# THE OCCURRENCE OF DEPRESSION IN PATIENTS FOLLOWING CORONARY ARTERY BYPASS GRAFT SURGERY

by

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ABSTRACT

A descriptive correlational study was conducted with 110 postoperative coronary artery bypass graft (CABG) patients at the Naval Regional Medical Center, San Diego, California.

The purpose of the research project was to determine the occurrence of depression in coronary artery bypass graft (CABG) patients who were up to 12-months post surgery, establish a common time of occurrence and identify any relationships of variables with coronary artery bypass graft (CABG) surgery and depression.

A mail survey was utilized and questionnaire packets were mailed simultaneously to subjects. Evidence of depression was based on scores from the Zung Self-Rating Depression Scale, while relationships between variables were identified from information obtained from a personal profile questionnaire.

Statistical analysis revealed 18.6% of the sample were clinically depressed. The use of an exclusive military sample somewhat limited the comparison of the findings to the national depression occurrence of 17.3% in the general population. However, there was a positive finding of higher depression scores within the first one to three months following CABG surgery. Furthermore, statistically significant relationships were found between satisfaction with surgical outcome, feeling as well as expected

and the number of postoperative complications, with findings of depression in CABG patients.

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# CHAPTER I

## INTRODUCTION

Statistics indicate that more than 650,000 Americans die each year from coronary artery disease (CAD), while an alarming number of new victims are diagnosed every year. Of the millions of people who suffer the ravages of this disease, it has been estimated that over 50,000 will undergo open heart surgery for coronary artery bypass grafts during 1980 (Cromwell, Huey, Korn, Weiss & Woodley, 1980).

Most patients whose health status is compromised by coronary artery disease (CAD) usually enter a treatment pathway. With the first pathway, these patients are the recipients of medical intervention in an attempt to alleviate the symptomatology of this pervasive cardiovascular disorder. For those individuals who do not experience satisfactory relief, there are two alternatives; a continuation of medical treatment or surgical intervention.

A great deal of time and money are spent performing diagnostic studies to determine which route any one person will follow. Should the decision be made to undergo open heart surgery for coronary artery bypass grafts (CABG), the individual is faced with an extremely rigorous, life-threatening ordeal of unexpected magnitude.

Following a successful surgical procedure, the cardiac revascularization patient is confronted with a postoperative recovery period which may or may not be lengthened by complications. During the recovery phase, most nursing activities are directed toward the prevention of complications and the promotion of health. As a patient approaches a point where maximum benefits from in-hospital care have been attained, preparations are usually made for discharge.

Once in the comfortable and secure surroundings of home, the patient who has survived open heart surgery for coronary artery bypass grafts (CABG) is expected to make a complete return to wellness in the following two months. Unfortunately, many do not experience a smooth return to good health within this prescribed time frame.

Evidence suggests that following surgery for coronary artery bypass grafts (CABG) many patients experience mental depression. Before it can be determined if this phenomenon poses a significant health problem, it is necessary to answer the question: Does mental depression occur during the convalescent phase in patients who have had open heart surgery for coronary artery bypass grafts (CABG)? This investigator sought to determine if a relationship exists between open heart surgery for coronary artery bypass grafts (CABG) and the occurrence of mental depression during convalescence.

## Purpose Of The Research

The purpose of this study was twofold. The first was to

ascertain if certain open heart surgery patients were confronted with mental depression following coronary artery bypass graft surgery. While post cardiotomy psychosis is the most common psychiatric disorder seen during the first week following this type of cardiac surgery, a depressive reaction appears to be a more prevalant psychiatric response that is seen weeks and sometimes months after surgery (Schwab, 1970). The second purpose was to identify possible demographic or stress-related features of coronary artery bypass graft (CABG) surgery associated with findings of depression.

## Significance

A psychiatric complication--that of post cardiotomy delirium--has been identified in patients who have undergone open heart surgery. As a result of this discovery, most critical care/cardiac surgery units have instituted measures and pre-operative teaching programs aimed at reducing the severity, or preventing the development of, this complication.

If it is determined that depression is also a psychiatric complication of CABG surgery, efforts could be made to identify susceptible individuals and offer required intervention. A whole new dimension of health care could be added to cardiac rehabilitation programs. While patients who suffer severe forms of depression may become suicidal, the significance goes beyond suicide prevention. The quality of life for CABG patients can be improved by informing health care providers of a hidden, insidious, complication that has several adverse effects upon these patients.

The most serious problem of post CABG depression is negative effect on rehabilitation and the patient's return to health. This may be evidenced by a prolonged convalescent period or inability to resume work. In addition, if the patient's family is unprepared for the possible occurrence of postoperative depression, family conflicts may become severe, further complicating a patient's physical and emotional recovery.

Another adverse effect is one directly impacting the patient's health care, that of compliance to prescribed treatment. This aspect could have numerous ramifications, beginning with keeping doctors' appointments, following diet and activity limitations, taking prescribed medication and possibly extending to disruption of relationships with medical personnel. This undesirable effect of depression could well be the most critical as it impacts directly upon the patient's health and well being.

# CHAPTER II

# REVIEW OF LITERATURE

## Depression

Of all the recognized mental disorders, depression is considered to be the most common affecting an estimated fifty percent of North Americans and Western Europeans at one time or another. The U.S. Department of Health and Human Serivces reported that an estimated 17.3% of the 108,000 Americans between the ages of 25 and 75 years suffered from depressive disorders in 1975 (U.S. Department of Health and Human Services, 1975). In addition to being such a widespread disease, depression is also considered to be an extremely dangerous condition due to its high mortality rate. As the tenth ranked cause of death in the United States, an "estimated 28,290 persons in the United States committed suicide in 1980" (U.S. Department of Health and Human Services, 1981, p. 5).

The term depression has been used as a diagnostic label for over 85 years. However, reference to this condition, also known as "melancholia," can be found in centuries-old recorded history, dating back to the ancient Greeks and Romans. Early writings by Aristotle, Hippocrates, and Galen, who were among some of the ancient practitioners, reflect a long-standing awareness and preoccupation with depression and its effects as observed in their

patients (Fabrega, 1975).

As a psychological entity, the term melancholia has been used since medieval clinicians coined the term to identify individuals who exhibited changes in mood, character pattern and alterations in body posture. Such a mental condition was thought to be caused by the biological force known as melan choler, or the black humor (Fabrega, 1975).

A major stumbling block to arriving at a universally accepted, scientific definition for depression involves the difficulty of adequately identifying its origin and numerous manifestations. In addition, the term depression has many meanings and interpretations. Current efforts to define depression are not directed toward identifying etiological factors which may provide a functional basis upon which a definition may be constructed.

When viewed as a clinical entity, depression has been termed an illness, a mood, a character style, an affect, a symptom and a syndrome. It is also considered a normal reaction in certain situations, most commonly seen in persons mourning the loss of a loved one (Ripley, 1977).

Depression, when seen as a symptom, is rather common and is usually associated with a wide variety of psychiatric and non-psychiatric illnesses. Individuals suffering from schizophrenia, alcoholism, aging and other psychiatric syndromes often exhibit depression as a chief complaint. Depression is also seen as a major symptom of several medical disorders including hyperthyroidism ism, cardiovascular disease and drug ingestion (Klerman, 1977).

Manifestations

Depression reflects an individual's response to the loss of something important or of value, to the individual. Included are the loss of people (mate, close friend, or relative), bodily function, money, status or self-image. In research by Ripley, bodily function seemed to be the major factor: 35% of a group of depressed patients were found to be concerned about illness or disability while this concern was noted in 70% of those patients who committed suicide (Ripley, 1977).

An individual who is considered to be depressed can be described as appearing sad, dejected, listless and low-spirited. These observations of physical and facial postures are indications that an individual has turned his attention inward and away from the environment. A cycle of events has begun which may or may not require professional intervention, depending upon the severity and duration of this cycle.

This introverted maneuver, usually self-protective, serves a functional use signaling to others that the individual's energies are being exhausted and help is needed if the individual is to continue to cope with the external threat, be it abandonment, sorrow, or grief. If those in the environment fail to recognize the needs of the individual, the cycle continues and worsens as the person withdraws further into isolation (Anthony, 1977). This withdrawal, or introverted reaction, has a negative effect on the individual's mental processes. Speech becomes slowed, the ability to fantasize is limited, self confidence is diminished and there is

a loss of self-esteem (Anthony, 1975).

For the purpose of this investigation of mental depression following CABG surgery, depression is defined to encompass the concept of decreased mental and physical response to external stimuli.

To be classified as suffering from depression, an individual had to meet certain criteria set forth by the task force on Nomenclature and Statistics of the American Psychiatric Association's publication, the Diagnostic and Statistical Manual (DSM-III), which addresses the classification of mood disorders. One definitive criteria concerns displaying a depressed mood, which is usually described as feeling "blue," dejected, hopeless, shirking responsibility, having a decreased level of physical activity and diminished involvement with one's environment.

In addition, an individual displayed at least three of the following symptoms: a) alteration in body weight due to either increased or decreased appetite; b) difficulty sleeping or hypersomnia; c) loss of energy, easily fatigued, or tired; d) agitation or retardation of psychomotor activity; e) loss of interest or pleasure in normal activities or hobbies, or decreased sexual desire; f) inappropriate or excessive guilt feelings, or feelings of self reproach; g) decreased mentation or concentration, slow thinking or indecisiveness; and, h) recurrent thoughts of death or suicide (DSM-III, 1980).

## Current Theories Of Depression

Depression can occur at any time during the human life span

regardless of race, wealth, occupation, or status. This illness respects no barriers and can impact the life of every human being. While it is possible to describe, it remains impossible to identify the cause of depression (Basch, 1975).

Practitioners are currently embroiled in a major endeavor to identify casual factors of depression. Various theories have been proposed all having a certain degree of validity and applicability. Some clinicians believe the depressive illnesses are genetically determined, some hold the origin to be psychological, while others contend depression is due to a biochemical disorder, neuroendocrine illness (Usdin, 1977).

Genetics and Depression. An area of tremendous interest among present day investigators concerns possible genetic predisposition to depression. Most of the research in this area is usually titled "Genetics and the Affective Disorders" which complicates the picture of heredity and simple depression. The majority of articles written deal primarily with schizophrenic behavior and manic-depressive psychosis.

Familial Trends. Recent research conducted in Switzerland, Sweden, Great Britain and the United States demonstrate overwhelming evidence implicating hereditary factors in affective disorders. These studies generally show a preponderance of affective illnesses in children of people suffering similar disorders, and to a greater degree than would be found in the general public (Tsuang, 1975).

In the manic-depressive illnesses, genetic investigations have shown a possible mode of transmission through the X-chromosome.

For example, Winokur & Cadoret studied seven families with manic-depressive illness and color blindness. The results confirmed an X-linkage involvement, though there may be other means of transmission (1977).

Research Of Twins. Studies show the occurrence of affective illnesses is four to five times greater in monozygotic than in dizygotic twins. These findings held for cases of simple depression; not mania or schizophrenia (Cadoret & Tanna, 1977). One argument against using twins for investigations of depression concerns the possible impact of familial influences and similar environmental conditions. A project was conducted in 1968 of twelve monozygotic twins that were raised in separate locations and different environments. The findings, not contaminated by family or environmental factors, showed a preponderance of depression greater than that found in the general population (Winokur & Cadoret, 1977).

To summarize, there is conclusive evidence of genetic predisposition to affective illnesses. The evidence for hereditary susceptibility to simple depression is not overwhelming at this point, and the explanation seems to lie in the genetics of enzymes and chemicals which may be responsible for depressive behavior.

## Biochemical Abnormalities

It was quite accidental that practitioners began to consider chemical and endocrine abnormalities as effecting depressive disorders.

Medical reports announced that hypertensive patients who received reserpine were becoming unexpectedly depressed while patients with tuberculosis evidenced euphoria while taking medication isoniazide and its isopropyl derivative, iproniazid (Byck, 1975). These discoveries ushered in a new era in research of mental illness as investigators began to consider neuropharmacological bases for depression.

It is beyond the scope of this paper to comment on all chemicals currently under investigation as there are many. However a few of the major hypotheses are subsequently reviewed.

Errors Of Metabolism Of Monoamines. The most widely discussed area of biochemical research concerns the possibility that affective disorders may be caused by errors in metabolism of biogenic amines, or monoamines. A number of hypotheses have derived from the theory that biologically active monoamines known to affect smooth muscle and other peripheral tissues, function in the central nervous system as neurotransmitters at chemically mediated synapses, or otherwise as neurohumors modulating the activity of the central neurons, which are involved in the regulation of mood and behavior (Wehr & Goodwin, 1977).

The amines receiving the most attention are the neurotransmitter catecholamines, dopamine and norepinephrine, and the indolamine, serotonin (a-hydroxytryptamine). The basis of these chemical theories is the idea that depression is associated with a decreased availability of one or more of these amines at receptor sites. The unavailability of these substances may be due to a

variety of reasons: faulty synthesis of amines, inadequate receptor sensitivity or overactive uptake at the synaptic cleft (Barchas, Patrick, Raese & Berger, 1977).

Although decreased levels of norepinephrine and dopamine are related to depression, it appears that an increased level of serotonin is another biochemical cause of depression (Baldessarini, (1975). Recent work by Ehsanullah and Mulgirigama using the human blood platelet as a model and serotonin and dopamine levels in depressed patients and normal controls, revealed that the blood platelets of the depressed patients had decreased uptake of serotonin (1979). Controversy continues over the role of serotonin as a cause of depression.

While the two monoamine systems, catecholamines and indolamines, have dominated the literature in biochemical and neuropharmacological research in depressive illness, other systems under investigation demonstrate a possible role in this disease. Phenylethylamine, has been found in the body fluids of depressed patients and its level has been correlated with mood, being diminished in severe depression and elevated in mania (Fawcett, 1975). Other chemical substances that have been found to have a role in depression include tryptophan, acetylcholine, tyrosine hydroxylase, tryptophan hydroxylase and acetylcholinesterase.

The complex biochemical/neuropharmacological puzzle continues to be a mystery. Every new discovery that implicates a substance in the occurrence of depression leads investigators to more unanswered questions and unknown interrelations. Current research

supports the premise that predisposing factors such as individual biochemistry exist in people, making them vulnerable to depression, and that these predisposing factors are genetically determined errors of metabolism.

Neuroendocrine Imbalances

Investigation of neuroendocrine imbalances remains strongly associated with biochemical research aiming to identify a chemical basis for depression. Most researchers refer to this area as the "hypothalamus-pituitary-adrenal axis hypothesis" for depression.

The hypothalamus-pituitary-adrenal (HPA) axis theory is the outgrowth of work which began in the 1950's. Research by Selye concerning adrenal response to stressors led to his conceptualization for the general adaptation syndrome (GAS), which emphasized the role of adrenal function in adaptation to both physical and psychological stressors. Formulation of the general adaptation syndrome (GAS) was a first step in linking psychological events with physiological reactions, thus establishing the importance of the central nervous system in the control of endocrine function.

Most of the pituitary hormones and the hypothalamic-hypophyseal hormones were investigated by neuroendocrinologists in an effort to identify relationships between psychological functioning and the interaction of the central nervous system and endocrine glands. Since it is impossible to relate findings and hypotheses of all recent research, a few important concepts and a brief discussion ensue (Rubin & Kendler, 1977).

Anterior Pituitary Hormones. Adrenocorticotropic hormone (ACTH) is one of the anterior pituitary hormones that has been widely studied in connection with etiological factors of depression. The major function of adrenocorticotropic hormone (ACTH) is to stimulate the adrenal cortex to secrete the corticosteroid hormones, particularly cortisol. The hypothalamus-pituitary-adrenal (HPA) axis has been shown sensitive to diverse psychological stresses such as anticipation of surgery, final board examinations for medical students and war movies (Fawcett, 1975). Abnormalities of the adrenocorticotropic hormone (ACTH) axis result in depressive illness due to an increased central nervous system release of corticotropin releasing factor.

Another hormone under scrutiny is the growth hormone (GH) which is also secreted by the anterior pituitary. Growth hormone (GH) has a number of important metabolic functions which include stimulating bone and cartilage growth, increasing the circulating levels of free fatty acids and blood sugar and enhancing protein synthesis (Rubin & Kendler, 1977).

Growth hormone (GH) has widespread metabolic actions which are greatly affected by hypoglycemia, fasting and exercise. Growth hormone (GH) also has been shown to increase as a result of several psychological stresses, such as surgery and arterial punctures. The relationship of growth hormone (GH) to depression appears to be an imparied GH response to 5-Hydroxytryptophan which is the immediate precursor to serotonin (Rubin & Kendler, 1977).

Also receiving attention are the glucocorticoids, cortico-

sterone and especially, cortisol. Findings suggest that depression appears to be related in most patients to an elevated level of free plasma cortisol (Carroll, 1977).

Circadian Rhythms. A common conclusion of most neuroendocrine researchers is an overall need to investigate further the influence of the circadian rhythms of these hormones. ACTH is released episodically, being lowest at four hours before to three hours after sleep, with peak values occurring two hours prior to one hour after wakening. If there is an abrupt change in the sleep-wake cycle, the cortisol rhythm is completely disrupted and requires two to three weeks to resume its proper phase position.

Likewise, there appears to be a "critical" period for organization of the circadian rhythm for the endocrine system. This critical time frame centers around midnight and, if pharmacologic or endocrine manipulations of the hypothalamus-pituitary-adrenal (HPA) axis occur at this time, the entire system will be disrupted which can then disrupt the normal HPA activity for the following 24 hour period (Carroll, 1977).

Vasopressin, also referred to as antidiuretic hormone (ADH), is being investigated to identify a possible link between depression and antidiuretic hormone (ADH) levels. Thus far, the evidence is contradictory, however most researchers believe antidiuretic hormone (ADH) is involved in the occurrence of depression resulting from the widespread release of ADH in response to stress. Glucose levels and insulin response is another area being studied, but like ADH, the relationship to depression remains obscure

(Rubin & Kendler, 1977).

## The General Adaptation Syndrome

The general adaptation syndrome (GAS) involves complex, multi-related systems which initiate neuroendocrine responses via the hypothalamus-pituitary-adrenal axis, resulting in the secretion of various hormones and the metabolism of biogenic amines. If all systems are functioning without impairment, the individual is able to adapt successfully to the environment and to maintain equilibrium. If one system fails to maintain its integrity, its failure will in turn affect other systems which rely on it and a domino effect of failure is initiated as the individual fails to adapt (Selye, 1976).

Categories Of Stress. Stress is the term most often used to identify the stimulus that activates the GAS. Stephenson developed a system whereby the sources of stress were divided into the following five categories: physical, chemical, biological, physiological, and socio-emotional (Stephenson, 1977). The first category encompasses physical aspects such as external temperature, sensory stimuli and the loss of the light/dark cycle as is frequently experienced by patients in intensive care units. This can have tremendous impact on the circadian rhythm of hormonal secretions.

A second category includes chemical factors such as drugs, anesthetic agents, blood components, and toxins. Biological stressors are internal aspects which encompass fever, sepsis and pathological organisms, and comprise the third category.

The fourth category, physiological stressors, includes burns, surgery, trauma, immobilization, food deprivation, and sleep deprivation (which also has implications on hormonal balance).

The fifth category combines emotional and social influences such as anxiety, fear, pain, and loss of significant other due to death or separation (Stephenson, 1977). At least one stressor from each category directly impacts every patient who undergoes coronary artery bypass graft surgery.

The Components of Stress. Stress is usually considered to be composed of two components, psychic and physical. The psychic component initiates an increase in catecholamines due to apprehension. The physical component involves the stimulation of the afferent nerves in the injured area which act as a potent activator of endocrine changes.

The stressful stimuli following surgical procedures are a combination or summation of these two components which initiate the neuroendocrine events via a common pathway. The magnitude of this response is directly related to the severity of the stressful stimulus (Meguid & Egdhal, 1977).

Stages of GAS. The psychic and physical components comprise the first stage of Selye's general adaptation syndrome (GAS), the alarm reaction. Upon recognizing a threatening stimulus, the body prepares itself to respond. There is a rise in the norepinephrine and epinephrine levels, and a rise in growth hormone and cortisol concentrations due to secretion of ACTH and the activation of the hypothalamus-pituitary-adrenal axis. There is also an increase

in body fluid volume due to the release of antidiuretic hormone from the posterior lobe of the pituitary gland (Marcinek, 1977).

The second phase of the GAS is known as the state of resistance. The individual who has responded successfully and adapted to the noxious stimuli enters the second stage. The stage of resistance drastically varies from the alarm reaction in that during this second stage there is a semblance of order, as though the individual has reset the endocrine systems to a level necessary to maintain homeostasis (Selye, 1976).

If the stress is especially severe or prolonged, the individual may have difficulty adapting and maintaining equilibrium. Should the individual become overwhelmed and his/her energies depleted, all attained adaptation is lost and the third phase, the stage of exhaustion, soon terminates the struggle (Stephenson, 1977). See Figure 1.

Diseases of Adaptation. A major premise set forth by Selye is that disease or illness reflects a failure to adapt to stress. A few of the diseases of adaptation listed by Selye included shock, peptic ulcer disease, cardiovascular diseases (especially hypertension and myocardial infarction), psychiatric disturbances and several of the immune diseases. Selye also asserted that in many of these disorders, inappropriate corticoid secretion plays an important role (1976).

Selye claimed the development of depression, along with other illnesses, represents a system failure to adapt to stress. There appeared to be opposing viewpoints concerning the sequence of events

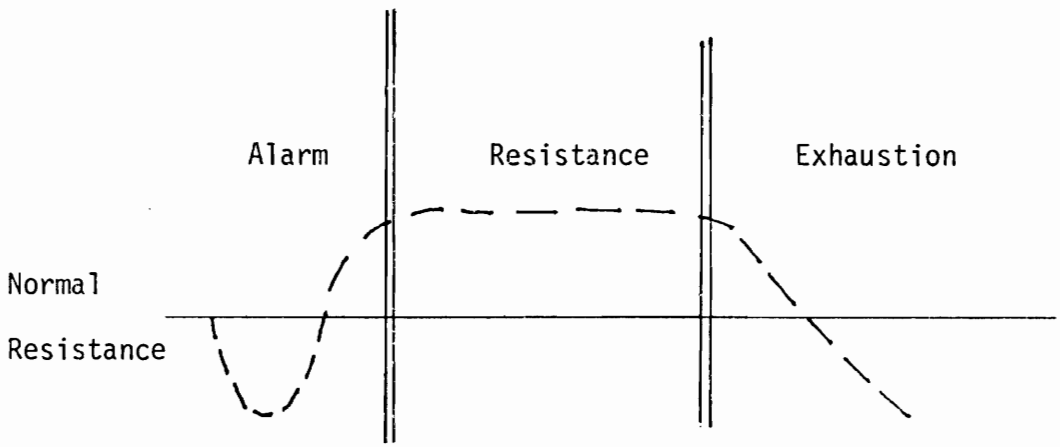


Figure 1. The three stages of the G.A.S. During initial exposure to the stressor, the body experiences alarm and death can result. During the second phase, signs associated with the alarm reaction disappear and resistance rises above normal Following long exposure to the same stressor, adaptation energy becomes exhausted and the body re-exhibits signs of the alarm reaction, however at this point, they are irreversible and death ensues (Adapted from Stephenson, 1977).

in the development of depression. However, a major factor in depression was that the first episode was almost always precipitated by an environmental stressor.

It is acknowledged by most researchers that neuroendocrine changes do occur in response to stress, and in depression, however, agreement ends there. One faction of clinicians maintains that hormonal alterations are secondary to the stress created by the disease, and are not pathogenic factors. Those holding the opposite viewpoint contend that some studies "support the possibility of a primary brain state alteration which results in both a depressive affect associated with loss of ego-defense strength and in stimulation of the hypothalamus-pituitary-adrenal axis" (Selye, 1976, p. 832).

In reference to the argument that similar stressors do not result in similar manifestations in different people, Selye believed this phenomenon could be traced to certain conditioning factors that selectively enhance or inhibit one or the other stress effects. These conditioning factors can be endogenous or exogenous. Endogenous factors include such variables as genetic predisposition, age, or sex, while exogenous conditioning factors are treatment with certain hormones, drugs, or dietary factors.

An individual can develop a disease of adaptation when the normally well-tolerated degree of stress becomes pathogenic because the conditioning factors predispose that system or organ to failure if and when it is confronted by stress (Selye, 1976).

Summary. While the biochemical theory is currently the most

popular there are alternate hypotheses under investigation. One of the most promising deals with the possibility that depression is a result of a combination of causes, not a single cause. This theory proposes that precipitating events occur prior to the development of depression. Freud, in Mourning and Melancholia, referred to a disposition to becoming depressed and of preconditions to melancholia. Predisposing conditions were real or imagined, mild or severe, biochemical or psychological (Ostow, 1975).

A person's psychological response to adversity and harm are well established during early childhood, and mental disorders occur when the individual suffers from a narcissistic loss or ambivalence not supported by prior experiences. Open heart surgery for coronary artery bypass grafts (CABG) may be an ordeal whereby an individual's past experiences are not sufficient for developing an adequate adaptive response to the trauma of this procedure.

## Physiological Response to Major Surgery

An understanding of the complexity of this subject necessitates an awareness of the body's physiological response to surgery. A planned surgical procedure, regardless of severity of risk, creates the feelings of anxiety and fear in most human beings. The surgical situation is perceived as a threat to an individual's well being and this threat elicits the stress response, or (GAS) in varying degrees, whereby a number of metabolic and neuroendocrine changes occur. These changes are attempts to maintain homeostasis. If the GAS fails, the individual may become vulnerable to both physi-

cal and mental illnesses.

In addition to the metabolic and neuroendocrine changes that occur as a result of the fear of surgery, there are also several metabolic and neuroendocrine changes that are a direct result of the surgical process itself.

Metabolic Responses. Hyperglycemia is the most commonly observed metabolic response to major surgery. This response often occurs as a result of a depressed insulin response which is influenced, to some degree, by catecholamines. There is also a rapid increase in free fatty acids following trauma. The rise is thought to be due to hydrolysis of peripheral fat stores (Meguid & Egdahl, 1977).

Another metabolic change occurring as a result of surgical stress, and related to depression, involves cholesterol levels. It appears that maximal synthesis of steroids coincide with cholesterol levels. Decreased cholesterol levels may be due to impaired lipoprotein and cholesterol synthesis by a liver impaired by surgery (Meguid & Egdahl, 1977).

Endocrine Responses. In addition to the metabolic changes listed above a number of endocrine changes occur as a result of surgical trauma. The overall effect of surgical stress in most human beings is an increase in circulating blood levels of glucocorticoids, aldosterone, catecholamines (epinephrine, norepinephrine, and dopamine), thyroid hormone, glucose, adrenocorticotropic hormone (ACTH), human growth hormone, antidiuretic hormone (ADH), lactate, and free fatty acids (Stanley, Philbin & Coggins, 1979).

The most commonly reported endocrine substances are the catecholamines, epinephrine and norepinephrine. There is a rapid and profound elevation of catecholamines associated with major surgery which persists for 12 to 48 hours following surgery. The duration of the elevations appears to depend on the magnitude and severity of the surgical procedure.

Andrenocorticotropic hormone (ACTH) is released in direct response to psychic stress, anxiety, shock, and hyperthermia. ACTH concentrations begin to rise soon after the start of the surgical procedure and can peak either during or after the completion of the operation. The negative feedback response to ACTH secretion may be altered during the stress of surgery. Again, the return of ACTH concentration to normal is a function of the severity of the surgery, and stabilization may take up to five days after major surgery to occur.

Growth hormone (GH) is elevated during and after surgery. Increased glucose tolerance and increased catecholamines are factors involved in the secretion of growth hormones.

Cortisol levels rise rapidly and steeply during surgery. Following major surgery, cortisol levels have been reported to remain elevated from 6 to 14 days. Again, a direct relationship exists between the extent of the trauma and the rise in plasma cortisol levels (Meguid & Egdahl, 1977).

Most patients have an elevated level of antidiuretic hormone (ADH) prior to surgery or anesthesia which is due in part to overnight fluid deprivation. As far as the surgical experience itself

is concerned, there is a significant increase in ADH levels after skin incision, and additional increases are associated with visceral traction. Following major surgery, ADH levels show a gradual decline, returning to normal values by the fourth or fifth day postoperatively.

During the surgical procedure, people are anesthetized and amnesic and, therefore, incapable of introducing a psychological component into the body's response to surgical stress. The stress response occurs even though the individual is not consciously aware of the immediate environment and the surgical assault taking place. Instead, the physiological response to surgical stress is initiated by the stimulation of the afferent nerves in the affected area, which proves to be a potent activator of the endocrine changes.

In essence, the discussion of physiological responses to surgical stress is best summarized by the following: "The magnitude of the response is directly related to the severity of the stressful stimulus: the greater the stimuli, the more pronounced the response" (Meguid & Egdahl, 1977, p. 10).

Coronary Artery Bypass Graft Surgery. There is probably no other planned surgical procedure that can compare with coronary artery bypass graft (CABG) surgery in severity of stressful stimuli. Anesthesia is administered and spontaneous respirations cease. Skin incisions are made from ankle to groin and from umbilicus to throat. Blood is anticoagulated, rerouted, diluted, and cooled. The integrity of the heart is violated by the blade. The chest

wall is punctured to facilitate insertion of plastic tubes. The bladder is invaded by a drainage catheter, and the upper extremities are pierced for placement of arterial monitoring cathethers and intravenous feeding lines. The severity of the stressful stimuli attendant to coronary artery bypass graft (CABG) surgery is extreme, and the magnitude of the physiological response is likewise extreme.

Coronary artery bypass graft (CABG) surgery, as performed today, is a relatively new procedure. The first successful CABG operation was performed in 1964 by Garrett (Ochsner & Mills, 1978). However, attempts to surgically improve cardiac vascularization date back to 1935 when Claude Beck successfully performed a thoracic procedure which attempted to increase myocardial blood flow by suturing an abraded muscle strip to the myocardium (Dietrich, 1975).

Open heart surgery for CABG has become a widely accepted mode of treatment for cardiac revascularization. Success, however, requires a tremendous amount of effort by the physicians and nurses involved with the entire process. Each individual patient is also called upon to make a tremendous effort in order to attain a surgical outcome which will improve the quality of life.

The majority of physiological changes associated with coronary artery bypass are in the same category as those observed in other major surgical procedures. The differences in magnitude of the physiological changes that occur with cardiac surgery are primarily due to the fact that the severity of the surgical stress is far greater

in this type of operation.

In addition to the physiological adjustments that follow cardiac surgery, the individual may also contend with psychological and philosophical issues. Many patients focus on the fascination of the heart as the origin and essence of life. This can further compound their surgical recovery by their clinging to the idea that the surgical injury is a permanent handicap (Kornfeld, Heller, Frank & Moskowitz, 1974).

Anesthetic Agents In CABG Surgery. As with other types of major surgery, CABG patients require anesthesia which entails the introduction of various chemical agents into the patient's body. While much is known concerning the physiological effects of these compounds, little is known about the overall psychological effects that may ensue as a result of their usage.

Physiological Response To Anesthesia. The human body generally responds to any major surgical stress with an increase in glucocorticoids, aldosterone, catecholamines (epinephrine, norepinephrine), thyroid hormone, glucose, adrenocorticotropic hormone (ACTH), growth hormone (GH), antidiuretic hormone (ADH), free fatty acids, and lactate. These responses, though modified or altered by most anesthetic agents, are not totally blocked by anesthesia (Stanley, et al., 1979).

People with minimal cardiac impairment can safely receive most anesthetic agents. On the other hand, an individual with a severely compromised myocardial blood supply will require anesthesia with an agent having a minimal cardiac depressant effect. Therefore,

when an anesthetic agent is selected for a patient undergoing cardiac surgery, the pivotal factor is the cardiac depressant effect of the agent and the myocardial blood supply of the patient (Ochsner & Mills, 1978).

The direct effects of the agent on myocardial performance and on the peripheral vasculature are important. Additionally, since these agents are transported by the circulatory system, it has been necessary to determine the effect of the various agents on the sympathetic nervous system and the attendant release of catecholamines (Philbin & Bland, 1978).

Any discussion of the cardiac effects of the anesthesia for patients physically compromised by coronary artery disease must be based on a firm understanding of the physiological phenomena involved. All anesthetic agents act to: " 1) reduce myocardial contractility, 2) impair ventilation, predisposing to hypoxia and hypercarbia, and 3) affect the autonomic nervous system, either the sympathetic or the parasympathetic branches" (Logue & Kaplan, 1978, p. 1769). Considering this, the anesthesiologist, intraoperatively, must maintain a delicate balance between myocardial oxygen supply and demand in order to minimize the hazards of anesthesia.

Fentanyl. Research has been conducted in an effort to identify the most effective and least harmful anesthetic agents for use in cardiac surgery. A recent study by Stanley, et al. (1979) evaluated the effects of fentanyl-oxygen anesthesia on cardiovascular and hormonal responses in patients undergoing coronary artery bypass surgery. Complete anesthesia and amnesia effect were accomplished with

fentanyl accompanied by oxygen ventilation. Cardiovascular parameters and ADH levels were measured and showed minimal change due to anesthesia. The authors concluded that fentanyl-oxygen anesthesia was a very effective method for coronary artery disease patients because it blocked the increase in plasma ADH levels, arterial blood pressure, and heart rate that commonly accompany anesthetic techniques, including morphine anesthesia (Stanley, et al., 1979).

Patients with coronary artery disease maintain a delicate compensated balance of myocardial oxygen supply and demand. This balance can be disturbed by the anesthetic agent if it increases heart rate, arterial blood pressure, myocardial contractility, ventricular filling pressures, and pulmonary and systemic vascular resistances. The anesthesiologist must minimize these effects to prevent further myocardial ischemia or infarction (Stanley, et al., 1979).

Numerous endocrine alterations, namely vasopressin and the activity of catecholamines occurs as a direct result of anesthetic agents. Thus, (if depression is related to chemical changes within the body) various types of anesthesia may prove to be a contributory factor in depression.

Cardiopulmonary Bypass. The surgical procedure, in itself, is an extremely stressful situation. When compounded with the effects of anesthesia and cardiopulmonary bypass utilized during CABG surgery, the psychological and physiological experience can be severe (Abram, 1965).

By reviewing the history of extracorporeal circulation, it becomes apparent that the present "state of the art" had its roots firmly planted over 100 years ago. As with most technology-based sciences, a number of experimental developments were required in order to pave the way for the more recent and successful advances.

Sophisticated experiments in 1868 enabled Ludwig and Schmidt to build an apparatus to provide constant arterial blood perfusion from a reservoir to maintain life in isolated mammalian organs. The next step was provided by von Schroder in 1882 who oxygenated blood by bubbling air through it from the bottom of a bottle. This development led the way for von Fry and Gruber, in 1885, to describe the first extracorporeal device that could oxygenate venous blood without an interruption of the circulation (Connolly, 1978). A major obstacle to achieving extracorporeal circulation was removed by a medical student, McLean, who discovered heparin in 1916 while conducting tissue extract experiments. This discovery was further refined by Howell and Holt in 1918, and innumerable advances in medical technology followed (Levine, 1975).

DeBakey pioneered the development of a roller pump, which became the forerunner of pulsatile flow for most clinically used heart-lung machines. In 1953, Gibbon performed the first successful open heart surgery using a screen type film-oxygenator to accomplish extracorporeal circulation. Though this apparatus was expensive and complicated, it illustrated that extracorporeal circulation did offer certain advantages for performing open heart surgery (Connolly, 1977).

From the efforts of these early pioneers, cardiopulmonary bypass (CPB) is now considered a safe and necessary adjunct to coronary artery bypass surgery. The first open heart surgery for coronary artery bypass grafts was performed in 1962 by Sabiston, and the first successful procedure of this type was performed by Jarrett in 1964 (Ochsner & Mills, 1978).

Despite the technological advances and improvements that have been made in extracorporeal oxygenators, these devices represent a foreign surface when exposed to blood during cardiopulmonary bypass (CPB). Most of the physiological changes that occur during coronary artery bypass surgery are directly related to the non-physiological state of cardiopulmonary bypass (CPB) whereby a patient's blood is artificially circulated through the membrane oxygenator.

Components of CPB and Physiological Responses. There are several components of CPB that are responsible for most of the physiological changes that occur. These physiological changes include metabolic, cardiovascular hemodynamic, endocrine, and hematological alterations. The characteristics of CPB which ultimately affect these physiological changes include hypothermia, hemodilution, use of cardioplegic solutions and air-blood contact on the oxygenator, red blood cell trauma due to the roller pumps, low perfusion pressures, and heparinization.

Hemodilution is one of the first steps of cardiopulmonary bypass and involves the introduction of electrolyte solutions to the oxygenator where it will be mixed with the patient's blood until a

hematocrit of about 21% is achieved. Most cardiac surgeons employ hemodilution because this process offers several advantages over the use of whole blood pump prime. These advantages include, in addition to a decreased risk of hepatitis, less hemolysis, improved renal perfusion and therefore decreased renal complications post-operatively, increased postoperative urinary output, and decreased metabolic acidosis (Connolly, 1977).

Hypothermia is another technique employed by most cardiac surgeons during cardiopulmonary bypass. Although some disagreement exists concerning the optimal temperature for intracardiac surgery, most authors suggest a temperature of 30-32$^{o}$ centigrade. Since most CPB devices incorporate a heat exchanger, it is a fairly simple process to achieve the desired body temperature. The major advantage of hypothermia is that the patient's metabolic rate is reduced, which in turn reduces oxygen consumption of the tissues without noticeably altering oxygen transport (Aspinall, 1973).

The range of tolerable perfusion pressures appears to be another area of tentative agreement among cardiac surgeons. The major premise is that decreased pressure is acceptable during CPB because the metabolic needs of the body are decreased by hypothermia. The consensus is that the range of perfusion should vary from a minimum of 50 mm Hg to a maximum of 70 mm Hg. This range is considered necessary to provide adequate blood oxygen flow to the brain, kidneys and liver during CPB (Barash, Katz, Kopriva, Shaffer & Kitahata, 1979).

Much of the literature related to perfusion pressures is

focused on the effect of inadequate pressures on cerebral function and neurologic damage during CPB. Stanley and Jackson recently examined bypass perfusion pressures in an effort to determine the effects of skeletal muscle perfusion on body temperature following surgery. They claimed that efforts should be made to raise perfusion pressures and blood flow during bypass. Also, they suggested that the use of vasopressors, while succeeding in raising perfusion pressures, did so at the expense of muscle blood flow (Stanley & Jackson, 1979).

Additional findings indicate that poor perfusion to skeletal muscle may be responsible for postoperative hypothermia, a common complication following cardiac surgery. Because perfusion and blood flow to skeletal muscle are decreased during CPB, initial efforts to achieve normothermia via surface rewarming after surgery are often unsuccessful. They suggest that surface rewarming is often unsuccessful because there is decreased perfusion at the end of bypass (Stanley & Jackson, 1979).

With the initiation of extracorporeal circulation, the patient's blood is circulated through an oxygenating device which is a non-physiological circuit. The blood oxygenator interface of cardiopulmonary bypass results in pronounced thrombocytopenia. A significant degree of functional impairment of circulating blood platelet surface interface further adds to the impact of surgical trauma and stress.

Experimenters are currently in search for a method of decreasing platelet alterations and aggregation at the blood-machine inter-

face. One investigator indicates the use of albumin and prostycyclin may prove beneficial in decreasing surface affinity of platelets, thereby decreasing platelet alterations (Addonizio, Macarak, Nicolaou & Edmonds, 1979).

Another direct effect of CPB upon blood components is hemolysis, a result of trauma caused by contact with air, and from the function of the blood roller pumps. In addition to the problem of hemolysis, the release of serotonin occurs as a result of sustained trauma to red blood cells (Aspinall, 1973).

Heparinization is another necessary component of coronary artery bypass surgery. The effects of heparin administration are primarily observed as changes in metabolism. The injection of heparin has an apparently direct inhibitory effect on pancreatic beta cells hence producing an immediate decrease in blood insulin concentrations. Heparin also elevates levels of free fatty acids via the hydrolysis of triglycerides (Yokota, Kawashima, Takao, Hashimoto & Manabe, 1977). The suppression effect of heparin upon insulin production may provide part of the answer to the problem of postoperative hyperglycemia, which is also influenced by the elevated concentrations of catecholamines and growth hormone (Nuutinen, Mononen, Kairaluoma & Tuononen, 1977).

Catecholamine levels rise as a result of surgical stress. These levels increase to even greater concentrations during CPB. In addition to a catecholamine response, there is a marked increase in ADH levels (Stanley, et al., 1979). This outpouring of antidiuretic hormone is most likely a stress response to the non-

physiologic state of CPB. There is a loss of pulsatile flow and a fall in left atrial pressure. It is surmised that the massive release of ADH is a response to these changes and the function of ADH in this situation is to act as a pressor producing an increase in peripheral resistance (Philbin, Coggins, Wilson & Sokoloshi, 1977).

In summary, while major surgery is a stressful and demanding experience, CABG surgery is even more so due to its required adjuncts and their numerous physiological responses. Every category of stress delineated by Stephenson is represented by one of the components of CABG surgery.

The choice of the anesthetic agent for the CAD patient is more difficult because of the attendant cardiac compromise which limits the number of acceptable agents. Even those agents deemed safe are considered stressful because they are chemical stressors. Numerous physiological reactions ensue as a direct result of the actual surgical trauma, while additional responses occur as a result of hemodilution and hypothermia required for cardiopulmonary bypass.

These physiological and chemical stressors are magnified by the number of components involved in CABG surgery. In addition, the emotional and social influences on CABG patients are tremendous resulting from the magnitude of pain, anxiety, fear of death, and the loss of significant other due to separation.

## Summary

These are numerous theories that attempt to explain the phe-

nomenon of depression, all are appropriate, feasible, and applicable. The many potential solutions to the complex puzzle of depression make it difficult to implicate a single cause for depression in patients who have undergone coronary artery bypass graft (CABG) surgery.

Major theories of depression encompass aspects of genetics, biochemical and endocrine abnormalities, psychogenesis, and adaptation to stress. These same aspects are seen in conjunction with cardiac surgery. The magnitude of the physiological response is directly related to the severity of the stressful stimuli. Coronary artery bypass surgery is an overwhelming experience accompanied by numerous metabolic and neuroendocrine changes that occur in response to these stressful stimuli.

An explanation for the occurrence of depression in CABG patients could be advanced by combining several current theories. A genetic predisposition may exist which is compounded by a massive alteration in metabolic and endocrine function and further complicated by failure to adapt to stresses encountered during the operative and recovery periods. A number of possible explanations exist: a) an extreme disruption of the patient's circadian rhythm which further impairs endocrine functioning; b) hypothermia, which may have long term effects on metabolism of enzymes and biogenic amines; or c) alteration of catecholamine concentrations occur as a result of alterations in the threshold levels, which can be likened to resetting a thermostat at a higher level.

In view of the magnitude of the surgical experience, and

realistic fears of death, invalidism and loss of self esteem, it would not be surprising if CABG patients developed depression during their convalescence.

## Conceptual Framework

CABG surgery is an extensive form of open heart surgery. It is performed on individuals suffering from coronary artery disease whose quality of life can be expected to improve with cardiac revascularization. Improved quality of life generally refers to an alleviation of painful symptoms and lifestyle limitations.

Figure 2 illustrates required adjuncts to CABG surgery, including anesthesia, surgical trauma to the chest wall and heart, and cardiopulmonary bypass with attending hemodilution, hemolysis, and hypothermia. Each of these components cause a unique array of physiological responses within the patient. Some responses are further compromised by a disruption of the patient's circadian rhythm which often occurs postoperatively in the critical care unit.

This research concerned the postoperative occurrence of depression in patients who had undergone CABG surgery. Several popular theorists attempted to define a single cause for depression. While each had substantial justification, it is unlikely all are correct. Although controversy demonstrated the absence of an accepted theory of depression, it did indicate pieces of a complex puzzle were being discovered.

Figure 3 illustrates current theories of the origin(s) of depression. There are basically six including a genetic basis, a

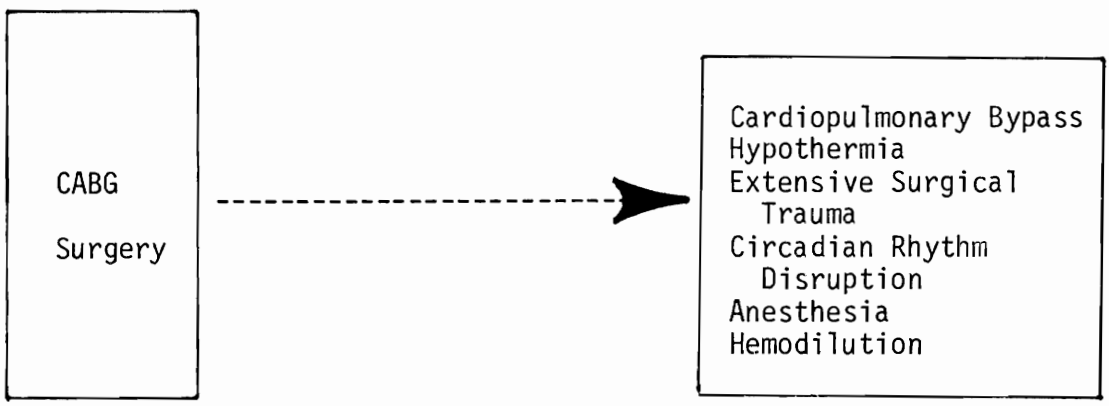


Figure 2. Components of CABG surgery.

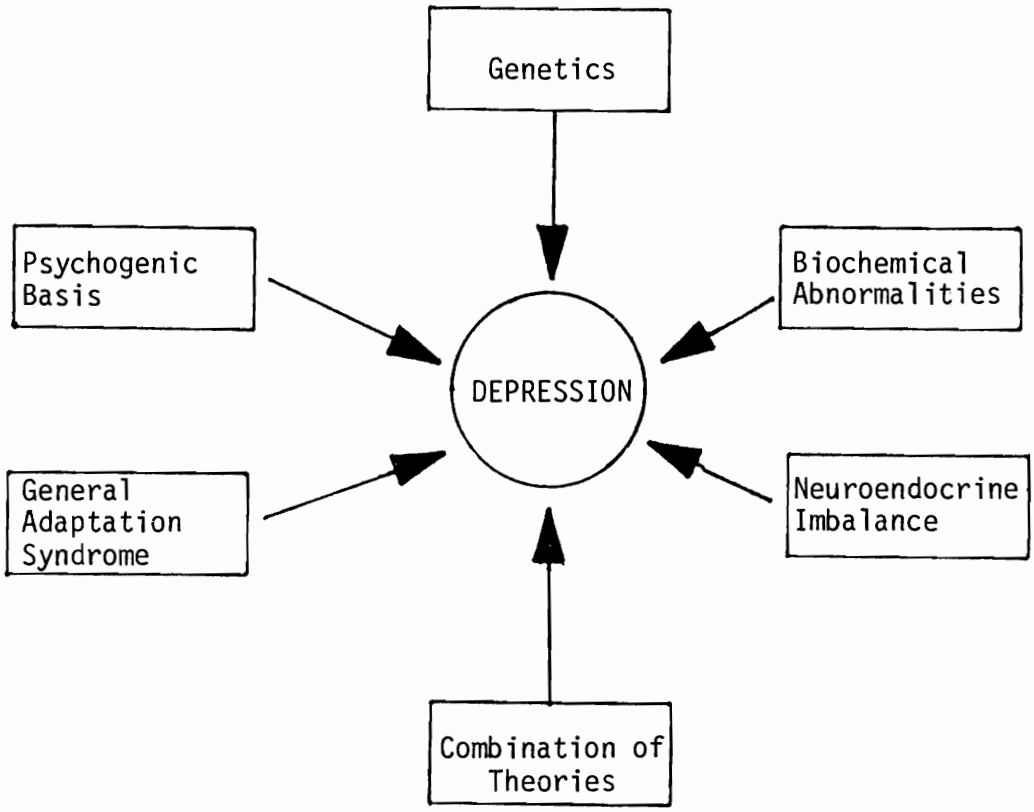


Figure 3. Current theories of depression.

psychogenic basis, failure of the general adaptation syndrome, neuroendocrine imbalances, biochemical abnormalities, or possibly, a combination of these theories.

While impossible to identify a specific cause for depression, there was agreement that depression is a pervasive, multifaceted disorder. Figure 4 reflects the five variables of depression that were selected for discussion. It displays variables that, at one time or another, under proper conditions, may be associated with depression in CABG patients.

## Physiological Variables Of Depression

The first category includes variables that are physiological in nature: chronological age, sex, extent of heart disease, and postoperative complications.

Age is usually considered a factor in determining a person's ability to withstand and survive the rigors of open heart surgery. The physiological age of a patient is reported to be far more reliable than chronological age in assessing a person's ability to survive the trauma of cardiac surgery. Physiological age is determined by factors such as preoperative activity, mental status, motivation, and the presence of severe associate diseases (Gann, Colin, Hildner, Samet, Yahy & Greenberg, 1977). However, an investigation with patients 70 years of age or older failed to demonstrate a positive correlation of age with postoperative psychological complications (Gann, et al., 1977).

Another age-related concern is the effect upon the human body

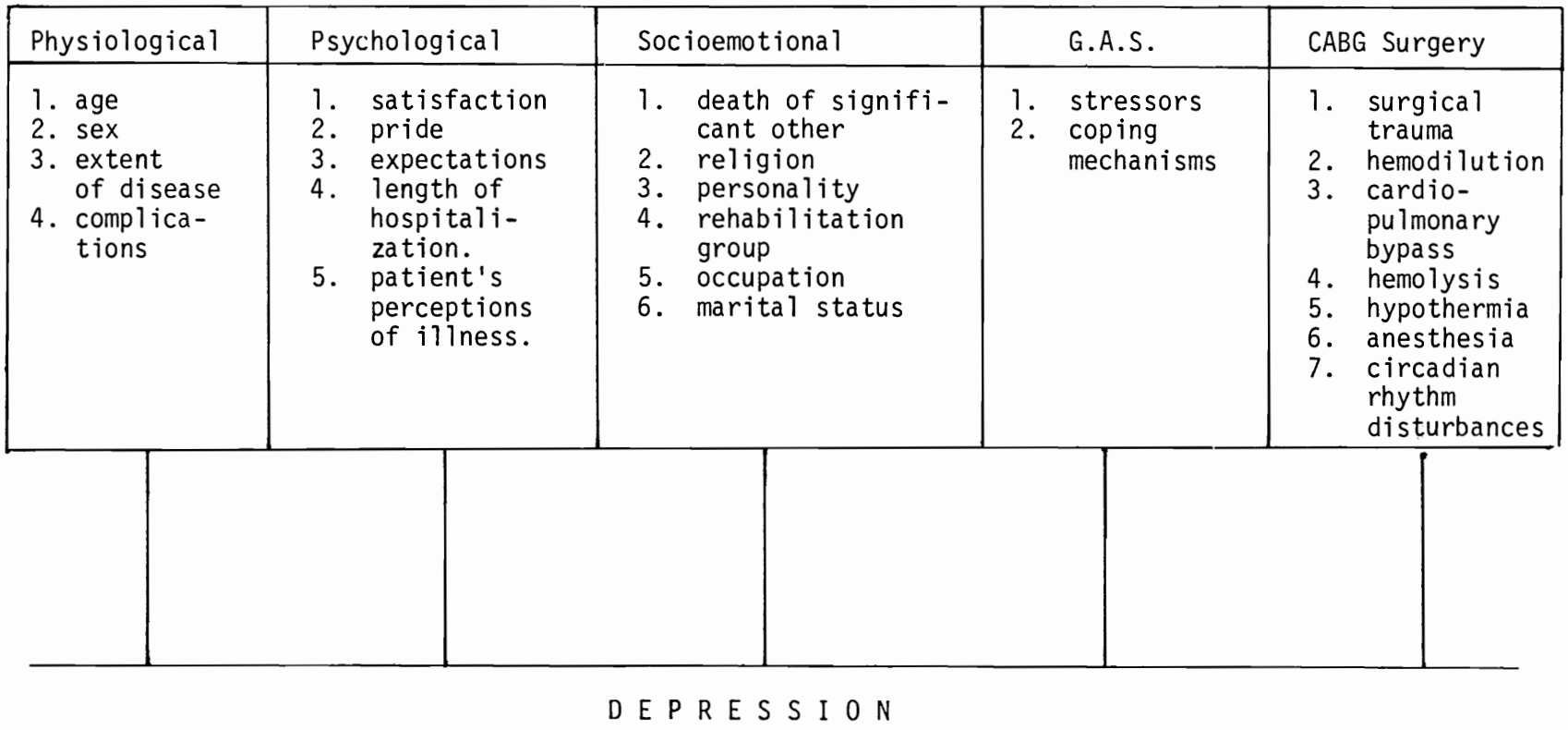


Figure 4. Variables of depression.

and resultant implications for postsurgical response and successful adaptation to the stresses of the operative procedure (Hardy, 1977). An important consideration in a patient's ability to respond to stress is the energy reserve required for adaptation. Decreased adaptability often accompanies advancing age and is usually a result of a failing hypothalamus-pituitary-adrenal axis (Selye, 1976).

Research by Surman, Hackett, Silverberg and Behrendt demonstrated that sex was not a significant variable in relation to a patient's response to cardiac surgery (1974).

A number of case studies reporting postoperative depression also noted an associated occurrence of postoperative complications. The severity of depression appeared to be related to the severity and duration of medical or surgical complications following coronary artery bypass surgery (Aspinall, 1973).

Psychological Variables Of Depression. Psychological variables include such subjective entities as pride, expectations, and the patient's perceptions of the illness. A major premise of this investigator focuses on the patient's satisfaction with the CABG surgery, disappointment over unmet expectations and the conflict involved when these psychological factors are compounded.

Socioemotional Variables Of Depression. The third category includes the variables which represent a variety of factors. For example, the death of a significant other may be such a tremendous loss to the patient that depressive symptoms appear. Support groups are important to people, therefore religion and rehabilitation pro-

grams may effect an individual's inner strength and augment attempts to adapt and find hope by association with others in similar circumstances.

Personality factors in post-cardiotomy psychosis have been investigated and people who have dominant, aggressive personalities and self confidence have been demonstrated to experience a higher incidence of psychosis after open heart surgery (Kornfeld, Heller, Frank & Moskowitz, 1974).

While Surman, et al., (1974) did not assert that the variables of occupation and marital status were significant, they were included in their research. However, these investigators evaluated this category in regard to a change in status within the previous 12 months. This was to determine if there was a change, and if that change was negative in nature. The premise was that given enough negative stressors, any patient could develop depression, leading to the fourth category, the general adaptation system (GAS).

General Adaptation System. Homeostasis is the ultimate goal of adaptation. Should the individual be overcome by stressors, or lack sufficent coping mechanisms, the G.A.S. fails and the individual begins to decline and to display signs of failure. With the occurrence of interactions with other categories, mental depression is a likely result.

CABG Surgery. The ramifications of these variables are awesome without additional stressors. However, this research was focused on CABG patients, so it is necessary to discuss the variables of coronary artery bypass graft (CABG) surgery.

A review of the literature supported the premise that open heart surgery for coronary artery bypass grafts is a rigorous and stressful experience which each individual patient must face alone. Certain aspects involved in the surgical procedure may eventually be implicated in the occurrence of mental depression. In addition, there may be some effect of CABG surgery on one or more of the other variables of depression. Other components of CABG surgery that are classified as variables include disruption of the circadian rhythm, anesthesia and extensive surgical stress with resultant massive physiological response to trauma.

Depression may occur as the result of a single, yet unknown, entity or it may occur as the result of a combination of various factors. If CABG surgery, with its accompanying endocrine imbalance, is performed upon a patient and expectations are not met, disappointment follows, stressors increase, and the patient's general adaptation system begins to fail and depression ensues.

Research Questions. In 1980, over 50,000 Americans experienced open heart surgery for coronary artery bypass grafts to alleviate suffering from coronary artery disease. While substantial medical attention is given the patient during hospitalization, there is a marked decrease in "patient-health care provider" contact during the convalescent period. The purpose of this investigation was to demonstrate that during this convalescent period, CABG patients become depressed.

Several research questions were developed and designed to be answered through use of the Zung Self-Rating Depression Scale (SDS)

and a questionnaire developed by the investigator, "the CABG Personal Profile II." The research questions were:

1. Does depression occur in patients who have undergone open heart surgery for coronary artery bypass grafts?
2. At what period of time following surgery does depression occur?
3. Are any of the following variables associated with the occurrence of depression in patients following CABG surgery?
   a. age
   b. sex
   c. occupation
   d. marital status
   e. religious service attendance
   f. recent death of significant other
   g. "brush with death"
   h. length of hospitalization
   i. number of vessels grafted
   j. number of post operative complications
   k. "satisfied with surgical outcome"
   l. expectations of feeling well

# CHAPTER III

# METHODOLOGY

## Design

The purpose of this research was to investigate the occurrence of mental depression in patients who experienced open heart surgery for coronary artery bypass grafts (CABG). A descriptive design was initially selected as the appropriate methodology.

Through the investigation of the relationships between the variables of depression and CABG surgery, it became evident that it was necessary to conduct a descriptive correlational study. This design was appropriate since the investigator sought to describe the problem and identify interrelationships between depression and other variables. Furthermore, the investigator had no control over independent variables, nor was there any "possibility of experimental manipulation or random assignment groups" (Polit & Hungler, 1978, p. 185).

The research was conducted utilizing a mail survey format. This format was selected because it offered several advantages to the investigator. First, it was far less expensive to conduct a survey by mailing questionnaires than by personal interviews. Secondly, it was a much faster procedure and did not require the employment of interviewers to work with the large sample (Dillman,

1978).

## Definitions

### Depression

> Depression was defined as a syndrome characterized by loss of object, real or symbolic, with hopelessness and helplessness; low mood or affect; vegetative signs (anorexia, insomnia, decreased libido); loss or gratification and withdrawal from relations (Raft, Spencer, Toomey & Brogan, 1977, pp. 999-1000).

### Zung Self-Rating Depression Scale

A self-reporting depression scale consisting of 20 short statements. Zung operationalized depression into four specific categories: affect, physiological, psychomotor and psychological. Zung stated that the affective mood disorder was characterized by the pervasive feelings of being sad, depressed, tearful and downhearted; sleep problems, decreased anorexia, decreased libido, unexplainable fatigue and constipation were a few of the physiological symptoms suggested. Psychomotor disturbances were evidenced by either agitation or retardation of activites, while psychological parameters included feelings of hopelessness, emptiness, dissatisfaction, personal devaluation, irritability and suicidal ideation (Zung, 1973).

### Existence of Depression

The presence of depression in the sample was determined by results from the Zung Self-Rating Depression Scale (SDS). An

SDS index score below 50 represented the normal range, one without psychopathology. Minimal to mild depression was considered to be present if the index was 50-59. An index score of 60-69 indicated the presence of moderate to marked depression, while an SDS index score of 70 or more represented severe to extreme depression.

### Coronary Artery Bypass Graft Surgery

Coronary artery bypass graft surgery is defined as the revascularization of the myocardium by grafting venous vessels to the coronary arteries, bypassing existing but occluded arteries and creating a bypass circulation. In this study, coronary artery bypass graft surgery included individuals who had between one and five vein grafts surgically inserted to revascularize the myocardium.

### CABG Personal Profile II

The CABG Personal Profile II is a questionnaire developed by the investigator to obtain demographic, historical and personal data on the participants.

## Sample

The sample included patients with open heart surgeries for coronary artery bypass grafts (CABG) performed in the past year at the Naval Regional Medical Center (NRMC), San Diego, California. All patients who underwent CABG surgery at that facility were military-oriented; they were either active duty military (all branches); retired personnel; or spouses of active duty or retired personnel. While this trait assures similarity to other military personnel who

had CABG surgery, they may not be representative of the general public.

A nonprobability form of sampling known as accidental sampling was selected for use. The sample included all postoperative coronary artery bypass graft surgery patients from the Naval Regional Medical Center (NRMC), San Diego, from 1 June 1980 through 1 June 1981. The sample included all adults 25 years and older who had experienced CABG surgery for coronary artery disease for the first time. Patients who had undergone more than one CABG surgery were excluded for two reasons: first, it was possible the prior experience had allowed them to develop coping mechanisms; and second, those patients may have been depressed as a result of the failure of previous CABG surgery.

Following careful review of hospital data for these patients, a sample of 157 subjects was found to be suitable.

## Instruments

A packet of material was assembled for each subject. Each consisted of a letter, a Zung Self-Rating Depression Scale, a CABG Personal Profile II, consent forms, and a stamped, return-addressed envelope.

The Zung Self-Rating Depression Scale (SDS), a frequently used tool, was utilized. It is a self-reporting instrument containing 20 short statements. The possibility of response set occurring is diminished by the combination of direct and reverse direction scoring of items. The Zung Self-Rating Depression

Scale (SDS), while measuring depression of all categories, is also capable of identifying the presence of situational depression. This is beneficial in identifying those individuals who are not coping effectively with a change in health status and the loss of the sick role.

Raft et al., (1977) demonstrated an "acceptable level of reliability and validity" for the Zung Self-Rating Depression Scale (SDS) (p. 1004). These authors however, noted a limitation in the ability of the SDS to identify individuals with masked or latent depression since 12% of clinically diagnosed depressed persons were not identified by the Zung SDS scale (Raft et al., 1977).

The second instrument was a questionnaire designed by the investigator to obtain personal background knowledge about each subject, the CABG II Personal Profile (See Appendix A). This data allowed an analysis of variables that could be related to depression such as sex, age, socio-economic status, occupation, length of time off work prior to surgery, and postoperative complications. Reliability and validity studies were not conducted on the CABG II Personal Profile.

An introductory letter was included in the packet (See Appendix B). The letter served to reinforce the importance of participation in the sample, and also included instructions for completion of questionnaires and directions for returning the packet. In the event a subject had questions concerning any part of the packet, the telephone number of the investigator was included.

Also included in the packet was the Consent and Privacy Act statements for signatures of participants (See Appendix C and D). These forms are required for research projects conducted on U.S. military installations. The enclosure of a stamped, return addressed envelope in each packet was expected to facilitate subject response.

## Procedures

Initial information, such as name and address, was obtained from hospital records on all CABG patients from 1 June 1980 to 1 June 1981 at the Naval Regional Medical Center, San Diego. A master list was compiled of all patients who met the sample criteria.

Data collection commenced after all necessary committees rendered approval. Contents of the packet were submitted to ten lay people within the community. The purpose was to identify vague questions, faulty directions, or poor format construction, common weaknesses of mail surveys (Dillman, 1978).

Following changes resulting from suggestions by the ten lay respondents, packets were mailed to the subjects. Data collection was completed in four weeks. The Zung Self-Rating Depression Scales were immediately evaluated to protect against overlooking the responses of a severely depressed patient.

In the event that severely depressed patients were identified, the protocol dictated an immediate telephone call to those patients by the investigator, which served to verify the mental status of these patients. They were then encouraged to return to the cardio-

thoracic clinic as soon as possible for evaluation and intervention.

The CABG Personal Profile II questionnaires were subsequently tabulated and information was transferred to a data sheet, where specific questions were analyzed.

## Human Subjects

This proposal was first submitted to and approved by the Research Advisory Board at NRMC San Diego. The same procedure was followed with the Committee for the Protection of Human Subjects at NRMC San Diego. As subjects were requested to complete questionnaires, no personal risk was anticipated.

To avoid violation of the individual's privacy, participants were required to sign a Privacy Act Statement and Medical Records Consent Form, as mandated by the Research Advisory Board at NRMC, San Diego. Complete anonymity of each subject was insured by the number coding of questionnaires prior to mailing. Only this code number was used to identify subjects in subsequent review.

Participation in the research project was completely voluntary. If a subject desired to withdraw from or be excluded from the sample, this request was immediately honored. The investigator did, however, attempt to ascertain a reason for this refusal in order to determine if it was related to questions or subject. A log was kept documenting the reasons for lack of participation as conveyed by the subjects.

# CHAPTER IV

# RESULTS

At the onset of the data collection, 157 packets were mailed and a response rate of 70% was observed with the return of 110 completed questionnaries. According to Polit and Hungler (1978) 50% can be considered an acceptable level of response for mail surveys. A sample of 107 subjects was obtained as three subjects did not complete the Zung SDS scale.

Analysis of the data generated focused on two areas; the Zung Self-Rating Depression Scale (SDS), and the CABG Personal Profile II. The Zung SDS Scales were scored according to the prescribed protocol (Zung, 1974).

Data analysis consisted of frequency distributions and nonparametric correlational statistical analysis. Frequency distributions were computed for the descriptive characteristics, physical and psychoemotional variables, and the Zung SDS Index scores. Nonparametric correlations were computed to measure the strength and direction of the relationships between selected patient variables and the depression variables.

## Descriptive Characteristics Of The Sample

Tables 1 and 2 present descriptive characteristics,

Table 1

Descriptive Characteristics of the Coronary Artery Bypass Graft Surgery Patients (N=107)

| Descriptive Characteristics | Percent | N | Range | Mean |
|---|---|---|---|---|
| Sex | | | | |
| Male | 92.5 | 99 | -- | -- |
| Female | 7.5 | 8 | -- | -- |
| Total N = 107 | | | | |
| Age | | | | |
| 31-39 years | 7.6 | 8 | -- | -- |
| 40-49 years | 16.2 | 17 | -- | -- |
| 50-89 years | 76.2 | 80 | -- | -- |
| Total N = 105 | | | | |
| Occupation | | | | |
| Professional | 35.5 | 38 | -- | -- |
| Nonprofessional | 62.6 | 67 | -- | -- |
| Total N = 105 | | | | |
| Marital Status | | | | |
| Married | 91.6 | 98 | -- | -- |
| Separated | 2.8 | 3 | -- | -- |
| Divorced | 2.8 | 3 | -- | -- |
| Widowed | 2.8 | 3 | -- | -- |
| Total N = 107 | | | | |
| Time Since Surgery | | | | |
| days | -- | -- | 36-362 | 221.3 |
| Total N = 107 | | | | |

Table 2

Physical Condition and Self-Report of Psychoemotional Condition of Coronary Artery Bypass Graft Surgery Patients

| Physical Condition Variables | Percent | N | Range | Mean |
|---|---|---|---|---|
| Length of Hospital Stay (Days) | -- | -- | 7-99 | 18.6 |
| Preoperative days | -- | -- | 1-41 | 4.7 |
| 1 day | 29.9 | 32 | -- | -- |
| 2 days | 23.4 | 25 | -- | -- |
| 3+ days | 46.7 | 50 | -- | -- |
| Postoperative days | -- | -- | 6-62 | 13.9 |
| 6-7 days | 9.3 | 10 | -- | -- |
| 8-14 days | 62.6 | 67 | -- | -- |
| 15+ days | 38.1 | 30 | -- | -- |
| Number of Heart Vessels Grafted | -- | -- | 1-5 | 3.4 |
| Number of Postoperative Complications | | | | |
| None | 40.2 | 43 | -- | -- |
| 1 | 43.0 | 46 | -- | -- |
| 2-4 | 16.8 | 27 | -- | -- |
| Self-Report of Psycho-emotional condition | | | | |
| Satisfied with Surgical Outcome | | | | |
| Yes | 81.3 | 87 | -- | -- |
| No | 18.7 | 20 | -- | -- |
| Feel as well as expected | | | | |
| Yes | 80.4 | 86 | -- | -- |
| No | 19.6 | 21 | -- | -- |

psychoemotional and physical condition variables of the sample. As demonstrated in Table 1, the sample consisted of 99 males and 8 females. Ages ranged from 31-89 years of age with a mean of 58.0 years. Occupational information revealed that 38 subjects were professionals while 67 were nonprofessionals. Ninety-eight subjects were married, 3 separated, 3 divorced and 3 widowed. Total time since surgery was calculated in days from the subjects' reported date of surgery. The range for time since surgery was 35-362 days with a mean of 221.3 days.

Table 2 contains the physical and psychoemotional condition variables. Total length of hospital stay ranged from 7 to 99 days with a mean of 18.6 days. This information was further divided into length of pre- and postoperative stay.

The number of vessels grafted ranged from one to five with a mean of 3.4. Postoperative complications were tabulated according to number occurring. Of the 106 subjects who reported this information, 43 patients (40.2%) did not have any complications. Forty-six (43.0%) had one postoperative complication, while 27 subjects (16.8%) suffered from two to four complications following CABG surgery.

A self report of psychoemotional condition variables is also included in Table 2. In response to the question: "Were you satisfied with the results of your surgery?" 87 subjects (81.3%) answered positively while 20 patients (18.7%) answered "No". When asked "Do you feel as well as you expected?" 86 (80.4%) replied "Yes" while 21 (19.6%) responded negatively.

## Occurrence of Depression in CABG Patients

Table 3 displays the frequency distribution of the Zung Self-Rating Depression Scale (SDS). The Zung scores listed on this table are the SDS index scores, not the raw scores. The range of index scores was 25-76 with a mean of 39.3 and a standard deviation of 10.5 which indicates a wide variability among the scores. According to Zung (1974) an index score of 50 or greater signifies depression. In this sample, 20 subjects, or 18.6% were depressed as compared to 17.3% for the age group 25-74 years in the general population during 1975 (Sayetta & Johnson, 1979).

Further analysis of depression including the standardized subscales is shown on Table 4. Means for each subscale of the Zung SDS are listed together with the ranges and standard deviations.

## Occurrence of Depression and Time Since Surgery

The relationship between the amount of time since surgery (coded in months) and the Zung SDS mean score is illustrated in Table 5. While 43.9% of the sample was 10-12 months post-CABG, the highest mean SDS score for depression was found in those patients who were 1-3 months post-CABG. In addition, Table 5 clearly shows depression is greatest for patients within the first three months following surgery, and this finding is supported by the ranges of the subscales. Furthermore, the mean SDS scores show a drop after the third postoperative month and then stabilize. The

Table 3

Frequency Distribution of Zung

Depression (SDS) Index

| SDS Score | Percent | (N) | SDS Score | Percent | (N) |
|---|---|---|---|---|---|
| 25 | 2.8 | 3 | 45 | .9 | 1 |
| 26 | 4.7 | 5 | 46 | 1.9 | 2 |
| 28 | 3.7 | 4 | 48 | 1.9 | 2 |
| 29 | 2.8 | 3 | 49 | .9 | 1 |
| 30 | 3.7 | 4 | 50[a] | 1.9 | 2 |
| 31 | 9.3 | 10 | 51 | 1.9 | 2 |
| 33 | 9.3 | 10 | 53 | 2.8 | 3 |
| 34 | 7.5 | 8 | 54 | .9 | 1 |
| 35 | 5.6 | 6 | 56 | 2.8 | 3 |
| 36 | .9 | 1 | 58 | 1.9 | 2 |
| 38 | 5.6 | 6 | 59 | 1.9 | 2 |
| 39 | 6.5 | 7 | 60 | .9 | 1 |
| 40 | 1.9 | 2 | 61 | .9 | 1 |
| 41 | 3.7 | 4 | 63 | .9 | 1 |
| 43 | 2.8 | 3 | 66 | .9 | 1 |
| 44 | 4.7 | 5 | 76 | .9 | 1 |

[a]Scores 50 and above are defined as clinically depressed.

Note. $\bar{X}$ = 39.3; S.D. = 10.5

Table 4

Mean Scores of the Sample on the

Depression Subscales

| Subscale | Mean Score | Range | S.D. |
|---|---|---|---|
| Pervasive Affective Disturbances (Possible 2-8) | 2.3 | 2-5 | .6 |
| Physiological Disturbances (Possible 8-32) | 13.5 | 8-25 | 3.2 |
| Psychomotor Disturbances (Possible 2-8) | 3.6 | 2-8 | 1.7 |
| Psychological Disturbances (Possible 8-32) | 12.2 | 8-26 | 4.5 |

Table 5

Levels of Depression by Amount of Time Since Surgery

| Time Since Surgery | (N) | Percent | Mean SDS Score | SDS Range | Mean Pervasive Affect Score | Mean Physiological Score | Mean Psychomotor Score | Mean Psychological Score |
|---|---|---|---|---|---|---|---|---|
| 1 - 3 months | 12 | 11.2 | 45.0 | 33-76 | 2.9 | 15.0 | 13.6 | 4.0 |
| 4 - 6 months | 32 | 29.9 | 38.0 | 25-66 | 2.2 | 13.3 | 11.9 | 3.5 |
| 7 - 9 months | 16 | 15.0 | 39.0 | 26-58 | 2.4 | 13.2 | 11.9 | 3.7 |
| 10 - 12 months | 47 | 43.9 | 38.7 | 25-61 | 2.3 | 13.3 | 12.2 | 3.4 |

Note. SDS score of 50 or greater = clinical depression.

SDS range indicates that depressed subjects were present throughout the 12-month period.

Relationship of CABG Factors with Depression

The relationships between the factors of CABG surgery and depression were examined. The factors were descriptive, psychological, socioemotional and physical condition variables.

Table 6 presents the nonparametric correlation coefficients (Spearman's rank order) between the major descriptive factors with the depression variables. No significant relationships were present between sex, age, occupation, or time since surgery with depression. Sex is shown to be important as females were slightly more likely to display psychomotor disturbances than males.

As seen in Table 7, significant statistical relationships were present between several of the psychological and socioemotional variables and the depression variables (total and subscales). "Satisfied with outcome" was significantly related to depression with a correlation coefficient (r), of -.28, ($p < .01$). "Feel as well as expected," $r = -.46$, ($p < 001$). As satisfaction increased depression decreased. "Brush with death" was also significantly related to the total SDS score at the $p < .01$ level of significance with $r = .25$. Change in marital status was associated with the pervasive affect subscale a $p < .001$ with $r = .34$. An increase in marital status change was associated with higher levels of depression.

Nonparametric correlations between physical condition variables

Table 6

Spearman Rank Order Correlations Between Selected Descriptive Variables and the Depression Variables

| Descriptive Variables | Depression Variables | | | | |
|---|---|---|---|---|---|
| | Total SDS Score | Pervasive Affect Category | Physio-logical Equi-valents | Psycho-logical Equi-valents | Psycho-motor Equi-valents |
| Sex | .05 | -.01 | -.01 | .05 | .15* |
| Age | -.07 | -.09 | .03 | -.11 | .07 |
| Occupation | -.05 | -.02 | -.14 | -.03 | .08 |
| Time Since Surgery | -.06 | -.08 | -.04 | .01 | -.08 |

*$p < .05$

Table 7

Spearman Rank Order Correlations Between Selected Psychological and Socioemotional Variables and the Depression Variables

| Psychological Variables | Depression Variables | | | | |
|---|---|---|---|---|---|
| | Total SDS Score | Pervasive Affect | Physiological | Psychological | Psychomotor |
| Satisfied with outcome | -.28** | .06 | -.27** | -.18* | -.27** |
| Feel as well as expected | -.46*** | -.21** | -.37*** | -.43*** | -.36*** |
| **Socioemotional Variables** | | | | | |
| Change in marital status | .07 | .34*** | .04 | .07 | -.06 |
| Frequency in church attendance | .01 | .05 | .00 | -.01 | .15* |
| Brush with death | .25** | .12 | .18* | .21** | .17* |
| Loss of significant other | .00 | .01 | .02 | .01 | .06 |

* $p < .05$
** $p < .01$
*** $p < .001$

and depression are presented in Table 8. Total length of stay was correlated to the total SDS score at $p < .05$ level with $r = .19$, and further related to the physiological subscale, $r = .20$, and the psychological subscale $r = .16$. Preoperative days correlated with the psychological subscale at the $p < .05$ level with $r = .17$.

Table 8 also reveals a stronger correlation between postoperative hospital stay with the total SDS score and the depression subscales. Total SDS score was significantly related, $r = 25$, $p < .01$, to number of postoperative days with the strongest correlation found in the physiological subscale, $r = .31$, ($p < .001$).

A negative correlation, $r = -.15$, ($p < .05$) was found of the number of vessels grafted and total SDS score, indicating the fewer number of vessels grafted the greater the depression. The strongest relationship, $r = .39$ ($p < .001$), was the number of postoperative complications with the physiological dimension of surgery and, accordingly, with the total SDS score of depression, $r = .29$, $p < .001$.

Descriptive data were not highly correlated with findings of depression. Based on Tables 7 and 8, the CABG patient variables most strongly related to depression were "feel as well as expected" and number of postoperative complications. Other data from Tables 7 and 8 that reflect strong correlations with depression are "satisfied with outcome", length of postoperative hospital stay, "brush with death", length of hospital stay (total), and number of vessels grafted (unexpected direction). It is important to note that while

Table 8

Spearman Rank Order Correlations Between Physical Condition Variables and the Depression Variables

| Physical Condition Variables | Depression Variables | | | | |
|---|---|---|---|---|---|
| | Total SDS | Perva-sive Affect | Physio-logical | Psycho-logical | Psycho-motor |
| Length of Hospital Stay (days) | .19* | -.06 | .20* | .16* | .08 |
| Preoperative days | .03 | -.02 | -.05 | .17* | -.06 |
| Postoperative days | .25* | -.01 | .31*** | .13 | .16* |
| Number of Vessels Grafted | -.15* | .10 | -.16* | -.16* | -.08 |
| Number of Postopera-tive Complications | .29*** | .01 | .39*** | .15 | .25** |

* $p \leq .05$
** $p \leq .01$
***$p < .001$

a change in marital status was not significantly related to the total SDS score, it was strongly related to the pervasive affect subscale of depression.

# CHAPTER V

# DISCUSSION

In summary, the descriptive data revealed the majority of the sample was comprised of males (99 of 107), an expected result since coronary artery disease is predominantly observed in males. Information concerning age revealed that 76% (80) of the subjects were 50-89 years of age with a mean of 58. This finding was expected since coronary artery disease is usually a slow, progressive disease of coronary artery occlusion. Evidence that this is not always true was demonstrated by eight patients who reached the end-stage of CAD at an early age (31-39 years).

In reference to occupational status, 62% of the subjects were nonprofessionals. This category was used to designate enlisted personnel and housewives. Further descriptive data indicated 98 subjects (91.6%) were married, while 9 were either separated, divorced or widowed.

The first research question sought to determine the possible occurrence of depression in patients who had undergone open heart surgery for coronary artery bypass grafts. Data obtained from the Zung Self-Rating Depression Scale (SDS) demonstrated evidence of clinical depression in patients who had experienced coronary artery

bypass graft surgery within the previous 12 months. According to the Zung SDS scale 18.6% (20 of 107) subjects were depressed (SDS index score 50 or greater).

As indicated by a 1975 report from the U.S. Department of Health and Human Services, 18.5 million Americans (17.3% of the age-group population) between the ages of 25 and 74 were estimated to be depressed (1975). The percentage of depressed subjects in this sample (18.6%) was similar to the national average (17.3%) However, four important factors should be noted.

First, this sample did not reflect the same age range as the national average, (31 to 89 years for the study and 25 to 74 for the U.S. population). There were no subjects in the 25 to 30 age range and several subjects were older than the upper age limit of 74 for the national figures. This deviation in the age comparison guide may not provide as suitable a frame of reference as desired.

The second factor comparing this sample to the national statistics is the reported suicide rate for the U.S. population as compared to Army and Navy personnel during the years of 1975 to 1979. "The male suicide rate for the general U.S. population is considerably higher than it is in the same age groups for the Army. A similar suicide rate discrepancy was found when Navy men were compared with U.S. men in general" (Datel & Johnson, 1979, p. 242).

While specific figures and percentage rates were not listed in the report, the following graph (Figure 5) indicates that the suicide rate was lower for U.S. military personnel than for the

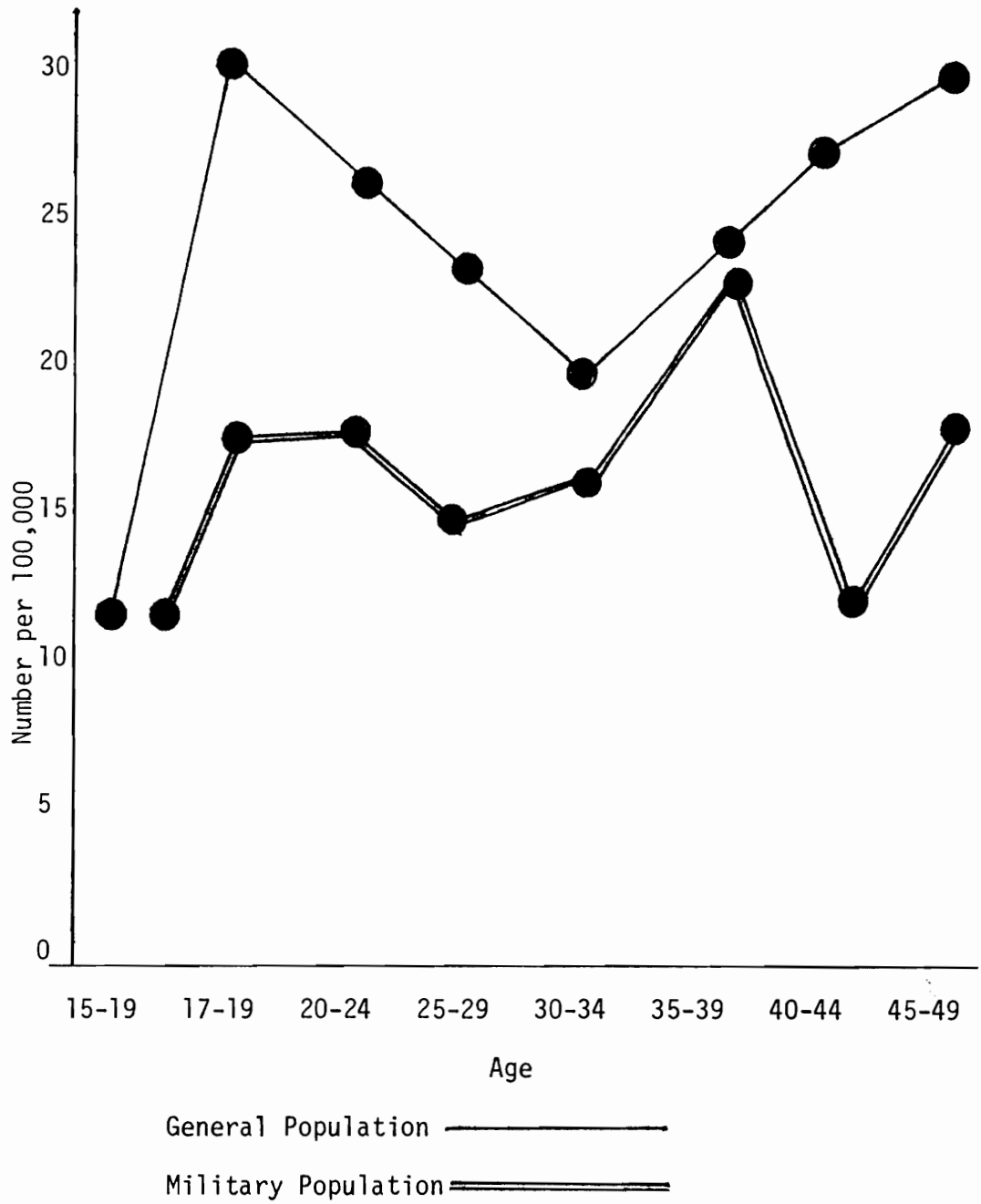


Figure 5. Suicide rates of Army vs. civilian populations. (Adapted from Datel & Johnson, 1979).

general public (Datel & Johnson, 1979).

Since depressive disorders precede suicidal actions, it was possible to conclude that whereas the incidence of suicide was lower in military personnel compared with the general public, the occurrence of depression may likewise be lower in military personnel. This may be due to the screening of individuals that occurs prior to military induction.

The third factor concerns the use of the Zung SDS scale as the primary evaluation tool for depression. As Raft et al., reported (1977), 12% of the depressed subjects in their sample were not identified by the Zung. It is quite possible that 12% of the CABG patients were likewise not identified.

Finally, the fewer number of respondents in the 1-3 month group may reflect the failure of depressed persons to participate. It is notable that the mean SDS scores for this time interval were higher than for any other, while the number of respondents were fewer than for any other group.

Findings from the Zung SDS subscales (pervasive affect disturbances, physiological disturbances, psychological disturbances, psychomotor disturbances) were compatible with the mean SDS scores. Higher depression findings were exhibited in the physiological and psychological disturbances subscales.

An observation of considerable significance was the finding that 18.6% (20 of 107) of the sample were clinically depressed. Specifically, not one patient had been identified by the primary physician as being depressed either before or after surgery.

Since patients may not recognize or inform their physicians of depressive symptoms, the onus of responsibility falls on all health care providers to identify these patients and provide appropriate intervention.

The problem of timely patient assessment and identification of depression was particularly important in the case of one patient whose SDS index score was 76, which indicated severe depression where suicidal ideation is often present. This patient's Zung SDS scale, according to the protocol was promptly scored upon return to the investigator. The subject was contacted by the investigator and following a lengthy telephone conversation, was encouraged to report to the cardiothoracic clinic for evaluation.

A finding of depression was expected based upon the number of stressors and the magnitude of stress to which the subjects were subjected concomitant with the CABG surgery and during the postoperative period. While the frequency of depression was not as high as expected, it was certainly high enough to warrant concern, further study, and intervention.

Positive findings were obtained in response to the second research question which sought to identify a common time frame for the postoperative occurrence of depression in CABG patients. Zung SDS scores for depression were highest in the first time interval, one to three months post-surgery. It should be noted that this information was recoded from days to months in order to provide even intervals for analysis.

Depression, though present in all four time intervals, was greatest at one to three months postoperatively, decreased at the four to six month period, and appeared to stabilize through the remaining two time intervals. While depression scores were highest in the one to three month group, the N for that group was the smallest (See Table 5). It is possible that patients in this time interval were too distressed to participate. The expected N for the three month group was not calculated.

Higher depression scores were expected in the earliest post-operative period for two reasons. The first explanation relates to the actual discharge process or transition from the hospital to home. At this phase of the CABG patient's recovery, this is a drastic change--the patient must leave a safe, known environment in which needs are quickly met by attentive, highly specialized nursing personnel and physicians, and will soon return home where uncertainty awaits.

The second proposed explanation for the finding of depression in the early phase of convalescence centers around the added stress of meeting expectations. As family, friends, and physicians begin to express expectations for the patient to resume work or career activity, the patient may become overly concerned about gaining the strength and capability to meet these expectations.

The combination of these two events occur at a time when the CABG patient is still physically recovering while adjusting to a new life role as he relinquishes the sick role. With this infor-

mation, health care providers may be better prepared to recognize the patient in need of assistance and to offer an appropriate intervention.

The third research question investigated the possible relationship between variables of CABG surgery and depression. The CABG variables were divided into descriptive characteristics, physical condition variables, psychological and socioemotional condition variables.

The descriptive characteristics, which included age, sex, occupation, and marital status did not display any significant correlations with depression. There was the strong correlation between females and high scores in the pervasive affect subscale of the Zung SDS for depression. It is not known why more females claimed to be tearful, sad and blue. However, culturally this is a more acceptable response for women than for men. As reported, age of the females lowered the possibility of menopausal influence, (youngest was 62 years old), these affective findings were probably not related to the hormonal effects of menopause.

In order to ascertain the presence of a relationship between gender and depression, it would be necessary to conduct a study where the number of females was greater than eight. In the meantime, clinicians might consider increasing observation of female CABG patients and offer support and assistance.

Of the physical, psychological, and socioemotional variables, a few were strongly related to depression. Patients who indicated

they did not feel as well as expected were more likely to score higher on the depression scales. Therefore, if a patient had unrealistic expectations of wellness, that patient would be inclined to be depressed. Conversely, the more realistic the expectations, the greater the likelihood the patient would not be depressed. This is reasonable because the more realistic the expectation, the greater the possibility of it being fulfilled.

The presence of satisfaction with the surgical outcome was correlated with an absence of depression. Patients who were satisfied with the results of the CABG surgery were least likely to be depressed. It follows that if patients were satisified and content, they would not experience the negative aspects of conflict and frustration.

There was a significant correlation with the number of postoperative complications and depression. The greater the number of complications, the greater was the finding of depression. This finding was expected because postoperative complications are clear indicators to the patient that even though he survived surgery, he remains ill. Therefore, the more complications a patient develops, the greater the reinforcement that he is not only still sick, but he is getting sicker. Such discouragements tend to increase feelings of hopelessness.

An unexpected finding of depression was the relationship between a patient's reported "brush with death" and depression. Statistical analysis of the data indicated that claims of a "brush

with death" were associated with higher findings of depression. Just the opposite finding was expected. It was surmised that military personnel might have encountered prior life-threatening situations which would provide them with a frame of reference for coping with the risks of CABG surgery. This previous experience was expected to aid in decreased findings of depression.

A possible explanation concerns the subject's interpretation of the question as it was worded on the CABG Personal Profile II. Comments written by the subjects revealed a variety of perceived "brush with death" situations ranging from war experiences and serious automobile accidents to a recent cardiac arrest, as well as the actual CABG surgery, which was considered by some subjects to be a "brush with death".

Another unexpected finding was the absence of a relationship between the loss of significant other and depression. It was expected that the loss of a significant other would be strongly related with greater findings of depression. This correlation was expected because of the devastating effect the loss of a loved one can have on the survivor. A possible explanation is that only three subjects reported being widowed while 98 reported being married.

A positive correlation was found between number of post-operative hospital stay (days) and the depression variables. The statistics revealed that the longer the hospital stay after CABG surgery, the greater the finding of depression. This finding also

correlates with the variable of expectations, which indicates that patients with unrealistic expectations of surgical outcome, combined with a greater number of operative complications, were more likely to be depressed. This was expected because the negative aspects encountered were the same and possibly additive for all three events: frustration, inner conflict, anger, and hopelessness. Therefore, when all three events occur in a patient, depression is a likely development.

## Summary

An investigation of the occurrence of depression in patients who experienced coronary artery bypass graft surgery from 1 June 1980 to 1 June 1981 was conducted at the Naval Regional Medical Center, San Diego, California. The purpose was to determine if CABG surgery patients became depressed at any time during the first 12 months postoperatively. In addition, it was the intent of this investigator to determine if findings of depression were more frequent at any one particular time interval. The final purpose of this research was to identify relationships between factors of CABG surgery and depression.

Statistical analysis of accumulated data revealed the following: 18.6% of the sample (N = 107) were clinically depressed as measured by the Zung Self-Rating Depression Scale (SDS); a greater level of depression was present during the first three months post-CABG surgery; and, several physical, psychological, and socioeconomic condition variables correlated with depression.

## Limitations

In view of the results of statistical analysis and a scrutiny of the entire protocol, several limiting factors were identified.

While the sample size obtained was suitable for the purposes of this research (N = 107), the decision not to implement follow-up procedures may have resulted in the loss of additional information. The most striking possibility is that the subjects who failed to return the questionnaires may have been too depressed to participate. Second, the small number of female subjects may have precluded the establishment of significant correlations between gender and depression.

Third, an evaluation of completion techniques on the Zung SDS scales revealed three subjects did not completely answer all subscale questions, which resulted in the loss of those subjects. Fourth, a statistical evaluation of the CABG Personal Profile II for validity and reliability is needed. Several questions were ambiguous, and specifically, the occupation question was not appropriate when applied to a military population.

## Implications For Nursing

The various implications extended into the three formal areas of professional nursing; clinical practice, research, and education. While some of the implications overlap, each area within the profession has individual responsibilities.

Nursing personnel who are engaged in clinical practice are in a position to institute change through knowledge and education. By

sharing these findings, clinicians will expand awareness of the psychiatric complication of depression for patients following coronary artery bypass graft surgery. Armed with this basic knowledge, clinicians will be able to make appropriate observations and purposeful assessments of the CABG surgery patient, and will know what to expect from these patients in terms of depression. These particular assessment features can be refined into a simple tool based on known descriptive, physical condition, phychological, and socioemotional condition variables for a preoperative evaluation.

Clinicians are in a primary position for designing, implementing and evaluating patient education programs. Such programs need to focus on preoperative and postoperative aspects. It would be beneficial to ascertain prior to surgery what expectations were held by the patient. Pre- and postoperative teaching programs as well as clinical practice, should focus on decreasing the risk of complications, which could result in shorter postoperative hospital stay, assist the patient in setting realistic expectations, and in achieving some degree of satisfaction with the surgical outcome. Another implication for nurses concerns the development of discharge teaching programs that would serve to prepare the patient for discharge home in order to decrease the stress of this critical change.

While the number of patients was small in the first three months postoperative group, depression levels were highest during this time interval. It becomes clear that rehabilitation programs for CABG patients should be expanded in scope. Such programs should

incorporate depression assessment methods, strive to ensure patient participation, be coordinated by a qualified clinical specialist, and have demonstrated physician support of the program.

Nurse educators are ideally suited to begin this education process. Pending additional research, nursing students need to be informed of the importance of adequate physical and emotional assessment of patients in order to select and offer appropriate interventions.

Nurse researchers will be instrumental in conducting and encouraging studies of this particular patient care problem. The ultimate goal will be to identify those patients at greatest risk of becoming depressed and thereby devise and evaluate an intervention program.

## Recommendations For Future Research

The first recommendation for future investigation is to replicate this study with a similar sample to determine if the findings can be duplicated. While some clinicians have observed depression in CABG patients, very little formal research of this topic has been conducted. Should this project be replicated, it is recommended that several questions in the CABG Personal Profile II be clarified in order to obtain more reliable data.

Specifically, the three questions pertaining to occupation and employment status were not worded properly for a sample comprised of military personnel. The problem was that military personnel often change position status (professional vs. nonprofes-

sional) upon retirement and the questions utilized were not worded in a manner suitable for obtaining the desired information.

The second weakness was with Question 14: "Have you ever had a brush with death?" After evaluating the responses of the subjects it was apparent that the phraseology and the absence of guidelines resulted in a question that was not uniformly interpreted. The information obtained was difficult to tabulate and evaluate because many of these subjects had been involved in at least one major armed conflict and some had even been involved in as many as three wars where a "brush with death" was a daily occurrence.

A second recommendation is to conduct a longitudinal study to evaluate the onset, duration, and termination of depressive symptoms. Additionally, a third recommendation is to extend the investigation for more than one year. This recommendation is based on the finding of depression in CABG patients during the fourth postoperative interval (10-12 months) which implies that depression may persist or occur beyond the 12 month period.

Fourth, a replication might include the use of another depression scale, such as the Beck Depression Inventory. It might prove useful to compare this inventory with Zung SDS subscale findings on levels of depression. In addition, the use of a different depression scale might help to identify some of the 12% depressed subjects missed by the Zung SDS.

Fifth, it is recommended that efforts be made to access more

females in order to obtain a more adequate representation. A larger number of female subjects would improve the likelihood of achieving reportable data.

Sixth, whenever mail survey and questionnaires are utilized as a research tool, recommended follow-up procedures should be implemented even if an adequate sample has been obtained. Primarily, the use of follow-up procedures should increase the sample size and decrease bias, as noted by Polit & Hungler (1978). In addition, follow-up procedures would encourage nonparticipants to respond and contribute valuable data.

Another recommendation for future study is based upon the positive findings of this endeavor. Data might be collected to determine how depression in CABG patients affects compliance, appointment keeping, and alterations in relationships with families, friends, and medical personnel.

Finally, it is recommended that this research be replicated, but altered to include a depression assessment of the patient (using the Zung SDS) prior to the surgical event. This is recommended in order to obtain an accurate preoperative evaluation of depression. This would help to confirm or dispute the occurrence of depression as related to CABG surgery rather than a pre-existing condition.

Major findings revealed the presence of depression in 18.6% of the sample; the greatest level of depression was found one to three months post-CABG surgery; and, depression was most strongly

related to unmet expectations of wellness, two to four postoperative complications, and feelings of dissatisfaction with surgical outcome. Members of the nursing profession must become actively involved in emotional and physical assessment of preoperative CABG patients, develop appropriate patient teaching programs, and initiate adequate nursing interventions. Post-discharge support programs may also be helpful in identifying and aiding depressed patients after surgery. Subsequent nursing research needs to focus on verifying this data, identifying additional variables, designing a valid preoperative assessment tool, and conducting necessary evaluations.

# APPENDIX A

## CABG PERSONAL PROFILE II

Code # _____

CABG Profile II

Please answer the following questions to the best of your knowledge:

Q-1 What was the date of your heart surgery?_____

Q-2 What was the date you were admitted to the hospital?_____

Q-3 What was the date you were discharged home from the hospital following your heart operation?_____

Q-4 How many heart vessels were grafted? (Circle number)

1 2 3 4 5 Don't Know

Q-5 Have you been completely satisfied with the results of your heart surgery?

1. Yes
2. No

If No, please indicate degree of satisfation (Circle number)

1. A little
2. Somewhat satisfied
3. A great deal of satisfaction

Q-6 If you answered No to Q-5, please indicate a reason for any dissatisfaction (Circle number, OR numbers)

1. Still have chest pain
2. Don't feel any stronger than before operation
3. I feel weaker than before operation
4. I'm not able to do things my doctor expects me to do
5. Other:_____

Q-7 Since your heart surgery, have you felt as good as you expected to feel? (Circle number)

1. No
2. Yes

CABG Profile II Code #_____

→If Yes, please indicate how good you've felt (Circle number)

1. A little better than I expected
2. A lot better than I expected
3. I feel great

Q-8 What is your usual occupation? If you are retired, what was your occupation before your retirement? (Circle number)

1. Doctor/Dentist
2. Nurse
3. Custodial Worker
4. Homemaker
5. Farmer
6. Lawyer
7. Office Worker
8. Plumber/Electrician
9. Construction Worker
10. Farm Worker
11. Salesperson
12. Salesclerk
13. Hospital Worker
14. Other:_____

Q-9 What is (was) your occupational title or position? (Please describe)

Q-10 Are you presently: (Circle number)

1. Employed
2. Unemployed - Why?_____
3. Full-Time Homemaker
4. Retired
5. Have not returned to work - Why?_____
6. Other:_____

Q-11 Did you have any of the following complications after your heart surgery? (Circle number)

1. No
2. Yes

If Yes, circle number(s) of complication(s) and indicate if occurred in the hospital or at home:

1. Pneumonia Hosp/Home
2. Delirium Hosp/Home
3. Irregular heart beat Hosp/Home
4. Cardiac arrest (heart stopped) Hosp/Home
5. Blood pressure problems Hosp/Home
6. Abnormal bleeding Hosp/Home
7. Other: (Please explain)_____
_____

Code #_____

Q-12 Have any of the following persons in your life died since last June 1979?

1. No
2. Yes

If Yes, please circle number that apply and list date of death:

Date

1. Spouse
2. Child (Son or Daughter?)
3. Parent (Mother or Father?)
4. Grandchild
5. Brother
6. Sister
7. Close Friend
8. Other: (Please explain)_____

Q-13 Have you ever had a "brush with death"? (Circle number)

1. No
2. Yes (Please tell when and explain circumstances_____

_____

_____

_____

_____

Q-14 Have you felt especially blue, sad, or down-in-the-dumps since your heart operation? (Circle number)

1. No
2. Yes

If Yes, please give date this occurred and explain incident:

Q-15 Are you presently taking any medications?

1. No
2. Yes

If Yes, please give the name of the medicine. If name is not known, tell what the medicine is supposed to do:

Code #_____

Q-16 Have you ever sought guidance or assistance for depression from a professional or religious leader? (Circle number)

1. No
2. Yes

Q-17 Have you ever sought guidance or assistance for depression from a doctor?

1. No
2. Yes

Q-18 If you answered Yes to Q-16 and/or Q-17, would you please answer the following questions?

What was the date of the first visit?_____
What was the date of the last visit?_____
What kind of treatment or assistance did you receive? (Circle number)

1. None
2. Talked about things
3. Received medication
4. Shock therapy
5. Biofeedback
6. Hypnosis
7. Other (Please explain)

Q-19 What is your present marital status? (Circle number)

1. Married
2. Separated
3. Divorced
4. Widowed
5. Single
6. Living together
7. Other (Please explain)_____
_____

Q-20 Has your marital status changed during the past year? (Circle number)

1. No
2. Yes

If Yes, please explain what the change was:_____
_____

Code #_____

Q-21 How many children do you have?_____

Q-22 What is the age of your oldest living child?_____

Q-23 What is the age of your youngest living child?_____

Q-24 For how many of your children do you provide 50% of their income?_____

Q-25 How often did you attend religious services in a place of worship during the past year? (Circle number)

1. Regularly (Once a week or more)
2. Occasionally
3. Only on special days (Christmas, Passover, etc.)
4. Not at all

Q-26 Since your heart operation, have you at any time attended any group rehabilitation programs, such as the Utah Heart Club or YMCA? (Circle number)

1. No
2. Yes

If Yes, please give the name of the program, and also describe your impression of the need for or usefulness of such programs:_____

# APPENDIX B

## COVER LETTER TO SUBJECTS

Naval Regional Medical Center
San Diego, California 92134

Dear :

At least 110,000 Americans undergo open heart surgery for coronary artery bypass grafts every year. As one of those people, you can be a tremendous help to me in my effort to improve the nursing care and treatment of open heart patients. My goal is to improve the nurse's understanding of the many implications of this type of surgical procedure.

As a Clinical Nurse Specialist at NRMC San Diego and a graduate student in Cardiovascular Nursing at the University of Utah, I am completing my thesis for a Master of Science degree. In order to do this, I am conducting a survey of patients who have had open heart surgery within the past year for coronary artery bypass grafts. Your participation in this study will be greatly appreciated and will also contribute greatly to a better understanding of complex aspects faced by patients after their heart surgery.

It is important for you to know that your answers and all information will be completely confidential and your identity will remain anonymous. I will use a special coding system that will convert your name to a code number in order to ensure confidentiality. In addition, please be sure to sign the Privacy Act/consent statement.

In order to participate in this study, all you have to do is answer the questions contained in this handout. These questions have been designed to obtain pertinent information about your postoperative recovery. This should take about 20 minutes to complete. When you have finished the questionnaires, please return the entire packet to me by mailing it back in the enclosed envelope.

Should you wish to withdraw from this study, please feel free to do so at any time.

I will be very happy to answer any questions you may have concerning this study. My telephone number is (W) 233-2586, Area IV, and ask for LCDR DePrima. Please feel free to call at any time.

Thank you for your assistance and for taking the time to read this letter. I hope you will be able to participate in this important study.

Sincerely,

Alicia Gail De Prima
LDCR NC USN
Principal Investigator/Masters Candidate

# APPENDIX C

## CONSENT FORM

Naval Regional Medical Center
San Diego, California 92134

Privacy Act Statement - Consent Form

This information is collected under the authority of Section 133, 1071-78, 3012, 5031 and 8012, Title 10, United States Code and Executive Order 9397. The purpose for requesting personal information is to conduct a survey of patients who have, within the past year, had coronary artery bypass graft surgery. This knowledge and information will lead to improved nursing care of cardiac patients who must some day undergo open heart surgery as you have already done.

Information including the Social Security Number (SSN), hospital number, and official home address is necessary to identify the person and records. Your answers and all information will be completely confidential and your identity will remain anonymous. I will use a special coding process that will convert your name to a code number in order to insure confidentiality.

You are free not to answer any questions and free to withdraw from this survey at any time without jeopardizing present or future medical care. If you have any questions, please feel free to ask me.

Patient Statement

I understand that a copy of this form, which I have signed, will be retained with the information gathered at the Naval Regional Medical Center, San Diego, for a minimum of one year.

I understand that the goal of this survey is to gather information concerning postoperative occurrences among patients who have had coronary artery bypass surgery. I further understand that there may be no direct benefit to myself, but that the information obtained may be useful in improving care given to other patients.

I understand that I may contact LCDR DePrima at any time to discuss the questionnaire with her; that I am free not to answer any question or questions if I so choose; and that my anonymity will be protected at all times.

I have received a copy of the Experimental Subject's Bill of Rights and the Privacy Act Statement.

_____ _____

Subjects Signature Date

_____

Investigator's Signature

# APPENDIX E

# PRIVACY ACT STATEMENT

# HEALTH CARE RECORDS

## Experimental Subject's Bill of Rights

Any person who is requested to consent to participate as a subject is a research study involving a medical experiment, or who is requested to consent on behalf of another, has the right to:

1. Be informed of the nature and purpose of the experiment.

2. Be given an explanation of the procedures to be followed in the medical experiment, and any drug or device to be used.

3. Be given a description of any attendant discomforts and risks reasonable to be expected from the experiment.

4. Be given an explanation of any benefits to the subject reasonable to be expected from the experiment, if applicable.

5. Be given a disclosure of an appropriate alternative procedures, drugs or devices that might be advantageous to the subject, and their relative risks or benefits.

6. Be informed of the avenues of medical treatment, if any, available to the subject after the experiment if complications should arise.

7. Be given an opportunity to ask any questions concerning the experiment or the procedures involved.

8. Be instructed that consent to participate in the medical experiment may be withdrawn at any time, and the subject may discontinue participation in the medical experiment without prejudice.

9. Be given a copy of a signed and dated written consent form when one is required.

10. Be given the opportunity to decide to consent or not consent to a medical experiment without the intervention of any element of force, fraud, deceit, duress, coercion, or undue influence on the subject's decision.

11. I understand that my confidentiality will be preserved and my name will not be released without my permission.

If you have questions regarding a research study, contact the principal investigator or associate investigators. You may seek information from the Committee for Protection of Human Subjects, established for the protection of volunteers in research projects, at the Naval Regional Medical Center, San Diego, California 92134, by calling (714) 233-2934 or writing to the above address.
Enclosure (2)

## Privacy Act Statement - Health Care Records

This form is not a consent form to release or use health care information pertaining to you.

1. Authority for collection of information including social security number (SSN).

   Sections 133, 1071-87, 3012, 5031 and 8012, title 10, United States Code and Executive Order 9397.

2. Principal purposes for which information is intended to be used.

   This form provides you the advise required by The Privacy Act of 1974. The personal information will facilitate and document your health care. The Social Security Number (SSN) of member or sponsor is required to identify and retrieve health care records.

3. Routine uses.

   The primary use of this information is to provide, plan and coordinate health care. As prior to enactment of the Privacy Act, other possible uses are to: Aid in preventive health and communicable disease control programs and report medical conditions required by law to federal, state and local agencies; compile statistical data; conduct research; teach; determine suitability of persons for service or assignments; adjudicate claims and determine benefits; other lawful purposes, including law enforcement and litigation; conduct authorized investigations; evaluate care rendered; determine professional certification and hospital accreditation; provide physical qualifications of patients to agencies of federal, state, or local government upon request in the pursuit of their offical duties.

4. Whether disclosure is mandatory or voluntary and effect on individual of not providing information.

   In the case of military personnel, the requested information is mandatory because of the need to document all active duty medical incidents in view of future rights and benefits. In the case of all other personnel/beneficiaries, the requested information is voluntary. If the requested information is not furnished, comprehensive health care may not be possible, but CARE WILL NOT BE DENIED.

   This all inclusive Privacy Act Statement will apply to all requests for personal information made by health care treatment personnel or for medical/dental treatment purposes and will become a permanent part of your health care record.

Your signature merely acknowledges that you have been advised of the foregoing. If requested, a copy of this form will be furnished to you.

| Signature of Patient or Sponsor | SSN of Member of Sponsor | Date |
|---|---|---|

Form Previous Edition Is Obsolete

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