uplifts Scales. In this way the three groups were compared in a descriptive as well as a statistical analysis. Kanner et al. (1981) mentioned a need for this type of analysis in this area of study.

RESULTS

Results are reported in the following order: demographic comparison of the subjects; discriminative function analysis of various factors differentiating the three criteria groups; multiple regression of data provided by hypertensives; and a descriptive analysis of the three groups on the basis of their responses on the Hassles/Uplifts survey.

Demographic Comparison

The three groups: hypertensives (HT), stress-related disorders (SR), and controls (C), revealed some interesting similarities and differences. Data are reported as percentages. Statistical comparison beyond this is not always appropriate since some of the categories are purely nominal. Where means are presented, these reflect a tendency and may not in themselves have inherent meaning.

Each of the three groups consisted of thirty (30) subjects. The stress-related (SR) group consisted of individuals with the following disorders: peptic ulcer disease (19), asthma (6), irritable bowel disease (4), and neurodermatitis (1). This wide range of disorders was chosen because of availability of subjects as well as to insure a variety of stress-related disorders. Thirty controls were recruited at random from the unscheduled appointments (walk-in) clinic. Individuals in this group were being seen for a variety of problems ranging

from orthopedic problems, infections, glaucoma, and dermatological lesions. Thirty hypertensive subjects were recruited who had three recorded blood pressures above 140/90 in the past three years. The other two groups had blood pressures below this value and the HT and C groups had no reported histories of the disorders used in the SR group.

As a control measure, subjects were recruited in all three groups who were over 40 years of age. The mean age for the SR group was 58 (S.D. 16.3); for the HT group the mean age was 60 (S.D. 7.6); and for the C group the mean age was 61 (S.D. 9.6). A pairwise comparison of these mean ages was performed using a standard t test. The means were not found to be significantly different at the .01 confidence level.

Blood pressure readings proved to be within the selected criterion limits. The highest reported blood pressure in the last three years averaged for the three groups to the following values: SR group systolic 125.2 (S.D. 12.8), diastolic 76.2 (S.D. 6.9); HT group systolic 162.3 (S.D. 20.7), diastolic 105.6 (S.D. 8.8); and C group systolic 126.8 (S.D. 12.1), diastolic 76.3 (S.D. 7.6). Comparing blood pressure readings that were the most recent for the three groups, the following values were obtained: SR group systolic 121.1 (S.D. 14.7), diastolic 75.4 (S.D. 19.2); HT group systolic 145.4 (S.D. 23.4), diastolic 89.1 (S.D. 12.8); C group systolic 126.0 (S.D. 17.9), diastolic 76.2 (S.D. 7.86). Some hypertensives were being maintained on medications at the time of their most recent readings and so their mean pressure was slightly below the criterion level. For the highest and the most

recent blood pressures, both the mean systolic and mean diastolic pressures of the stress-related and the control groups are significantly different from the mean systolic and mean diastolic pressures of the hypertensive group at the .01 confidence level on a standard t test.

Occupational differences were reported by the three groups. The SR group reported that over half (56.7%) were associated with the following professions: managers and administrators (20%), craftsmen (20%), and professional/technical (16.7%). The HT group reported that over half (59.7%) were associated with the following professions: professional/technical (33%), and managers/administrators (26.7%). The C group reported that over half (66.7%) were associated with the following professions: professional/technical (26.7%), managers/administrators (20.0%), craftsmen and kindred workers (20.0%). Although these percentages reflect trends in the groups, a χ^2 (Chi-square) procedure revealed that the differences were not significant overall at the .05 significance level.

Industrial affiliations of these professions reflected similar trends. The SR group reported that the majority (70%) were associated with the following industries: transportation/communication/public utilities (26.7%), business/repair (23.3%), and manufacturing (20.0%). The HT group reported the majority (63.4%) were associated with the following industries: professional and related services (46.7%) and manufacturing (16.7%). The C group reported that over half (66.7%) were associated with the following three industries: professional and related services (20%), manufacturing (16.7%), and business/repair

(16.7%). Interestingly, a χ^2 procedure revealed that these industrial affiliations are different overall at the .05 significance level.

Weight and height were also reported and an "obesity ratio" (OR=weight/height) was calculated for each group. Average weight for the SR group was 166.1 pounds (S.D. 25.1). Average weight for the HT group was 194.4 pounds (S.D. 38.0). Average weight for the C group was 169.3 (S.D. 23.0). Average height for the SR group was 67.9 inches (S.D. 4.0). Average height for the HT group was 70.1 inches (S.D. 3.8). Average height for the C group was 68.9 inches (S.D. 3.9). Obesity ratios for the three groups are as follows: SR = 2.45, HT = 2.77, and C = 2.46. An Univariate F-Ratio done on the data indicate that the obesity ratios are significantly different at the .01 significance level (see Table 3). Further analysis using a standard t -test revealed that the hypertensive group was significantly different in weight from the other two groups at the .01 level. No significant difference was found between the stress-related and the control groups in weight. For height, using a t test, the hypertensive group was found to be significantly different from the stress-related group at the .01 significance level but not from the control group. No difference was found between the control and stress-related groups in terms of height.

In terms of employment, the majority in each group reported being retired: SR-63.3%, HT-53.3%, and C-63.3%. The HT group reported the largest percentage (33.3%) as actively working versus 23.3% of the

C group and 16.7% of the SR group. A χ^2 test revealed that there was no significant difference between groups in employment status.

Marital status was similar for the three groups with the majority in each group reporting being married. The percentages reporting being married are as follows for each group: SR group-70.0%, HT group-86.7%, and C group-73.3%. The groups were not found to be significantly different in marital status on a F-test (see Table 3).

Educational background was varied for the groups. The HT group and the C group appear to be the more highly educated with 70% reporting some college or advanced degrees versus only 40% of the SR group reporting the same. The HT group reported that 43.3% had achieved a B.A. or higher degree. The groups were found to be significantly different in educational background at the .01 level on a F-test (see Table 3).

Almost all individuals participating in the study reported being of the "white" race. Only one individual in the SR group reported being of an "other" race. Several individuals declined to answer this question, but the percentages reporting being of the "white" race are as follows: SR-93.3%, HT-93.3%, and C-100%.

The HT group reported having the highest income with 60% reporting an income of over \$20,000 (36.7% reported having an income of over \$24,000). The C group reported that 40% had an income of over \$20,000 and the SR group reported 43.4% in this category. No significance was found overall in income differences (see Table 3).

In terms of alcohol use, most of the members in each group reported that they never drink more alcohol than they should. The SR group reported that 60% were non-abusers; the HT group reported that 50% were non-abusers; and the C group reported that 60% were non-abusers. Only one individual (3.3%) in the HT group reported that he abused alcohol "all the time." These differences were not found to be significantly different on a F-test (see Table 3).

Smoking habits were similar across the three groups. Most individuals in each group revealed that they were not cigarette smokers. The percentage of each group that reported in this fashion are as follows: SR group-60.7% non-smokers, HT group-70.0% non-smokers, and the C group-60.0%. Among those who reported that they did smoke, those that smoked one pack a day are the following percentages in each group: SR group-10%, HT group-6.7%, and C group-3.3%. The percentages of each group that reported smoking more than one pack a day are: SR group-16.7%, HT group-10%, and C group-6.7%. No significance was found in the difference between these data on a F-test (see Table 3).

A number of individuals in each group reported having a family history of hypertension. The HT group reported the highest percentage followed by the SR group and lastly, the C group. The reported percentages of those replying are: SR group-48.3%, HT group-55.6%, and C group-20.7%. These percentages were found to be significantly different at the .05 level using a X² procedure.

Subjects were asked whether they were on a salt restricted or a weight reduction diet. The hypertensive group reported the highest

percentages in each of these areas. Those reporting being on a salt reduction diet are as follows: SR group-20.7%, HT group-79.3%, and C group-23.3%. Those reporting being on a weight reduction diet are as follows: SR group-17.2%, HT group-43.3%, and C group-6.7%. Significance was found for differences in groups on the question of being on a salt-restricted or a weight reduction diet at the .05 level using the χ^2 procedure.

Discriminant Analysis

In order to give a perspective on how the respective groups answered the surveys, Table 1 is presented. Table 1 is a listing of the mean scores of each group on each of the scales used in the study.

As can be seen in Table 1, group means are similar across groups and there are consistently large standard deviations. This is important to note because these factors will be shown to be important when trying to understand the statistical analysis.

The same process was done for a number of demographic items. The means presented in Table 2 are the result of the averaging of scaled values created for the sociodemographic questions. This is a standard procedure for comparison, but the values have no inherent meaning. Item D2 refers to marital status. This has been examined before in terms of percentages. For the purpose of statistical analysis, the items have been assigned the following values: 0 = never married, 1 = widowed, 1 = divorced, 2 = separated, and 3 = married. Therefore, when we have a reported mean of 2.8 for a group, this

Table 1
 Mean Scores and Standard Deviations of
 Three Groups on Various Scales

SCALE	C		GROUPE HT		SR		F
	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>	
State Anxiety	38.7	(13.7)	37.5	(14.7)	43.8	(13.2)	2.02
Trait Anxiety	41.2	(10.9)	38.6	(12.1)	43.5	(12.6)	1.52
Somatic Anxiety	12.9	(5.3)	14.9	(6.3)	14.6	(6.3)	1.68
Cognitive Anxiety	13.1	(6.1)	14.4	(6.9)	15.1	(8.3)	.71
Hassles Severity	58.3	(39.1)	62.6	(51.4)	79.8	(60.1)	1.43
Hassles Frequency	35.4	(19.6)	37.2	(25.3)	44.2	(25.7)	.99
Uplifts Severity	132.1	(43.3)	141.9	(52.1)	144.2	(62.5)	.15
Uplifts Frequency	74.9	(19.6)	78.0	(21.6)	76.7	(22.8)	.04

*
 p < NS

Table 2
 Mean Scores and Standard Deviations of
 Three Groups on Various Demographics

ITEM	C		GROUP HT		SR		F
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
D2=Marital	2.5	(1.0)	2.8	(0.6)	2.5	(0.8)	1.21
D3=Education	3.9	(1.2)	4.0	(1.0)	3.1	(1.2)	5.30*
D5=Income	3.1	(1.7)	3.5	(1.5)	3.3	(1.6)	.64
D6=Alcohol Use	1.4	(0.5)	1.6	(0.7)	1.3	(0.5)	1.23
D8=Smoking	1.7	(1.2)	1.7	(1.4)	2.0	(1.6)	.51
OR=Obesity Ratio	2.5	(0.4)	2.8	(0.5)	2.4	(0.4)	4.96*

* p < .05

reflects a degree of "marriedness." Items such as education (D3) and income (D5) have a natural scale and so values did not have to be "forced." Other items used in this analysis are: D6 = degree of alcohol consumption; D8 = amount of cigarettes smoked; and the obesity ratio (OR).

In the canonical discriminant function used for the above variables, a Wilks Lambda (U-Statistic) and Univariate F-Ration were generated. Table 3 reflects the values for this statistic. As can be seen, significance was found for only two variables: D3 (education) and OR (obesity ratio). The significance of this finding will be discussed later.

The multiple discriminant analysis used compared the three criteria groups in two ways. First, the groups were compared on the basis of their scores on the anxiety/stress questionnaires to see if this block of tests would separate the three groups on the basis of their group centroids. This "best fit" method is useful for future studies that require prediction for membership in a group using the discriminant function coefficients available. The same rationale holds for the second comparison, i.e., the use of the sociodemographic items as a block in an attempt to separate membership in a group.

No significance was obtained for the canonical discriminant function used for the anxiety/stress questionnaires based on a two-function plotting of group centroids. The group centroids were quite similar for each of the three groups. In terms of the sociodemographic items, significance was obtained for function one of the canonical

Table 3
 Wilks Lambda (U-Statistic) and Univariate
 F-Ratio with 2 and 82 Degrees of Freedom

VARIABLE	WILKS LAMBDA	F	SIGNIFICANCE
D2=Marital	.97	1.21	.30
D3=Education	.89	5.30	.01
D5=Income	.99	.64	.53
D6=Alcohol Use	.97	1.23	.30
D8=Smoking	.99	.51	.60
OR=Obesity Ratio	.89	4.96	.01
State Anxiety	.95	2.02	.13
Trait Anxiety	.96	1.52	.23
Somatic Anxiety	.96	1.68	.19
Cognitive Anxiety	.99	.71	.55
Hassles Severity	.97	1.43	.25
Hassles Frequency	.98	.99	.38
Uplifts Severity	.996	.15	.87
Uplifts Frequency	.999	.04	.96

discriminant function, but overall significance was not obtained. The group centroids were a bit more varied than the above comparison but not to a significant degree. These findings indicate that the body of tests and demographics have failed to provide a discrimination between groups. Possible reasons for this limitation are discussed later.

Multiple Regression Analysis

Multiple regression analyses were done on the data provided by the hypertensives examining the relationship between various factors and hypertension. Systolic and diastolic pressures, which were recorded as the highest in the past three years, were used as dependent variables. Independent variables for this analysis were: age (by decades over forty years of age); obesity ratio; marital status; education; alcohol use; number of cigarettes smoked daily; taking medication for high blood pressure; family history of hypertension; being on a low sodium diet; being on a weight reduction diet; state anxiety; trait anxiety; somatic anxiety; cognitive anxiety; hassles severity; hassles frequency; uplifts severity; and uplifts frequency.

Table 4 reflects the multiple regression analysis using systolic blood pressure as a dependent variable. Significance at the .05 level was obtained for eight variables which accounted for 52% of the variance. These eight variables in order of magnitude are: age, hassles severity, uplifts frequency, family history of hypertension, number of cigarettes smoked daily, being on a weight reduction diet, somatic anxiety, and hassles frequency. Overall, all 17 factors

Table 4

Multiple Regression Analysis Using Systolic
Blood Pressure as the Dependent Variable

VARIABLE	MULTIPLE R	R SQUARE	SIGNIFICANCE
Age	.466	.217	.012
Hassles Severity	.575	.330	.007
Uplifts Frequency	.614	.377	.009
Family History	.640	.410	.013
Number of Cigarettes	.657	.432	.021
Weight Reduction Diet	.678	.460	.029
Somatic Anxiety	.705	.497	.032
Hassles Frequency	.718	.516	.046
Obesity Ratio	.734	.537	.062
Low Sodium Diet	.752	.565	.072
Uplifts Severity	.764	.584	.095
State Anxiety	.767	.588	.143
Cognitive Anxiety	.769	.591	.211
Taking Medication	.774	.599	.280
Alcohol Abuse	.777	.603	.371
Trait Anxiety	.778	.606	.476
Education	.779	.607	.586

accounted for 61% of the variance, but as mentioned, only the first eight were significant. Age and hassles severity proved to be the most salient variables, accounting for 22% and 11% of the variance respectively.

Table 5 reflects the multiple regression analysis using diastolic blood pressure as a dependent variable. Significance was not obtained for any variables in this analysis. Overall, the variables only accounted for 45% of the variance. The factors contributing the most in terms of variance accounted for are: trait anxiety (8.4%), cognitive anxiety (6.0%), Uplifts frequency (4.6%), and taking medication (4.6%).

Descriptive Analysis

In order to examine the content of the surveys answered by the subjects relating to stress, the most frequently reported items by each group are indicated in Tables 6, 7, and 8. An examination of these tables reveals that the stress-related (SR) group had the most distinctive pattern of reported health related stressors in that the first seven most frequent items relate to personal health, illness, personal energy, or the health of a family member. The other two groups also had a greater frequency of health related stressors in their list of most frequently reported stressors, but the pattern is not the distinct one presented by the SR group. The HT group appears to have a pattern of anxiety-related issues as their most common complaint. Issues such as being troubled by thoughts about the future, and trouble relaxing,

Table 5
 Multiple Regression Analysis Using Diastolic
 Blood Pressure as the Dependent Variable

VARIABLE	MULTIPLE R	R SQUARE	SIGNIFICANCE
Taking Medication	.215	.046	.271
Uplifts Frequency	.304	.092	.298
Weight Reduction Diet	.350	.123	.362
Hassles Frequency	.372	.138	.469
Trait Anxiety	.472	.222	.317
Cognitive Anxiety	.506	.256	.344
Alcohol Abuse	.562	.316	.292
Obesity Ratio	.583	.339	.340
Hassles Severity	.600	.360	.395
Low Sodium Diet	.617	.380	.451
Age	.623	.388	.543
Uplifts Intensity	.628	.395	.635
Family History	.638	.407	.703
Number of Cigarettes	.648	.420	.765
Somatic Anxiety	.666	.443	.798
State Anxiety	.667	.444	.866
Marital Status	.668	.446	.916
Education	.669	.448	.951

Table 6
Most Frequently Chosen Stressors
by the Stress Related (SR) Group

RANK	FREQUENCY	ITEM CONTENT
1	25/30	Concerns about health in general
2	24/30	Physical illness
3	23/30	Concerns about bodily functions
4	22/30	Declining physical abilities
5	22/30	Concerns about medical treatment
6	22/30	Not enough personal energy
7	22/30	Health of a family member
8	21/30	Misplacing or losing things
9	23/30	Crime
10	23/30	Traffic

Table 7
Most Frequently Chosen Stressors
by the Hypertensive (HT) Group

RANK	FREQUENCY	ITEM CONTENT
1	21/30	Troubling thoughts about the future
2	19/30	Health of a family member
3	19/30	Rising prices of common goods
4	18/30	Trouble relaxing
5	18/30	Declining physical abilities
6	18/30	Not enough personal energy
7	17/30	Misplacing or losing things
8	17/30	Concerns about health in general
9	17/30	Crime
10	16/30	Problems getting along with fellow workers
11	16/30	Concerns about weight
12	16/30	Having to wait
13	16/30	Concerns about news events
14	16/30	Traffic

Table 8
 Most Frequently Chosen Stressors
 by the Control (C) Group

RANK	FREQUENCY	ITEM CONTENT
1	23/30	Physical illness
2	22/30	Rising prices of common goods
3	20/30	Having to wait
4	20/30	Concerns about weight
5	19/30	Troubling thoughts about the future
6	19/30	Concerns about news events
7	18/30	Health of a family member
8	18/30	Concerns about health in general
9	17/30	Trouble relaxing
10	17/30	Concerns about medical treatment
11	17/30	Declining physical abilities
12	17/30	Regrets over past decisions
13	17/30	Crime

were reported frequently by the HT group. The control group reported physical illness as their most common concern, followed by concerns about the rising prices of common goods, and having to wait.

The least frequently chosen items by the groups in terms of stressors relate primarily to their life situation in that most of the items deal with children, marital change issues, and occupational issues. Most of the individuals in each of the three groups reported being married and retired, explaining the lack of problems in these areas.

An examination of the most frequently reported reinforcers or "Uplifts" was also done. The HT group reported that the following were most common reinforcers in their lives: being lucky; laughing; having fun; being well prepared; home pleasing; music, and fresh air. The SR group reported the following as the most common reinforcers: eating; home pleasing; having someone listen to you; relaxing well with friends; meeting your responsibilities; having fun; getting love; thinking about the past; exercising, and learning something.

Pooled Correlations

Pooled correlations were obtained from the data used in the discriminant function analysis. Correlations between various factors and their significance are indicated in Table 9 and discussed thoroughly in the discussion section.

Table 9
 Pooled Correlations of Various Factors
 Used in the Discriminant Function

VARIABLE 1	VARIABLE 2	r	p
Obesity Ratio	Marital Status	.35	.01
Education	Income	.33	.01
Smoking	Drinking	.31	.01
Smoking	Hassles Severity	.32	.01
Smoking	Hassles Frequency	.27	.01
Trait Anxiety	State Anxiety	.80	.01
State Anxiety	Somatic Anxiety	.54	.01
State Anxiety	Cognitive Anxiety	.62	.01
State Anxiety	Hassles Frequency	.54	.01
State Anxiety	Hassles Severity	.62	.01
State Anxiety	Uplifts Severity	-.26	.05
State Anxiety	Uplifts Severity	-.26	.05
Trait Anxiety	Somatic Anxiety	.62	.01
Trait Anxiety	Cognitive Anxiety	.77	.01
Trait Anxiety	Hassles Severity	.73	.01
Trait Anxiety	Hassles Frequency	.62	.01
Somatic Anxiety	Cognitive Anxiety	.75	.01
Somatic Anxiety	Hassles Severity	.45	.01
Somatic Anxiety	Hassles Frequency	.45	.01
Cognitive Anxiety	Hassles Severity	.58	.01
Cognitive Anxiety	Hassles Frequency	.48	.01
Hassles Severity	Hassles Frequency	.93	.01
Uplifts Severity	Uplifts Frequency	.82	.01

DISCUSSION

Sociodemographic Comparison

An important issue to discuss before examining the results of the present study is the population used for analysis. All of the subjects were veterans over forty years of age who were seeking care at the Veterans Administration Medical Center in Tucson. Current trends in medical care in the V.A. system are such that service-connection for medical problems is required before treatment can be obtained in most of the clinics. This presents a picture of older ex-servicemen who have had long-standing medical problems. Having a long-standing problem is obviously true for the hypertensive (HT) group and was also seen in the other two groups for other medical difficulties as indicated by their charts. The groups were separated on the basis of stress-related disorders, but no attempt was made to screen for other medical problems (e.g., diabetes).

Other similarities between groups can be seen by examining the sociodemographic results. As has been noted, most of the individuals were male, married, retired, and caucasian. These similarities can be compared to the findings of the National Data Program for the Social Sciences as prepared by Davis, Stephenson, and Smith (1980). This survey is a definitive and standard sociological survey of the American

population. Data were drawn from a sample of over 12,000 English-speaking persons 18 years of age or over, living in non-institutional arrangements within the continental United States. The survey was produced by the National Opinion Research Center (NORC) at the University of Chicago. Items in this NORC survey have been replicated in the present study in order to provide standardization, and originally appeared on previous national surveys. Occupational backgrounds were more varied in the national sample taken from 1972 to 1980 than were found in the three criteria groups used in the present study. Professional/technical occupations comprised only 15.0% of the national sample. This category was the most common for the HT group (33%) and C group (26.7%), and in the top three for the SR group (16.7%). In fact, the three most common occupations (professional/technical, managers, and craftsmen) for the criteria groups in the present study, averaging close to 60% of the total, comprised only 42% of the national average. The V.A. sample appears to have been one of more highly skilled backgrounds than the national sample. The most common occupation in the national sample was that of clerical and kindred workers.

Industrial affiliations of the three study groups reflected similar differences from the national sample. The most common industry in the national sample was manufacturing (25.5%), whereas this was the third most common for the study groups. Professional and related services appears as the most common for the hypertensive and control groups. The picture, based on the samples, is that the present study's population have a more highly technical background than the national

population does. This is something that would be expected of veterans who were usually given technical training in the service.

The employment status of the present study's sample was also quite different from the national sample. Nationally, 76.5% of the sample reported that they were currently working. The present study's sample was primarily retired (see Results section). This difference is also reflected in the age differences. All of the study's sample were above 40 with an average age close to 60 years old, whereas in the national average 45% were below 40 years old and had an average age close to 45 years.

Other differences between the present study's and national samples are noted in marital status, education, and income. In general, the present study's sample had a higher percentage in the married category, were more highly educated, and made significantly more money than the national sample. The national percentages are: 66.8% married; 16.6% with some college or higher; and only 12.7% with an income of over \$24,000. The present study's makeup in these areas can be found in the Results section, and it can be noted that the differences are pronounced in these areas.

The overall impression here is that the sample used in the present study is not a representative sample of the American population. This is an important issue because the tests and devices used in this study were created and standardized on normative samples from the general population. This factor becomes important in trying to understand why the obtained results failed to perform in the predicted

fashion and failed to provide a discrimination between groups. When examining the "microstressors" or hassles, for instance, one notes that a great number of the questions refer to such things as work-related stressors, financial difficulties, difficulty with offspring, and in general, areas concerned with a more active lifestyle. The high percentage of financially stable, retired individuals in the present study may obviate the fine tuning ability of the devices to differentiate groups. In other words, if the individual groups are not exposed to a wide variety of stressors, their complaints would become quite similar.

In general, the three groups used in the present study are quite similar in terms of sociodemographic makeup and personal habits. The reason for this similarity may be the nature of the sample's background. Three groups of older individuals, all veterans who are mostly retired and living in southern Arizona, have been questioned. It is most likely that these groups have similar attitudes and lifestyles, having come from a generation that served mainly in World War II. The fact that they all have sought treatment at the Veterans Hospital is also significant. There are a few factors that do differ between groups. These will be discussed when the discriminant function is analyzed.

An argument could be made that three groups matched so closely on demographics would be advantageous in accentuating differences as a result of other variables which should be aggravated, for instance, by the disease processes. Indeed, this was the hope of the present design. A problem arises when an understanding of what is being analyzed

is considered. Primarily, the devices used measure anxiety. The groups report a similar lack of anxiety in their lives. As compared to the normalized data for male general medical patients as provided by Spielberger (1970), all three groups' scores fall below or slightly above the fiftieth percentile for State and Trait anxiety (only the stress-related group was above the 50th percentile). Normative data are not as yet available for the Cognitive and Somatic anxiety scales, but the mean scores for the three groups in the study are below those of two groups of meditators and exercisers used in the study by Schwartz, Davidson, and Goleman (1978).

Interestingly, the mean frequency of Hassles as reported by the three groups in the present study was higher than the mean frequency of 60 year olds as reported by Kanner et al. (1981). The Uplifts frequency means for the present study's group were well over two times that of Kanner's group. The ratios of frequency to severity (intensity) scores, however, were closely matched in both studies. Incidentally, Kanner found severity and intensity to correlate so highly that they are interchangeable and, therefore, in the present study severity was used for calculations.

The Uplifts reported by the groups in the present study, in general, are roughly two times as frequent as the Hassles, indicating a highly rewarding/low stress life. (The ratios are: control group-2.1; hypertensive group-2.3; and stress-related group-1.8.) The biggest difference between the two scales was obtained by the hypertensive group, indicating that they would be the most likely candidates for

stress-related troubles. The weight of the evidence from prior studies (see Introduction) indicates that hypertensives have different personality makeups from normals or other groups. It is possible that in this study the individuals were examined after these tendencies had been stabilized or had gone into remission, or that the devices used were inappropriate or too insensitive to detect the differences. It is also possible that as the individuals increased in age their anxiety styles changed to a depressive style, as is commonly seen in the adult years, thus decreasing their scores on anxiety tests.

Discriminant Function Analysis -- Demographic Items

When the results of the canonical discriminant function are examined, a few interesting findings are discovered among the socio-demographic variables. Only two factors emerge as being significant at the .01 level on the Wilks Lambda (U-Statistic) and Univariate F-Ratio. These two factors are education and obesity ratio. Examining the group means for these two factors reveals that the hypertensive and control groups were more highly educated than the stress-related group, and that the hypertensive group had the highest obesity ratio. These findings imply that there may be some correlation between obesity and hypertension. This has been indicated by other authors. Genest, Koiw, and Kuchel (1977) noted: "There is no question of a definite correlation between blood pressure and the relation of body weight to height."

Educational differences, especially in the lack of education and relationship to stress-related disorders, are difficult to interpret. It could be argued that a higher degree of education reflects a

higher stress job (stress of a certain kind). Lower educational background may result in a lower economic status and a different kind of stress. Weiner (1979) noted that, although the incidence of hypertension is higher among the poor and uneducated, this may be a factor of bad living conditions and poorer diet. The added stress of a poorer income may be an important factor in the development of the stress-related diseases in the present study, but the close matching of the control group and the hypertensives eliminates this kind of stress as a salient factor in the development of hypertension in the present study.

Overall, the sociodemographic items failed to discriminate the three groups. This means that predictions cannot be made regarding group membership on the basis of sociodemographic variables. It had been hoped that factors such as alcohol use and number of cigarettes smoked along with the obesity ratio would have materialized as discriminators between groups to provide some insight as to the specific make-up of the hypertensive group.

The above procedure failed to provide distinct "profiles" for each group for the reasons of group similarity given above and also possibly a problem with honest disclosure. Although the surveys were done in confidence, there may have been a tendency by the subjects to understate certain problems (such as alcohol abuse), due to filling out a form in a government institution. In any event, all members of all three groups answered in similar ways--providing an insignificant discriminant and similar group centroids for each group.

Discriminant Function Analysis -- Anxiety and Stress

A separate discriminant function analysis was performed using the scores of the anxiety and stress questionnaires as variables. No individual variables were found to be significant on the Wilks Lambda (U-Statistic) and Univariate F-Ratio. In like manner, no significance was discovered for the overall canonical discriminant function. Again, it was hoped that a distinct pattern of tests would emerge as being significant in being able to differentiate the three groups. This would provide a nice package that would enable an experimenter to predict group membership using the weighting variables generated by the statistical procedure. Group centroids are quite similar and reflect the similar mean scores on the specific tests by each group. Reasons for the failure of this discrimination are conjecture, but may be due to similar lifestyles, lack of stressors, and the inadequacy of testing devices to measure the stress of this particular population.

Pooled within group correlations of the above variables revealed some interesting relationships. Among the sociodemographic variables it was found that the obesity ratio correlated moderately (.35, $p < .01$) with marital status. Being married may lead to obesity. Education correlated moderately (.33, $p < .01$) with income, an expected finding. Smoking was found to correlate moderately (.31, $p < .01$) with drinking, another expected relationship. Adding the anxiety/stress surveys, smoking was also found to correlate moderately with Hassles Severity (.32, $p < .01$) and Hassles Frequency (.29, $p < .01$).

Correlations were high among some of the scores of the scales themselves. Trait anxiety correlated highly with state anxiety (.80, $p < .01$), a finding which is higher than the values discovered by previous research. Spielberger (1970) reported correlations between his two scales, in general, to be between .51 and .67 for males. State anxiety also correlated relatively strongly with Somatic anxiety (.54, $p < .01$), Cognitive anxiety (.62, $p < .01$), Hassles severity (.62, $p < .01$), and Hassles Frequency (.54, $p < .01$), but negatively with Uplifts severity (-.26, $p < .05$) and Uplifts frequency (-.26, $p < .05$). Trait anxiety followed a similar trend in correlations. Trait anxiety correlated highly with Somatic anxiety (.62, $p < .01$), Cognitive anxiety (.77, $p < .01$), Hassles severity (.73, $p < .01$), and Hassles frequency (.62, $p < .01$), and negatively with the two Uplifts scales.

Somatic anxiety correlated highly with Cognitive anxiety (.75, $p < .01$), casting some doubt on the purported specificity of these two scales. Moderate correlations were also obtained between Somatic anxiety and Hassles severity (.45, $p < .01$) and Hassles frequency (.45, $p < .01$). Cognitive anxiety had moderate correlations with Hassles severity (.58, $p < .01$) and Hassles frequency (.48, $p < .01$). An extremely high correlation (.93, $p < .01$) was found between Hassles severity and frequency. Finally, another very high correlation (.82, $p < .01$) was found between the Uplifts frequency and Uplifts severity.

Some of the above correlations are to be expected since most of the scales assess some form of anxiety. It is disappointing to see so many high correlations because this reduces the belief in the purported

specificity of each of the scales. The types of anxiety to be tested are theoretically different. In this study they were similar. There is enough difference to warrant the use of the scales in an attempt to gather additional information, but one wonders whether the differences are significant enough to warrant the additional time and expense.

Multiple Regression Analysis

The multiple regression analysis of the data provided by the hypertensives revealed some interesting information. As mentioned in the Results section, eight variables accounted for 51.6% of the variance at the .05 confidence level. Age was the most prominent of these factors, accounting for 21.7% of the variance. This is an expected finding and it has been well established that blood pressure tends to rise with age (Ask-Upmark, 1967; Weiner, 1979).

The next most important factor accounting for 11.3% of the variance was the score of Hassles severity. This is a promising finding in that it had been hoped that the Hassles scale in particular would be useful in analyzing risk factors in the etiology variable, but it accounted for only 1.9% of the variance. Hassles frequency had a high correlation of .84 ($p < .01$) with Hassles severity. In a regression analysis factors that correlate highly with significant variables are "devalued" as a result of the nature of the statistical procedure. It would be expected that dropping the Hassles severity score from the equation would cause the Hassles frequency score to account for a greater amount of the variance.

Other variables which are significant in the regression equation are: Uplifts frequency (4.7% of the variance); family history of hypertension (3.3%); number of cigarettes smoked daily (2.2%); being on a weight reduction diet (2.8%); and Somatic anxiety (3.7%).

Some of the above variables are expected risk factors in the etiology of hypertension such as family history and smoking (although this latter factor has been debated--Weiner, 1979). Somatic anxiety is also a logical inclusion in this list as one would expect and was predicted.

The "positive" factors in the above list need further discussion. In the original development of the Hassles and Uplifts scales, it was predicted that people who experienced a good deal of distress would also experience a good deal of "eustress" (Hans Selye's term) and vice versa. The important factor is which way the balance tips. As can be seen in this case, the distress as measured by the Hassles score outweighed the eustress as measured by the Uplifts score (even though the actual values are opposite this). This is a useful finding and it reaffirms the necessity of giving both kinds of tests in order to measure both positive and negative things in a person's life. Kanner et al. (1981) noted that positively toned experiences might serve as buffers against stress disorders and that negatively toned stress can cause neurohumoral changes that result in "the diseases of adaptation."

Holmes and Rahe (1967) included "positive" items in their Social Readjustment Rating Scale as stressors. Kanner et al. (1981) note that other authors such as Lowenthal and Chiriboga (1973) report

that a person's resources and deficits taken together predict adaptation better than either alone. Positive experiences may produce an amount of stress, but a more useful way of examining stress in an individual's life would be the technique of weighing the positive against the negative. These positive and negative events must also be of a small enough nature to account for the daily problems and rewards that would be etiological in the development of stress diseases since cumulated life events correlate only weakly with health outcomes (Kanner et al. 1981). Of course, refinement of the device used to assess daily microstressors and reinforcers is necessary and Kanner et al. (1981) report that this is now being done with the development of subscales for the Hassles and Uplifts Survey.

Being on a weight reduction diet may appear to be a positive factor, but it may also be an indication of obesity. The obesity ratio appears ninth on the list. These two factors correlate moderately with each other (.38, $p < .05$). Again there is evidence that obesity is an important factor in the disease of hypertension.

Low on the list of correlation to blood pressure levels (low to high) were: education, Trait anxiety, alcohol abuse, being on medication, Cognitive anxiety, State anxiety, and being on a low sodium diet. The latter two, although they did not appear as obtaining significance, accounted for 1.8% and 2.9% of the variance and do appear to have some weight. Trait anxiety has been found to correlate poorly with blood pressure by Banahan et al. (1979). The same experimenters, however, found a strong relationship between elevated blood pressure and State

anxiety. These authors noted that the State-Trait theory considers A-trait to be a mediating variable determining A-state reactions to stress. They, therefore, had hypothesized that A-trait would be related to the development of hypertension as age increased. They felt that their own study and others have led to the conclusion that: "The A-Trait Scale of the State-Trait Anxiety Inventory does not adequately identify individuals over-reactive to the type of stress that results in the development of hypertension." The present study confirms this conclusion and adds the important finding that measures of actual stressors in the environment (distress and eustress) as measured by the Hassles and Uplifts scales is a much more useful and important measure of hypertensive patterns than measures of anxiety. Therefore, it may be argued that analysis of reaction to stress is important (as indicated in this case by Somatic Anxiety), but that an analysis of microstressors in an individual's life is even more important in determining propensity toward hypertension. This has some valuable implications and indicates the need for adequate measurement of actual life stressors (reaction to these stressors is measured by the "severity" reported). Future studies may be generated to detect patterns of stress unique to hypertension or other diseases. Older trends have attempted to examine proposed personality propensities or anxiety reactions. Future studies also may have to examine what is actually going on in a person's life in addition to these psychological reactions.

The reason the other variables scored low in this analysis may be explained. Taking medication for high blood pressure is low because

some subjects in this study were taking medication and others were not. An interesting study, using a larger group or more refined surveys, would be to examine the life stressors and anxiety patterns of these two groups. Cognitive anxiety is low because it relates to the type of anxiety as measured by Trait anxiety ($\gamma = .81, p < .01$) and State anxiety ($\gamma = .67, p < .01$). This is another indication that it is more important to measure actual complaints (including biological ones as measured by Somatic anxiety) than mental ruminations when examining hypertensive patients. Alcohol abuse is low in this study because few individuals admitted to abusing alcohol. A more accurate method of assessing this problem would be necessary (hopefully a physiological measure). Education is the lowest on the list. With this population, this factor does not appear to be important, although it may be argued that a higher education leads to jobs that have different forms of stress. The specific forms of stress that are a precursor to hypertension may have a different quality (take for instance the example of Air Traffic Controllers mentioned above). Further research is needed to investigate the specificity issue. As noted earlier, the hypertensives' educational background most closely matched the educational background of the control group in this study. The stress-related group was the one with the significantly different educational background.

Intra-Group Correlations -- Hypertensives

Intra-group correlations in this analysis provided some predictable results. Most of the anxiety scales correlated highly with each other. This again indicates the possibility of overlap in testing some quality and may indicate the failure of the specificity of the scales. The sub-scales of each device correlate exceptionally highly with each other. For instance, State anxiety had a correlation level of .75 ($p < .01$) with Trait anxiety. The type of anxiety measured by each scale may be similar or have a similar basis.

Somatic and Cognitive anxiety correlated at a level of .79 ($p < .01$), again indicating the possibility that they are measuring the same underlying mediating mechanism. Hassles severity and frequency correlated at a level of .93 ($p < .01$). This finding may indicate that it is unnecessary to measure the scale in two ways (although frequency is supposed to measure the actual stressor and severity is supposed to measure the reaction to it). A correlation of .84 ($p < .01$) for the two Uplifts scales indicates the same thing.

Significance was not found for any factors when using diastolic blood pressure as the dependent variable in the multiple regression analysis. One possibility for this is that the diastolic pressure had a far lesser degree of variance than the systolic. For a mean pressure of 105.6, the standard deviation is only 8.8. This yielded a multiple R of only .22 as compared to a multiple of R of .76 ($p < .01$) for the

systolic pressure. It is possible that this low degree of variability left little to correlate with in the regression analysis.

Descriptive Analysis

This type of analysis, although not a statistical methodology, was done to shed light upon the pattern of responses of each group. Kanner et al. (1981) used this method in his research to detect "themes" that are present in the reported Hassles and Uplifts.

In terms of the Uplifts, all three groups reported activities which reflected the same findings of Kanner et al. (1981) in their original study for middle-aged adults (home and social satisfaction). The hypertensive group reported activities which were more hedonic than the other two groups (laughing, having fun, and music). Their pattern more closely matches the pattern found by Kanner with students. Whether this is an indication of a personality or lifestyle pattern for hypertensives is an interesting question and would warrant further study.

In terms of the "hassles", an examination of the most common responses for the Control group revealed something about the nature of the recruitment process for this group. This group was composed of individuals who were coming in for illnesses without appointments. This "unscheduled" group usually has to wait, the time dependent upon their priority status. Usually there is a long wait for those of low priority--those who do not have "service connected" status. The answers of this group reveal that they are most troubled by physical

illness, inflation, and having to wait. The first and third items reflect their status at the time of the testing. The remaining complaints appear to be common for individuals over forty in this society.

The prevalence of health-related complaints for the Stress-Related group may be indicative of their biological complaints. Hypertensives usually have few "symptoms" of their disease. Individuals with ulcer disease, asthma, irritable bowel disease, and neurodermatitis usually have definite symptoms which plague them. This is reflected in the frequency of health-related "hassles" reported.

Hypertension and Anxiety

Hypertensives reported a higher number of complaints of anxiety-type stressors than the other two groups. The most common complaint noted was "Troubling thoughts about the future." This type of ruminative behavior may be important in the maintenance of this disease. Weiner (1979) noted that anxiety produces elevations in blood pressure and that studies done by Ostfeld and Lebovitz (1959, 1960) comparing hypertensives and renovascular hypertensives, anxiety produced similar elevations of blood pressure that last equally long. One interpretation of this finding is that psychological factors do not play a role in the etiology of essential hypertension. Weiner (1979) argues that anxiety may be effective as an intermediary mechanism that causes blood pressure to rise in both groups. Thus, although anxiety may not have a role in the etiology of the disease, it may help to sustain hypertension by repeatedly raising blood pressure further. A

conclusion is that renal factors have a prepotent role in the development of essential hypertension, and that these are later replaced by neurogenic mechanism. The present study found that reactions to environmental stressors as opposed to cognitive patterns (such as Trait anxiety) were the more powerful in predicting elevated blood pressure. Since the present study has examined hypertensives who have had the disease for some time, these factors may be looked at as maintainers rather than generators. A longitudinal study with pre-morbids would decide how much they are important in the etiology of the disease.

The above argumentation is compatible with the diathesis-stress theory. Davison and Neale (1974) noted that this theory, that indicates individuals have a constitutional predisposition toward disease and that stressful experiences bring on the disease, is the most viable theory in explaining psychosomatic illnesses, especially in the case of essential hypertension. Hypertensives have a biological propensity toward the disease (although not enough to account for all the variance) as has been noted by genetic studies (Weiner, 1979), and the stress in their environment causes physiological reactions that are important in the etiology and maintenance of the disease (Weiner, 1979). The significant factor here is reaction to stress. Anxiety may be an important reaction to stress but the type as measured by anxiety surveys may not be solely important in explaining reactions to stress. This was confirmed by the findings of the present study. The scales which measured actual stressors as opposed to anxiety reactions proved to be the most powerful predictors of elevated blood pressure.

Another concept which may be discussed is the anxiety types. Banahan et al. (1979) found that A-state (State anxiety) was more significant than A-trait (Trait anxiety) as a predictor of blood pressure levels. A person who is chronically anxious may develop physiological coping mechanisms which offset the kind of degeneration that occurs in essential hypertension. In other words, an "anxiety homeostasis" may be generated which does not cause vascular mechanism degeneration, but may cause breakdown in different systems. Individuals with chronic anxiety may have a tendency to develop ulcers or other types of stress-diseases. Clearly in the present study the stress-related group, which was comprised primarily of ulcer patients, were found to be the more anxious of the three groups on most measures.

Stress-Related Diseases and Anxiety

It was predicted that the stress-related group would be higher in Trait anxiety than the hypertensives but equal in Somatic anxiety. In the present study it was found that the stress-related group was higher in Trait anxiety and about equal in Somatic anxiety with the hypertensive group. The stress-related group was, however, higher in scores on all anxiety and stress scales (hypertensives were higher on Uplifts frequency). The Control group scored lower on all scales except for Trait Anxiety.

A multivariate analysis of variance was performed on the scores from all the scales used, but the results were not statistically significant. (This would have been predicted based upon the results of the

discriminant function analysis.) Thus, the conjecture above derived from a view of the differences in means is simply conjecture since the scores were not found to be significantly different. The finding that the stress-related group scored higher on almost all the anxiety and stress scales may be important in understanding the development and maintenance of their diseases. Further studies which compare specific stress-related diseases and hypertension using different measures of anxiety and stress and different populations are called for.

In the present study, the stress-related group was a "mixed bag" containing mainly ulcer patients, but also included other types. This was done because of limitations in acquiring the required number of subjects possessing a bona-fide stress-induced disorder at the Veterans Hospital. One of the reviewers of the proposal for the present study suggested using only a group composed of irritable bowel subjects or patients with chronic stress-induced urticaria (hives). A pilot study of the availability of this type of patient at the Veterans Hospital revealed that only one subject or less could be recruited per week from the respective clinics at the Veterans Hospital. This is due to the nature of the eligibility criteria for treatment at this facility. As mentioned earlier, since most patients are service connected for their disorders, those with primary presenting problems which are "psychosomatic" are naturally weeded out by virtue of the compensation process. Patients have to be screened for compensation by the Veterans Administration and have to pass several review boards and hearings before they are awarded a "service connected" classification. This

leaves individuals who have been screened as having "real" medical problems. It was hoped that these individuals would have a significant incidence of recognizable stress-related diseases in addition to those for which they were compensated. This was not found to be true.

Physicians working at the Veterans Hospital (e.g., dermatology and gastrointestinal units) and who also maintained positions at other hospitals reported that they found a much higher incidence of stress-related disorders at the other hospitals than at the Veterans. The present study was conducted at the Veterans Hospital exclusively in order to avoid the problem of extraneous variables that may be salient from other groups of more varied background and makeup. A redesigning of the present study would consider these alternative groups in spite of the obvious drawbacks, for in the present case the groups may have been so similar in lifestyles and psychological makeup that they answered so similarly on the battery of tests that the individual differences due to their disease were obscured. Of course, an alternate argument is that the devices were not appropriate for this population and there is some evidence for this in some cases.

Hypertension -- Etiology and Maintenance

It may be concluded from the findings of the present study that the etiology and maintenance of essential hypertension is strongly dependent upon environmental factors. This was a conclusion suggested by Page (1976). Further, the best way to test for individuals who have a propensity toward elevated blood pressures is to examine the stressors (microstressors) and reinforcers in their environment. Other factors

must be considered when labeling a person as having a high probability of developing the disease, such as family history and also their particular reactivity to stress. A strong argument was made for the superiority of examining disease-prone individuals via an analysis of the environmental stressors over a simple analysis of their anxiety, but this was not meant to suggest the latter should not be performed. As mentioned before, there are differences between known stressors, perceived stressors and reactions to both of these.

A simple examination of "known" stressors (e.g., as with the Social Readjustment Rating Scale) is not sufficient, for some people may not be as bothered by these events as others. Likewise, an examination of only what people name (perceive) as being stressors in their life is insufficient because of known mechanisms (such as denial) which may obscure the person's self-awareness of stress. Measurement of a person's reaction to stress via an anxiety test is insufficient because it does not account for all the possible reactions to stress.

Ideally, therefore, to assess a person's potentiality for developing a disease, one must know the genetic tendency, actual life stressors (on a small enough basis), perceived stressors (which may or may not be common to others), and the personal reaction to stress (via both anxiety scales and physiological measures). Further research may streamline this process as it develops better assessment devices.

One area for needed research would be the assessment of environmental stress over smaller units of time and in a more objective fashion. The present study examined stressors over a month's period of

time as reported by the subjects. Possibly cutting this period of time down to a daily or hourly basis and including an objective observer of behavior (either in person or via a device), and extending these observations over a long period of time, would give us the data we are seeking. Of course this kind of research becomes more and more impractical, but the suggestion is heuristic in providing a generally orderly direction.

Intervention Strategems

Intervention stragems may be generated based upon this type of research. For a given stress-related disease, the pattern of stress can be analyzed via the Hassles scale and treatment can be specifically tailored to the type of stress discovered. For instance, if a patient is found to have stress revolving primarily around work related issues and further analysis reveals that the type of stress involves interactions with co-workers, a specific stress reduction treatment can be effected which would deal specifically with the pattern of stress. This type of treatment would be an advancement over previous "stress reduction" treatments which involve the teaching of a relaxation technique to be done once or twice a day. This "in vivo" stress reduction can only become as refined and specific as the devices that assess the "microstressors". The task then is to refine and perfect stress measurement devices as have been used in the present study.

Summary Based on Hypothesis

In terms of the hypotheses generated by this study, some aspects have been verified and others have not. Hypertensives did not prove to be more reactive in anxiety styles (as measured by State anxiety) than the stress-related group or normals. The hypertensive group was, however, about the same in terms of Somatic anxiety as the stress-related group. Hypertensives were higher on the Hassles severity and frequency than the normals (C group), but not lower on the Uplifts measures. However, the ratio, indicating differences between Hassles and Uplifts, was greater for the Hypertensives--indicating an overall higher degree of stress. The stress-related group was higher on both scales, but the ratio was not.

The "risk factor" list could not be generated comparatively for the three groups because of the lack of significance of the discriminant. Possible risk factors for the hypertensive group were generated via a multiple regression and it was found that known factors such as age, obesity, and family history were important as well as cigarette smoking. Stress, as measured by real life occurrences as opposed to by measures of anxiety, also appears to play an important role in hypertension.

A word of caution must be mentioned in closing. Inferences made from the data must be taken as conjecture due to the unusual circumstance of having all three comparison groups match so closely on some variables. Problems of diagnosing "true" hypertensive from

medical records are well known, as well as the questionable accuracy of self-report measures for such psychological qualities as anxiety. The state of the art in this type of research dictates continued research along the lines of the present design until technological advances are made in the assessment of etiological factors in stress-related diseases.

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