FATIGUE

IN PATIENTS WITH CORONARY ARTERY DISEASE

by

Eloise Mittleider Gatchet, R.N., B.S.N.

A THESIS

Presented to
The Oregon Health Sciences University
School of Nursing
in partial fulfillment
of the requirements for the degree of

Master of Nursing

June, 1989

APPROVED:

[redacted]

Mary McFarland, R.N., Ed.D. Associate Professor,
Thesis Advisor

[redacted]

Carol S. Burckhardt, R.N., Ph.D., Associate Professor,
First Reader

[redacted]

Barbara Gaines, R.N., Ed.D., Associate Professor,
Second Reader

[redacted]

Carol A. Lindeman, R.N., Ph.D., F.A.A.N., Dean,
Oregon Health Sciences University School of Nursing

This study was supported by a
United States Public Health Service
Division of Nursing Traineeship
from Grant Number
2A11 NU00250-09

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CHAPTER I

INTRODUCTION

Heart disease is the most prevalent disease in the United States (American Heart Association, 1986). In the last twenty years tremendous advances have been made in the diagnosis and management of coronary artery disease. Most patients who suffer an acute cardiac event such as myocardial infarction (MI) or coronary artery bypass graft (CABG) survive their initial episode and are capable of returning to a satisfying life. The emphasis of the cardiac team is not only to help patients survive the initial critical period of their illness but to guide them through the rehabilitation process that restores them to satisfying lives (Wenger, Hurst & McIntyer, 1980; Johnson, 1984).

Current standards of practice include early ambulation and progressive increases in activity and exercise both during the hospital stay and early after hospital discharge. A critical evaluation of patients' responses to the exercise performed is essential in balancing the risks of complications caused by increased work load on the heart and the benefits of activity in promoting a quicker return to an active life. After leaving the hospital, many patients receive monitoring in Phase II cardiac rehabilitation programs. The goal is to plan activity based on the individual patient's needs and capabilities. The nurse is the health professional in most continuous contact

with patients and is therefore in the unique position of being able to make the ongoing observations on which to base such planning.

Evaluation of exercise is generally based on heart rate and blood pressure responses, dysrhythmias, S-T segment changes and fatigue. Standardized measurement parameters for heart rate, blood pressure, and cardiac rhythms are readily available to the cardiac nurse. A measurement of fatigue, however, is not as easily obtained since the concept of fatigue is not well defined or understood. Fatigue can mean many different things to different people. There are no commonly accepted tools to measure patients' fatigue. It is not surprising, therefore, that fatigue is not uniformly assessed or described. It is dependent upon the nurse's subjective perception based on experience and intuition. Data obtained in this way can be unreliable and difficult to communicate to other team members. Judgments based on inaccurate or incomplete data may lead to inappropriate actions.

Therefore this study was undertaken to gain a better understanding of fatigue in patients with coronary artery disease recovering from acute myocardial infaraction or coronary artery bypass graft. Selected instruments available to measure fatigue in healthy subjects were used to see if they could describe the degree and symptoms of fatigue more accurately and uniformly in this population.

REVIEW OF THE LITERATURE

The literature review will describe attempts to define and to measure fatigue. Fatigue in illness will be discussed including studies of fatigue in patients with multiple sclerosis and in patients receiving treatment for cancer. No studies were reported in the literature that measured or described fatigue in patients with coronary artery disease.

Definitions of fatigue

Fatigue is a common experience of human beings, yet it has to a large extent escaped accurate definition and measurement. It is a term with slightly different meanings depending upon the perspective of the individual defining it. Fatigue originated as a lay term referring to a self-experienced feeling of tiredness or weariness (Bartley & Chute, 1947). The meaning of the word fatigue has become more varied as it has been studied by various desciplines until "There are as many different definitions as there are studies of it" (MacFarland, 1971).

Fatigue has been studied by the various branches of science such as physiology, chemistry, pathology, and psychology. It has been of concern to industry as it relates to productivity, to athletes as it affects accomplishment, and to the field of aeronautics as it relates to safety and performance. Fatigue has been defined and described with the researcher's own particular

perspective in mind. Most definitions seem specific to a particular situation and thus generalizations may need to be limited. The complexity of fatigue makes it difficult to develop an interdisciplinary definition (Eidleman, 1980; Spaulding, 1964, Bartley, 1981; Burkhardt, 1956).

Physiologists view fatigue as an expenditure of energy that results in a decrease in physical performance, impairment, or a state in which the organism has lost its capacity to carry on or respond to stimuli (Barley & Chute, 1947; Grandjean, 1970; Simonson & Weiser, 1976; Kennedy, 1987; Spaulding, 1964). However, as early as 1925 Whiting and English recognized the importance of making a distinction between impairment and fatigue (Bartley & Chute, 1947).

Pathologists view fatigue as an important indicator of failure to adapt to stressful events (failure to maintain homeostasis) or an indication of a pathological process or illness (Brown, 1964; Grandjean, 1970; Takatuma, 1982; Poteliakhoff, 1981; Rhoten, 1982).

Psychologists have been interested in the subjective sense of weariness or tiredness as it affects the whole person. They usually take into consideration the effects of stress, motivation and boredom on fatigue (Bartley & Chute, 1947; Simonson & Weiser, 1976; Grandjean, 1970; Bartley, 1981). Bartley (1981) defined fatigue as a "sensory, cognitive syndrome which includes tiredness, aversion to

work, body discomfort, ineffectiveness in performance... a self felt assessment of inadequacy... with the desire to escape".

Fatigue has thus, been variously described as physiological change in activity of body mechanisms (local action within the body), objective work decrement, or subjective sense of weariness or tiredness. Fatigue is even used in describing impairment in inanimate objects, such as metal fatigue. Such a broad spectrum of use makes it difficult to arrive at a specific definition of fatigue that is universally accepted.

While researchers have had difficulty defining, measuring and identifying causes of fatigue, it is a feeling that is well-known in daily experience (Grandjean, 1970). Fatigue is the subjective, overall sense of discomfort related to tiredness, weariness, and decreased capacity for mental or physical work. Individuals are able to distinguish fatigue from other similar feelings such as exertion, pain, discomfort and depression.

Measurement of fatigue

Early attempts to establish a subjective measure of fatigue were frustrated by the difficulty of treating affective responses in a simple quantitative manner. Researchers assessing other affective responses such as dyspnea, pain and exertion have had similar difficulty. Measurement of fatigue has been approached from several

angles. Many attempts to measure fatigue have been directed at measuring work impairment and physiological variables such as oxygen debt and heart rate (Takatuma, 1982; Bartley & Chute, 1947; Daley & Wilson, 1983).

Other researchers have attempted to measure or describe fatigue by listing the symptoms of fatigue (Yoshitake, 1971; Hart & Freel, 1982; Rhoten, 1982). The Industrial Fatigue Research Committee of the Japanese Association of Industrial Health identified some of the specific symptoms of fatigue (Yoshitake, 1971). The result of their work was a 30-item fatigue symptoms checklist containing three dimensions or categories relating to: 1) weakened activation (dull, sleepy factor), 2) weakened motivation (mental symptoms), and 3) physical disintegration (specific physical symptoms in the body) (Appendix F). Yoshitake (1971) found that the frequency of these symptoms and the degree of concurrent fatigue experienced correlated significantly in bank workers and broadcast workers. The symptoms checklist has also been used to collect information on the symptoms of fatigue experienced by patients with multiple sclerosis (Hart, 1978) and by patients undergoing localized radiation therapy for cancer (Haylock & Hart, 1979).

While symptoms of fatigue are a basis for expressing the feeling of fatigue, they are not exactly the same thing. Symptoms are specific complaints, while fatigue is

an overall feeling of unpleasantness.

Several researchers have attempted to quantify or measure the degree (level, intensity) of fatigue experienced. As early as 1928, Paffenbarger reported the use of a simple rating scale to evaluate the feeling of tiredness during prolonged mental work (Kinsman & Weiser, 1976). Ratings of tiredness were obtained using a 7-point ordinal scale, given immediately before and after each trial of a task. A positive correlation was found between rating of tiredness and work decrement.

Pearson and Byars (1956) developed The Pearson and Byars Fatigue Checklist, a self-rating interval scale to measure levels of subjective fatigue in healthy subjects (Appendix D). This checklist defined the fatigue feeling continuum in ten phrases from 1--very lively to 10--ready to drop. The scale was constructed according to sound psychometric principles and was extensively tested. It is considered by some to be unsurpassed as a unidimensional measure of tiredness (Kinsman & Weiser, 1976). The checklist clearly differentiated between the fatigued subjects and the control subjects. The fatigue checklist was originally used in aeromedical studies. More recently it has been used to assess fatigue in ill individuals (Hart, 1978; Haylock & Hart, 1979).

Rhoten (1982) developed a scale to measure the degree of fatigue experienced by post-surgical patients. The

Rhoten Fatigue Scale consisted of 10 increments beginning at 0--not tired, full of energy, peppy, to 10--total exhaustion (Appendix G). Post-surgical patients were asked to point out their level or degree of fatigue on the scale. Early postsurgical patients experienced some fatigue, ranked usually at 3-4 on the scale, but they were more concerned about pain, IV's and nasogastric tubes.

Researchers have attempted to describe and measure fatigue levels objectively by identifying characteristics of fatigued individuals that can be observed by others. Kashiwagi (1971) constructed a fatigue rating scale based on the Fatigue Symptoms Checklist (Yoshitake, 1971) that would allow an objective judgement of fatigue by evaluation of a person's appearance. He used the following objective symptoms to indicate weakened activation (dull, sleepy): tired walk, unsteady voice, absentmindedness, hollow-cheeked, avoidance of conversation, sulky face, spiritless eyes, irritability, listlessness and dull face. The weakened motivation symptoms (mental) were: making many misstatements, avoiding others' eyes, being difficult to speak to, sluggishness, restlessness, anxiety, pale face, stiff face, trembling fingers, and inability to concentrate or listen. He found that the component of weakened activation played the most important role in effectively being able to objectively evaluate changes in the level of a person's fatigue.

In addition to the Fatigue Scale already mentioned, Rhoten (1982) developed An Observation Checklist to identify the objective characteristics of fatigue manifested by surgical patients (Appendix G). The checklist included items under the following headings: physical appearance, coloring, breathing, eyes, facial expression, speech, movements, ambulation, posture, food and fluid intake, and attitude. When used with the Rhoten fatigue scale (Rhoten, 1982) there was a positive correlation between the rankings made by patients and rankings assigned by observers. As might be expected in post-surgical patients, those most fatigued also complained of more pain than those less fatigued.

Both the checklist constructed by Kashiwagi and the one by Rhoten were developed for specific populations and do not necessarily describe fatigue in other populations. There may be some cultural or racial bias. For example both use color (pale face, pink, or ashen) in their checklists. If black individuals are being evaluated this particular item may not be helpful. Other items on Kashiwagi's list such as sulky face, hollow-cheeked, or spiritless eyes may be more prevalent in the Japanese culture than others. Rhoten's descriptions under the heading of posture such as lying on back and body not arranged in comfortable position may apply to post surgical patients that are in bed, but be less helpful in identifying fatigue in ambulatory patients.

Fatigue in Illness

Fatigue is probably the most prevalent symptom found in physical and mental illness (Piper, 1986; MacBryde, 1970; Burkhardt, 1956; Spaulding, 1964; Coates, 1964). Acute fatigue, similar to acute pain, may serve a protective function against injury and overwork. Chronic fatigue, however, serves no purpose and can interfere with valued activities, relationships and participation in medical therapies (Piper, 1986). Fatigue research done so far has primarily studied fatigue in healthy individuals. There has been very little work done by health professionals to bring this research into the clinical area of describing fatigue experiences or management of those who are ill. This is an important issue since in many pathological conditions fatigue is a major complaint or symptom of the disease and/or side effect of treatment regimes. In dealing with patient's fatigue it is essential that fatigue be defined in the same way as it is used by the patient. Therefore the best method to measure fatigue is by eliciting the individual's own description. This has not been done in a way that allows patients to describe fatigue in their own terms.

A few researchers have attempted to measure and describe fatigue in specific patient populations. Rhoten (1982), as already reported, had post-surgical patients rank their fatigue on a 10-point scale and reported

objective fatigue manifestations on an Observation Checklist.

Several studies have looked at fatigue in relationship to patients with cancer. Haylock and Hart (1979) studied fatigue in patients receiving localized radiation. The purpose of the study was to obtain a description of the fatigue experienced post-radiation. The Pearson and Byars Fatigue Checklist (Pearson & Byars, 1956) was used to obtain a description of the level of fatigue on a continuum. The specific symptoms of fatigue were measured by the Fatigue Symptoms Checklist of the Japanese Association of Industrial Health (Yoshitake, 1971). Findings supported the idea that localized radiation does precipitate fatigue. The fatigue symptoms which correlated significantly with reported fatigue levels were physical rather than psychological. The pattern of fatigue experienced by these patients related to the time of exposure and should assist in scheduling activities in relationship to therapy.

Kobashi-Schoot, Hanewald, VanDam and Bruning (1985) also studied fatigue experienced by cancer patients treated with radiation therapy. They sometimes referred to fatigue as "malaise" but the definition of malaise was the same, i.e., "one feels tired and weak, and is unable to accomplish much." Similar results to Haylock and Hart's study were obtained. Patients described increased fatigue

after receiving radiation therapy. Specific symptoms described were more likely to be physical rather than mental.

Some studies have looked at fatigue experienced by cancer patients receiving chemotherapy. These patients, similar to those receiving radiation therapy, described increased fatigue after treatments. In a study by Meyerositz, Watkins and Spark (1983) 96% of the patients reported fatigue and most viewed it as the most common and disruptive symptom. Physical fatigue resulting from the treatment drugs was not distinquished from fatigue based on depression and anxiety related to the diagnosis of cancer, mastectomy and fear of reoccurence.

Fatigue experienced by patients with multiple sclerosis (MS) has also been studied. Hart (1978) compared reponses on a questionnaire related to fatigue in patients with multiple sclerosis to healthy persons. The patients rated their fatigue levels higher and described more fatigue symptoms than healthy individuals as measured by the Pearson and Byars Fatigue Checklist (1956) or the Fatigue Symptoms Checklist (Yoshitake, 1971). They reported feeling more severe feelings of fatigue throughout most of the day than healthy persons even though more than 65% of the patients took at least one nap during the day. The fatigue symptoms most frequently experienced were physical feelings such as tired in legs, unsteady or clumsy, and wanting to

lie down. Many patients also complained of more specific symptoms such as tremors of limbs.

Patients with multiple sclerosis (MS) and the fatigue they experienced were also studied by Freal, Kraft, and Coryell (1984). Fatigue was the most frequently mentioned symptom by patients responding to a questionnaire. Most of the patients (90%) described fatigue as tiredness or the need to rest. Forty-eight percent also described a worsening of MS symptoms. Fatigue was greatest in the late afternoon. Extreme environmental temperatures seemed to make fatigue worse.

Fatigue, or aspects of fatigue, were included in a Symptoms Distress Scale developed by McCorkle and Young (1978). The scale was used to identify human concerns of patients receiving cancer treatments. Fatigue was reported to be a major concern to 9 out of 28 patients.

Fatigue as an early and insidious symptom of impending MI has been demonstrated retrospectively. Unusual fatigue was reported in 77% of a study population questioned following an acute MI (Nixon & Bethell, 1974). The time from onset of fatigue to the developement of the infarction varied from 6 weeks to a year or more. Seventy-two percent (72%) of this group reported excessive sleepiness during the same period. While this retrospective study reported that the patients had experienced fatigue, there was no effort to describe the symptoms or to measure the degree of

fatigue experienced. There were no other studies reported in the literature that studied fatigue in patients with coronary artery disease.

Summary

Fatigue originated as a term referring to the subjective feeling of tiredness or weariness. It has been studied by various branches of science such as physiology, pathology and psychology as well as by those in industry, aeronautics and athletics. Each has studied fatigue from its own perspective variously describing fatigue as energy expenditure, work decrement, physiological change or subjective sense of weariness. Some attempts to measure fatigue in terms of the symptoms expressed or along a continuum have been made. Fatigue is a common symptom in illness. A few researchers have attempted to measure and describe fatigue in specific patient populations such as patients with MS, surgical patients and patients receiving treatment for cancer. No studies have measured or described fatigue in patients with coronary artery disease.

CONCEPTUAL FRAMEWORK: FATIGUE

The conceptual framework chosen for this research was an integrated model drawn from the literature of fatigue in general and fatigue and illness in particular.

Everyone experiences fatigue. Fatigue is considered a normal response to many physical and psychological factors. It is also a common symptom of illness or side effect of treatment (Haylock & Hart, 1979; Hart and Freal, 1982; Piper, 1986).

Fatigue is a subjective self-evaluation of sensations associated with tiredness, discomfort, decreased capacity for physical and mental work and increased task aversion (Bartley, 1968; Spaulding, 1964; Morris, 1982). Fatigue occurs when the body is unable to maintain physical and mental equilibrium when faced with a stressor that taxes homeostatic mechanisms. When equilibrium is attained or adequate compensation takes place, fatigue is reduced or eliminated.

Fatigue may be acute or chronic, specific or generalized. It may be primarily physical or psychological in nature or a combination. Fatigue is often considered a normal response and may be related to specific events such as loss of sleep or lack of exercise. When it becomes unusual, excessive or chronic, it may be related to illness (Chen, 1986).

Components of Fatigue

Factors that affect fatigue

Fatigue is a perception arising from the complex interplay of physical and psychological factors that may increase or relieve fatigue. In fact, some factors such as exercise may both increase or decrease fatigue symptoms, depending upon the situation.

The overall feeling of fatigue is usually affected by more than one factor at a time. Many physical factors such as energy expenditure, rest, nutrition, temperature, and integrity of body systems and psychological factors such as depression, anxiety, boredom and motivation may work together to cause fatigue. In contrast, many of these factors can be minimized by other factors. For example, high motivation may minimize the effects of muscle work in causing fatigue. The overall feeling of fatigue is a composite of factors that exert force to increase feelings of fatigue and those factors that minimize or eliminate fatigue (Brown, 1964, Piper, 1986; Burkhardt, 1956) .

Manifestations of fatigue

The manifestations of fatigue fall into two general categories, objective and subjective. Some objective manifestations are physical measurements that give an indication of work load (i.e. heart rate) or pathological states (i.e. anemia) that may lead to fatigue. Others are observable behavior that may indicated fatigue, such as

yawning, slow speech, or droopy posture (Rhoten, 1982).

Subjective manifestations are those symptoms, physical and psychological (ie, tired legs or inability to concentrate), that make up the overall feeling of fatigue (Yoshitake, 1971). These symptoms may vary from situation to situation and may be thought of as primarily physical or psychological fatigue. Symptoms are a basis for expressing the feeling of fatigue, but they do not describe fatigue totally for a person. Symptoms are specific complaints, while fatigue is an overall feeling of unpleasantness.

The physiological manifestations of fatigue do not always correlate well with the behavioral manifestations or the subjective symptoms of fatigue. This is due to the variability in the types, causes, and manifestations of fatigue.

Fatigue and Perceived Exertion

The perception of fatigue and the perception of exertion are closely related but are not the same thing. Perceived exertion is the subjective rating of the intensity of physical work or the difficulty of the task (Borg, 1973; O'Sullivan, 1984). Perceived fatigue is a subjective symptom of tiredness that may be a result of that exertion but may also be affected by many other physical and psychological factors.

Significance of Fatigue

In normal circumstances, fatigue can signal when the

body or mind needs to allow some recovery from a stressor. It allows for some adjustments before damage is done. It may also be a warning of illness. For example, many patients who experience myocardial infarction have described fatigue as a primary prodromal symptom (Nixon & Bethell, 1974).

Fatigue is thought to be the most common symptom in illness. It is also a common side effect of many types of treatment. As such, fatigue has a major impact on patients' quality of life both in terms of comfort and in terms of ability to carry out daily activities. It is of concern to nurses since they are frequently called on to assess patients' complaints of fatigue. Nursing professionals are often the only care providers to get involved in managing such patient-centered concerns (Potempa, et al. 1986).

Model of Fatigue

The model of fatigue guiding this study (Figure 1) is adapted from Grandjean (1970) and Piper (1986). The overall subjective feeling of fatigue may move along a continuum of fatigue that ranges from extremly fresh (least fatigued) to completely exhausted (extremely fatigued). The level of fatigue perceived along this continuum depends upon a multitude of factors that influence fatigue negatively or positively. These factors may be environmental such as temperature or noise, physical such as exercise or rest, or psychological such as motivation or depression. They may be internal or external. The effect these factors have upon the

degree of fatigue perceived depends upon how these factors are processed by the individual.

MODEL OF SUBJECTIVE FATIGUE

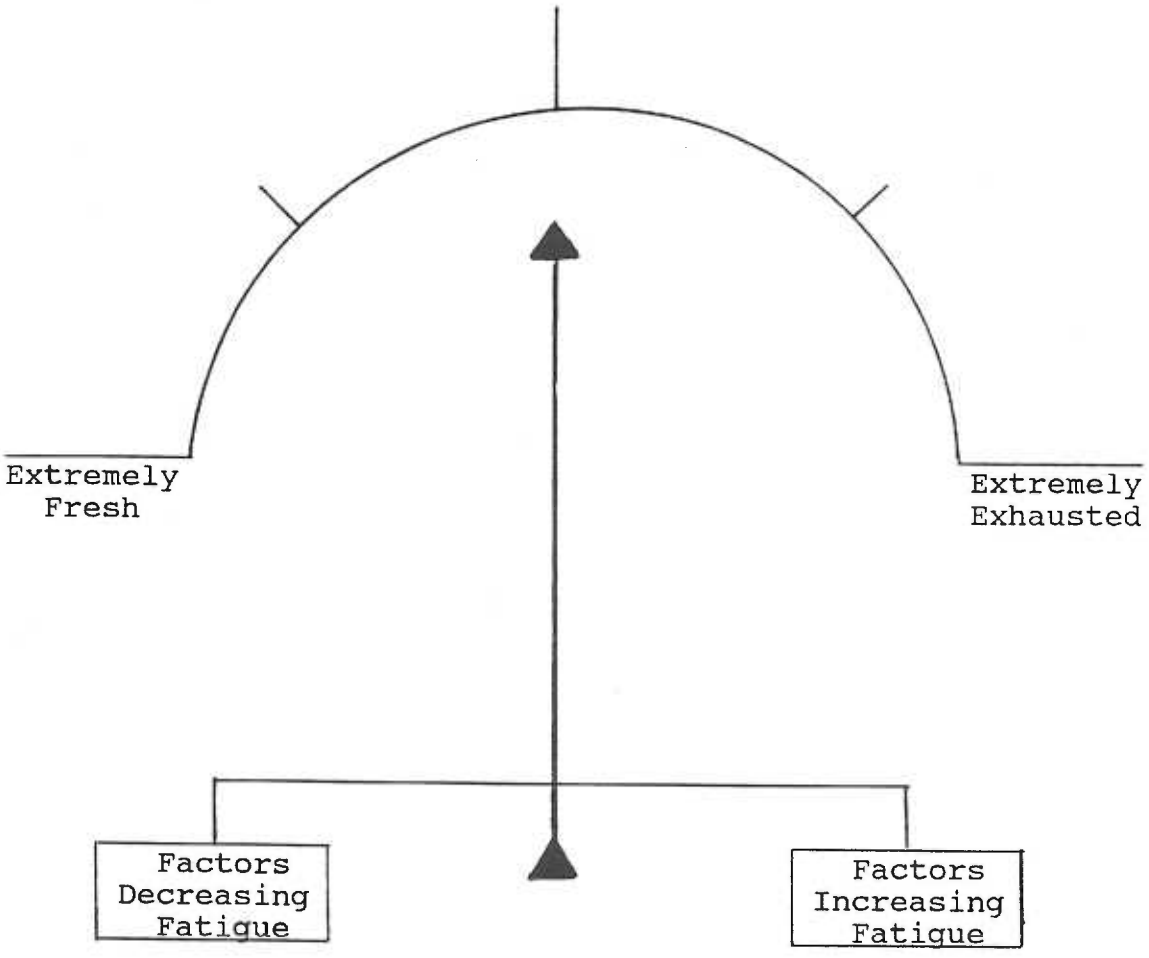


Figure 1: Model of Fatigue
Adapted from Grandjean,1970.

PURPOSE OF THE STUDY

Fatigue is a symptom commonly experienced by patients with coronary artery disease, especially following an acute cardiac event such as myocardial infarction (MI) or coronary artery bypass graft (CABG) surgery. There are no studies reported in the literature that measure the level of fatigue or describe the specific symptoms of fatigue experienced by these patients.

This study was conducted to:

1. Measure the level of fatigue experienced with controlled exercise by patients in a phase II cardiac rehabilitation program.
2. Describe the specific symptoms of fatigue experienced with activity by patients with MI and CABG.

CHAPTER II

METHODS

Design

This study was designed in two parts, the first part descriptive. Subjects enrolled in a cardiac rehabilitation program were asked to report their level of fatigue and the specific symptoms of fatigue experienced with exercise. Characteristics of fatigue that were observable by the investigator were also reported. The second part of the study was correlational. The number of fatigue symptoms was correlated with the level of fatigue experienced.

Sample

A convenience sample of 24 patients with medically diagnosed coronary artery disease was selected from patients enrolled in a cardiac rehabilitation program.

Criteria for inclusion in the study were: 1) Diagnosed coronary artery disease; 2) Enrollment in a phase II cardiac rehabilitation program; 3) Medically stable as agreed upon by their attending physician and/or the cardiac rehabilitation staff; and 4) Signed informed consent.

All had recently experienced an acute cardiac event such as myocardial infarction, coronary artery bypass graft surgery, or recurrent ventricular tachycardia. All subjects were adults who spoke English and were able to understand and complete the questionnaires.

Setting

The setting of the study was an outpatient phase II cardiac rehabilitation program located in an acute care hospital.

Phase II cardiac rehabilitation is that phase of rehabilitation after an acute cardiac event such as myocardial infarction or coronary artery bypass graft surgery that occurs early after hospital discharge. Patients at this early stage of recovery are at greater risk for complications and need close monitoring of their progress. Organized programs offer medically supervised telemetry monitored exercise sessions, educational information, and support. Cardiac rehabilitation improves function, fosters active patient participation during recovery, and may facilitate return to work (Hertanu, Davis, Focseneau & Lahman, 1986). Patients typically enter phase II cardiac rehabilitation programs 1-4 weeks post hospital discharge and continue for 6-12 weeks.

The overall goals of rehabilitation for cardiac patients are to 1) prevent deconditioning, enhance aerobic conditioning, and improve functional capacity, 2) diminish or eliminate established coronary risk factors, 3) educate patients and families regarding causes of coronary heart disease and methods of preventing its progression, and 4) prevent psychological disability (McKool & Nelson, 1985).

The rehabilitation process is divided into stages or

phases. Phase I refers to the in-hospital, acute phase of cardiac rehabilitation. Phase II refers to the very early post hospital recovery period as explained above. Phase III refers to the later outpatient rehabilitation when patients are more stable, usually starting about 12 weeks post discharge and continuing as long as needed.

The participants attended the program three days per week, on Monday, Wednesday, and Thursday for a one-hour exercise session. They wore telemetry heart monitors during the sessions and were closely supervised by two professionals, a cardiac nurse and an exercise physiologist.

The exercise sessions consisted of:

1. Recording base line (at rest) heart rate, heart rhythm, and blood pressure.
2. Warm-up exercises that included arm and leg work. (one to three pound hand-held weights were used when it became appropriate)
3. Thirty minutes of exercise on a stationary bicycle or treadmill. Blood pressure, heart rate, heart rhythm, and perceived exertion were recorded at least one-half way through the exercise.
4. Cool-down arm and leg exercises and stretching out.
5. Recording post exercise heart rate, heart rhythm, and blood pressure.

Participants also attended an education session and a support group, each lasting about one hour per week.

In addition to their regular participation and monitoring in the program, subjects in the study were asked to rate their level of fatigue before and after exercise and to indicate their specific symptoms of fatigue on a checklist. In all other ways, they were treated like any other participants in the rehabilitation program.

Instruments

Selected descriptive and illness related characteristics of the subjects such as age, gender and health history were gathered from information provided in the patients' hospital record and recorded on the biographical data form. (Appendix B).

Cardiac monitoring

A Transkinetics telemetry cardiac monitor, model # TCR-1000 was used to measure the heart rate and rhythm before, during and after exercise. The monitor is calibrated and serviced at least yearly according to the standard hospital policy. Subjects were monitored continuously during exercise.

The blood pressure was measured with the standard mercury sphygmomanometer and a Littman stethoscope used in the cardiac rehabilitation program. Blood pressure measurements were done by the cardiac rehabilitation staff and recorded on the patients' records.

Exertion

Intensity of the exercise performed was measured both objectively (METS) and subjectively using the Borg Perceived Exertion Scale.

METS refers to the metabolic equivalents of the resting metabolic rate. They are used as a simple means for describing the energy requirements of exercise. One MET is the equivalent of energy used (oxygen consumption) while at rest. Any exercise requiring twice the energy of resting would be 2 METS, and so forth. METS levels were obtained by measuring the workloads (in kgm/min if cycling and m/min if walking) and calculating METS by using standard formulas recommended by the American College of Sports Medicine (1986).

The Borg Perceived Exertion Scale (Appendix E) was used to obtain the subjective rating of the intensity of the exercise performed. Subjects were asked to rate their exertion level on the scale during the activity. The scale was originally designed as a 15-point, graded scale with numbers ranging from 6-20 (Borg, 1973). Descriptive words were included with every other number and ranged from "very very light" at "7" to "very very hard" at "19". Healthy subjects' ratings of perceived exertion have shown linear correlations with heart rate (Borg, 1973; O'Sullivan, 1984). The Borg Scale has been proven valid and reliable in repeated tests of increasing work intensity with work loads

progressively or randomly ordered (O'Sullivan, 1984). It has been widely used to evaluate subjective responses of patients during exercise testing (Noble, 1982). It is also frequently used in evaluation of exercise in cardiac rehabilitation programs (Noble, 1982; Gutmann, et al., 1981), including the program used in this study. In order to give the scale ratio properties, Borg adapted it and developed a 10-point scale. However, the original scale was used in this study primarily because it was already being used in the rehabilitation program. It was thought that having subjects change to a new scale might be confusing and lead to inaccurate data.

Fatigue

Subjective fatigue levels perceived by the participants were measured by the Pearson and Byars Fatigue Checklist (Pearson & Byars, 1956). The specific symptoms of fatigue experienced by the subjects were indicated on the Fatigue Symptoms Checklist (Yoshitake, 1971). Objective characteristics of fatigue were recorded on An Observation Checklist (Rhoten, 1982).

Pearson and Byars Fatigue Checklist was used to identify the level of fatigue the subjects experienced before and after activity. This checklist defines the fatigue feeling continuum in ten short easily understood phrases such as "extremely tired", "very lively", and "ready to drop" (Appendix D).

Pearson and Byars (1956) developed this interval scale to measure the subjective quality of fatigue experienced by aircrews. Items were scaled using Thurstone's method of equal appearing intervals (Guilford, 1954). Reliability and validity has been established through extensive testing of the checklist. Pearson and Byars (1954) found their checklist able to measure differences ($p<.001$) in the fatigue feeling-tone between 100 subjects who worked four and one-half hours on a perceptual motor task and 100 control subjects who worked at no tasks. Kinsman and Weiser (1976) consider it unsurpassed as a unidimensional measure of tiredness.

The fatigue checklist was originally used in aeromedical studies. More recently it has been used to assess fatigue in ill individuals. Hart (1978) used it to assess fatigue levels of patients with multiple sclerosis. The checklist has also been used to assess fatigue in patients receiving localized radiation therapy (Haylock & Hart, 1979)

A Fatigue Symptoms Checklist (Yoshitake, 1971) developed by the Industrial Fatigue Research Committee of the Japanese Association of Industrial Health was used to identify the specific symptoms associated with fatigue in these subjects. This is a 30-item fatigue symptoms checklist containing three dimensions or categories: 1)general feelings of incongruity in the body (dull, sleepy factors),

2) decline of motivation or mental symptoms and 3) specific feelings of incongruity in body parts (Appendix F). Yoshitake (1971) found the correlation between the frequency of these symptoms and the degree of concurrent fatigue feelings reached the .01 significance level in the study of bank workers and broadcasting workers. The scale has also been used in collecting information on the symptoms of fatigue in patients with multiple sclerosis (Hart, 1978) and in patients undergoing localized radiation therapy (Haylock & Hart, 1979).

An Observation Checklist (Rhoten, 1982) was used to identify the characteristics of fatigue manifested by the subjects that were observed by the investigator and the rehabilitation staff. The checklist was originally used to identify objective fatigue characteristics of postsurgical patients. Content validity was supported by gathering descriptions of how patients looked and acted when fatigued. Using the checklist, observations of subjects were made by two nurse graduate students to establish inter-rater reliability and to further establish both face and content validity.

Procedure

Permission to conduct the study was obtained from the participating hospital and cardiac rehabilitation director. Clients meeting the criteria for inclusion in the study were given an explanation of the study and their questions were

answered before obtaining their signed consent (Appendix A). Confidentiality was assured by assigning each subject a code number. All information gathered was identified by the code number only.

Selective descriptive and illness related characteristics of the subjects were obtained from information provided in the clients' hospital and rehabilitation records. The information gathered was recorded by the investigator on the biographical data form (Appendix B).

Subjects participated in the cardiac rehabilitation program three times per week for 6-10 wks. Data for the study were gathered on six consecutive occasions (3 sessions each week for 2 weeks) at the beginning of their participation in the program.

Before exercise, with subjects resting in a chair, baseline heart rate, heart rhythm, blood pressure, and fatigue level were measured. Heart rate and rhythm were obtained by continuous cardiac monitoring. A 6-second monitor strip was recorded and placed in the subjects' records. Blood pressure was taken using standard procedure and equipment. Subjects were asked to indicated their fatigue level on the Pearson and Byars Fatigue Checklist.

Subjects did approximately eight minutes of warm-up exercises that included arm and leg work. Then they did 30 minutes of exercise either on a stationary bicycle or a treadmill. Heart rate, heart rhythm, blood pressure, and

exertion level were measured at least half way through the 30 minute exercise period. Exertion levels were obtain by asking subjects to indicate how hard the exercise seemed to them on the Borg Perceived Exertion Scale. Work loads were also recorded.

After 30 minutes of continuous exercise, subjects did 10 minutes of cool-down exercises and some stretching. They continued the cool-down, sitting in a chair. Immediately after the cool-down exercises were completed, subjects were asked to indicate their level of fatigue on Pearson and Byars Fatigue Checklist and to mark any symptoms they experienced on the Fatigue Symptoms Checklist. After 3-5 minutes resting in a chair, heart rate, heart rhythm, and blood pressure were again recorded. During and immediately after exercise subjects were observed for characteristis of fatigue. These observations were recorded on Rhoten's Observation Checklist (Appendix G).

Data Analysis

Data were aggregated and reported in frequencies, range, and central tendencies (mean or median) for the different variables. Data were reported for each day as well as grouped together as overall totals. Each subject's data were graphically plotted and visually inspected for trends. Pearson's r was used to analyse the correlation between the level of fatigue and the number of fatigue symptoms reported.

CHAPTER III

RESULTS

Description of the Sample

Ages of the subjects ranged from 34 years to 72 years with a mean age of 54 years. Eighteen of the subjects (75%) were men while six (25%) were women. The majority of the subjects (19) were married; five were single.

Nineteen of the subjects had experienced recent myocardial infarction (MI); 13 inferior, 4 anterior, 1 lateral and 1 nontransmural. Two of those patients had subsequently been treated with percutaneous transluminal coronary angioplasty (PTCA). One subject had experienced recurrent ventricular tachycardia after his MI and had undergone electrical physiological testing and antiarrhythmic therapy. Four subjects had recently undergone coronary artery bypass grafting (CABG). One subject had ischemic cardiomyopathy and had recently been hospitalized for recurrent ventricular tachycardia. He had also undergone electrical physiological testing and antiarrhythmic therapy.

The time that elapsed between the subjects' acute cardiac event and inclusion in the study varied from 1-6 weeks (8-72 days, average 20 days). Three weeks or less had elapsed for 15 subjects. Three more subjects had 3-4 weeks elapse between their cardiac event and being included in the study.

Seventeen of the subjects had ejection fractions of greater than 50%, which is considered to be normal or only mildly reduced. Seven subjects had ejection fractions of less than 50%. Subjects were equally divided between single and multiple vessel disease as reported by coronary angiogram (12 each).

Six patients had experienced a previous myocardial infarction. Four of these had also previously undergone coronary artery bypass graft surgery. Five subjects had a history of diabetes mellitus; three were insulin dependent and two were on oral medications. A history of hypertension was present in five of the subjects.

Reported activity levels prior to the current cardiac event were about equally divided between sedentary (11) and active (13). Ten were moderately active, three very active.

Only three subjects were current smokers although nine had just quit smoking with the current cardiac event. Nine other subjects had quit smoking two or more years prior to the study and three had never smoked.

All subjects took a variety of medications including beta blockers (4), calcium blockers (12), antiarrhythmics (7), diuretics (5), and aspirin (19). Seven subjects took four or more medications, 16 took two or three medications and only one subject took a single medication (Table 1).

Table 1: SUMMARY - DEMOGRAPHIC DATA AND HEALTH HISTORY

	No. of Subjects	Percent
1. Age		
34-55	13	54%
56-72	11	46%
2. Sex		
Male	18	75%
Female	6	25%
3. Marital Status		
Married	19	79%
Single	5	21%
4. Diagnosis		
Myocardial Infraction	19	79%
Coronary Artery Bypass Graft	4	17%
Recurrent V-Tach (remote MI & CABG)	1	4%
5. Medical History		
Previous MI	6	25%
Diabetes Mellitus	5	21%
Hypertension	5	21%
Previous CABG	4	17%
Chronic Obstructive Pulm. Disease	3	12%
Cerebral Vascular Accident	2	8%
Cancer	1	4%
Liver Disease	1	4%
6. Previous Activity		
Sedentary	11	46%
Moderately active	10	42%
Very Active	3	12%
7. Smoking History		
Never Smoked	3	12%
Quit 2 or more years ago	9	38%
Quit with current event	9	38%
Smoking	3	12%
8. Ejection Fraction		
Greater than 50%	17	71%
Less than 50%	7	29%
9. Extent of Disease		
Single vessel Disease	12	50%
Multiple vessel disease	12	50%

Exercise

Subjects in this study rode stationary bicycles or walked on a treadmill for 30 minutes. The intensity of the exercise (or workload) was measured in METS and ranged from 1.4 to 3.2 METS. The first day, work loads were low, with no tension on the stationary bicycle for 16 subjects and light tension for the remaining eight subjects. Twenty-one (21) subjects worked at MET levels of less than 2.0 (1.4-1.8) METS; three subjects worked at 2.0-2.3 METS.

Workloads were gradually increased over the six days. On the sixth day only seven subjects worked at less than 2.0 METS (1.5-1.9). Seventeen (17) subjects worked at greater than 2.0 METS, seven of these worked greater than 2.5 METS and three worked at greater than 3.0 METS. (Table 2)

Table 2: INTENSITY OF ACTIVITY OVER TIME

MET level	day 1	day 2	day 3	day 4	day 5	day 6
1.4-1.5	7	6	1	2	1	2
1.6-1.9	14	1	14	7	8	5
2.0-2.4	3	7	8	14	12	9
2.5-2.9	0	0	1	1	2	5
3.0-3.2	0	0	0	0	1	3
Mean	1.68	1.78	1.90	2.00	2.05	2.13
Range	1.4 to 2.3	1.4 to 2.4	1.5 to 2.6	1.5 to 2.6	1.6 to 3.0	1.6 to 3.2

Perceived exertion

The rate of perceived exertion on the Borg Scale of Perceived Exertion reported by the subjects ranged from 7--very very light to 14--between somewhat hard and hard. The average exertion level reported was 11--light.

Very very light (7) exertion was reported only twice, both times were on the first day in the study. Very light (9) exertion was reported four times, three times within the first three days in the study. Light exertion (11) was reported 70 times. Between light and somewhat hard (12) was reported 41 times. Somewhat hard (13) was reported 13 times. Between very light and light (10) was reported 12 times. Very light (9) was reported four times. The greatest exertion reported was between somewhat hard and hard (14). It was reported just once.

Table 3: EXERTION LEVELS

Exertion level (Borg scale)	Subjects	No. of times
7 - very very light	2	2
8	0	0
9 - very light	4	4
10	6	12
11 - light	21	70
12	17	41
13 - somewhat hard	7	13
14	1	1
15 - hard	0	0

mean exertion level 11.2

Table 4: EXERTION LEVELS OVER TIME

Exertion Level	day 1	day 2	day 3	day 4	day 5	day 6
7-very, very, light	2	0	0	0	0	0
8	0	0	0	0	0	0
9-very light	1	1	1	0	0	1
10	3	3	1	3	1	1
11-light	11	12	11	12	13	11
12	6	5	8	6	8	8
13-somewhat hard	1	3	3	3	2	2
14	0	0	0	0	0	1
15-hard	0	0	0	0	0	0
Mean	10.8	11.3	11.5	11.4	11.5	11.6
Range	7-13	9-13	9-13	10-13	10-13	10-14

Level of fatigue

The level of fatigue the subjects reported using the Fatigue Checklist (Pearson and Byars, 1956) ranged from 2--very lively to 9--extremely tired (Table no. 5). The level of fatigue reported most frequently was 5--somewhat fresh. Eighty percent (80%) of the responses fell in the range of 4--quite fresh to 6--slightly pooped. Ninety percent (90%) of the responses ranged from 3--very refreshed to 7--fairly well pooped.

Pre-exercise fatigue levels reported most frequently were 4--quite fresh and 5--somewhat fresh. Post-exercise fatigue levels were slightly higher than pre-exercise. The most frequently reported post-exercise levels were 5--somewhat fresh and 6--slightly pooped.

There were five subjects who reported increased levels of fatigue at rest, ranging from 7--fairly well pooped to 9--extremely tired. Two subjects reported 7--fairly well pooped. Of these, one had experienced a large anterior MI with reduced ejection fraction (EF) and one had associated COPD and had undergone surgery for cancer of the throat three months earlier. Three subjects reported 9--extremely tired on one or more occasions. All of the latter were associated with increased weight gain that might signal fluid retention and early CHF.

Table 5: FATIGUE LEVELS

Fatigue level	Subjects		No. of times	
	pre-ex.	post-ex.	pre-ex.	post-ex
1. extremely peppy	0	0	0	0
2. very lively	2	0	3	0
3. very refreshed	8	2	15	2
4. quite fresh	17	13	42	27
5. somewhat fresh	21	17	54	47
6. slightly pooped	10	17	18	45
7. fairly well pooped	3	6	6	15
8. petered out	1	3	1	6
9. extremely tired	3	1	5	2
10. ready to drop	0	0	0	0
mean	4.6	6.3	4.76	5.42
median	4.0	5.0	4.5	5.0
mode	5.0	5.5	5.0	6.0
range	2-9	3-9	2-9	3-9

Items from Pearson and Byers Fatigue Checklist
(Pearson and Byers, 1956)

All subjects (24) reported their fatigue levels on six different days, before and after exercise, for a total of 144 reporting days. Twenty (20) subjects reported that their fatigue levels increased with exercise on one or more occasions for a total of 82 times (57%). Eighteen (18) subjects reported on 48 occasions (33%) that the fatigue level stayed the same with exercise. Decreased level of fatigue with exercise was reported by seven subjects on 14 occasions (<10%) (Table 4). There were four subjects that never increased their fatigue levels with exercise (either stayed the same or decreased). One subject reported no change in fatigue with activity (same) on all six days.

Of those who increased their fatigue level with exercise, most (91%) increased only 1-2 levels to about level 6--slightly pooped. However, four subjects increased their fatigue levels with exercise 3-4 levels to the 7-fairly well pooped and 8-petered out levels. One of these subjects had developed a pulmonary embolus and one subject required reduction in a beta blocker medication.

Five of the subjects who decreased their fatigue with exercise were the same subjects who had high resting fatigue levels (7-9).

Table 6: CHANGE IN FATIGUE WITH EXERCISE

Fatigue Change	Subjects	No. of times
Increased with exercise	20 (83%)	82 (57%)
1-2 levels	20	75
3-4 levels	4 (17%)	7
Stayed the same with exercise	18 (75%)	48 (33%)
Decreased with exercise (All decreased 1-2 levels)	7	14 (10%)
Never increased with exercise (decr. or stayed the same all 6 days)	4 (17%)	
Never changed with exercise (stayed the same all 6 days)	1 (4%)	

The level of fatigue reported both before and after exercise gradually decreased over the six days of reporting.(Table 7). The median pre-exercise fatigue level on day one was 5--somewhat fresh; on day six it was 4--quite fresh. The median post-exercise fatigue level on the first day was 6--slightly pooped. On the sixth day it was 5--somewhat fresh.

Table 7: FATIGUE LEVELS OVER TIME

Level of fatigue	day 1	day 2	day 3	day 4	day 5	day 6
Pre-exercise						
1. extremely peppy	0	0	0	0	0	0
2. very lively	1	0	0	0	2	0
3. very refreshed	0	3	3	3	3	3
4. quite fresh	3	7	6	9	7	10
5. somewhat fresh	13	9	9	9	8	6
6. slightly pooped	4	2	6	2	1	3
7. fairly well pooped	2	1	0	3	3	0
8. petered out	0	0	0	0	0	1
9. ready to drop	1	2	0	1	0	1
10. ready to drop	0	0	0	0	0	0
mean	5.2	5.0	4.8	4.6	4.5	4.7
median	5.0	5.0	5.0	4.5	4.5	4.0
mode	5.0	5.0	5.0	4.5	5.0	4.0
range	2-9	3-9	3-6	3-9	2-7	3-9
standard deviation	1.34	1.57	0.99	1.25	1.38	1.44
Post-exercise						
1. extremely peppy	0	0	0	0	0	0
2. very lively	0	0	0	0	0	0
3. very refreshed	0	0	0	1	0	1
4. quite fresh	1	1	3	4	11	8
5. somewhat fresh	7	10	7	9	6	7
6. slightly pooped	12	8	10	8	4	3
7. fairly well pooped	2	3	3	1	3	4
8. petered out	1	1	1	1	0	1
9. extremely tired	1	1	0	0	0	0
10. ready to drop	0	0	0	0	0	0
mean	6.0	5.8	5.7	5.3	5.0	5.2
median	6.0	6.0	6.0	5.0	5.0	5.0
mode	6.0	5.0	6.0	5.0	4.0	4.0
range	4-9	4-9	4-8	3-8	4-7	3-8
standard deviation	1.08	1.13	1.00	1.01	1.08	1.29

Symptoms of Fatigue

The most frequent symptom of fatigue reported after activity was tired legs with 21 subjects (88%) reporting this symptom a total of 77 times over the six days of data collection. Twelve (12) patients reported being thirsty (37 times). Feeling tired in the whole body was reported by 10 patients (23 times). Other frequently reported symptoms were short of breath, no energy, stiffness in the shoulder, irritable, and low back pain (Table 8).

Symptoms reported less frequently included: feeling unsteady while standing, yawning, and feeling ill. Two subjects reported each of the following symptoms: become drowsy, apt to forget things, dizzy, unable to maintain a straight posture and headache. Only one subject reported each of the following: feeling confused, difficulty thinking, no interest in things, eye strain, weary while talking, or want to lie down.

None of the subjects reported the following: anxious about things, apt to make mistakes, unable to concentrate, limb tremors, husky voice, feeling heavy in the head, becoming rigid or clumsy when moving, apt to forget things, or eyelid spasms.

Table 8: REPORTED FATIGUE SYMPTOMS

Symptoms	Subjects		Times reported
tired legs	21	(88%)	77
thirsty	12	(50%)	37
feel tired in the whole body	10	(41%)	23
no energy	9		28
short of breath/difficulty breathing	6		18
stiffness in the shoulder	4		12
irritable	4		8
low back pain	3		9
feel unsteady while standing	4		6
yawning	4		5
feel ill	3		3
become drowsy	2		3
apt to forget things	2		3
dizzy	2		2
unable to maintain a straight posture	2		2
headache	2		2
Want to lie down	1		2
became weary while talking	1		2
no interest in things	1		2
eye strain	1		1
feel confused	1		1
difficulty thinking	1		1
limb tremors	0		0
husky voice	0		0
unable to concentrate	0		0
apt to make mistakes	0		0
anxious about things	0		0
feel heavy in the head	0		0
become rigid or clumsy when moving	0		0
eyelid spasms	0		0

In order of frequency.
Items from Fatigue Symptoms Checklist
(Yoshitake, 1971)

The number of fatigue symptoms subjects reported using the Fatigue Symptoms Checklist (Yoshitake, 1971) ranged from zero to seven symptoms. More than 50 % (13) subjects never reported more than three symptoms. Seventy-five percent (75%) never reported more than four symptoms. There was only one subject who reported as many as seven symptoms. There were two subjects who never reported any symptoms (Table 9).

The fatigue levels reported by those with no symptoms were correspondingly low with a pre-exercise mean of 3.75 and a post-exercise mean of 4.33. Similarly the subject who reported an increased number of symptoms (7) also reported an increased level of fatigue at 9--extremely tired. Each subject (24) reported symptoms after exercise on six occasions for a total of 144 reponses. Seventy percent (70%) of the respondents (110) reported 2 symptoms or less. Five (5) or more symptoms were reported in less than 7% of the reponses (Table 9).

Table no. 9: NUMBER OF SYMPTOMS REPORTED

No. of SX	Subjects	No. of times
0	13	44
1	12	27
2	17	36
3	7	7
4	8	17
5	3	4
6	4	4
7	1	2

No. of SX	Subjects
Never	> 0 = 2
Always	≤ 1 = 5
	≤ 2 = 11
	≤ 3 = 13
	≤ 4 = 18
	≤ 5 = 19
	≥ 5 = 6
	7 = 1

More symptoms were reported on the first day of exercise than were reported on the sixth day. The number of fatigue symptoms reported on the first day ranged from zero to seven, with a mean of 2.7 symptoms. On sixth day, four symptoms or less were reported by each subject with a mean of 1.1.

Table 10: NO. OF FATIGUE SYMPTOMS OVER TIME

No. of Symptoms	day 1	day 2	day 3	day 4	day 5	day 6
0	4	6	6	9	11	11
1	2	4	7	5	5	4
2	9	7	6	4	4	6
3	1	1	1	2	1	1
4	4	3	2	3	3	2
5	0	2	2	0	0	0
6	3	0	0	1	0	0
7	1	1	0	0	0	0
mean	2.7	2.0	1.7	1.5	1.0	1.1
range	0-7	0-7	0-5	0-6	0-4	0-4

The number of symptoms reported were positively correlated with fatigue levels with a Pearson's r of 0.6733 ($p < 0.002$). In every subject who reported six or seven symptoms, the fatigue level either at rest or after exercise was 7--fairly well pooped to 9--extremely tired, compared to the average of about 5--somewhat fresh.

Observable Signs of Fatigue

Rhoten's Observation Checklist (Appendix G) was used to assess objective, observable manifestations of fatigue. The items marked most frequently were: appearance--alert, awake;

coloring--pink; breathing--normal rate, regular; eyes--wide open, eye contact present; facial expression--smiling, muscles relaxed; speech--complete sentences, clear tone; ambulation--slow pace alone; posture--upright; attitude--interested, cooperative (Table 11).

Quite a few items on this list were never marked such as drowsy, closed eyes, eyes rolling, slurred or mumbled speech, and hard to arouse. These manifestations of fatigue would not be expected in an ambulatory out-patient population. The section on fluid and food intake was likewise never marked as subjects in this study were not eating during the data collection.

A few subjects were observed sighing (4) and breathing more rapidly (6). These subjects also reported higher levels of fatigue. One patient's color was ashen throughout the six days of participation in the study. His reported fatigue levels were 5--somewhat fresh to 6--somewhat pooped. He had multiple vessel disease with an ejection fraction of less than 50%, cardiomyopathy, previous MI, previous CABG, COPD, and was currently smoking. His ashen color seems related to the severity of his disease and his inability to oxygenate his blood. These factors may also contribute to fatigue.

Table 11: SUMMARY - OBSERVATION OF FATIGUE

Observation	No. of Subjects	Times reported
Physical Appearance		
1. Alert	23	111
2. Awake	24	144
3. Drowsy	0	0
4. Disheveled	0	0
5. Quiet	13	21
Coloring		
1. Flushed	0	0
2. Pink	22	116
3. Pale	9	25
4. Ashen	1	6
Breathing		
1. Normal rate	24	125
2. Rapid	6	19
3. Slow	0	0
4. Regular	24	144
5. Irregular	0	0
6. Shallow	0	0
7. Deep	0	0
8. Sighs	4	5
Eyes		
1. Wide open	19	92
2. Closed	0	0
3. Eye contact present	24	144
4. Eyelids droopy	0	0
5. Fixed Staring	0	0
6. Look vacant	0	0
Facial expression		
1. Grimacing	0	0
2. Eyes rolling	0	0
3. Brow wrinkling	2	3
4. Mouth open	0	0
5. Jaw tight	3	4
6. Smiling	24	118
7. Muscles relaxed	24	130
8. Yawning frequent	0	0
Speech		
1. Complete sentences	24	144
2. Incomplete sentences	0	0
3. Short, abbreviated answers	11	22

(Continued on next page)

Table 11: SUMMARY - OBSERVATION OF FATIGUE (continued)

Observation	No. of Subjects	Times reported
Speech (con't)		
4. Frequent pauses	1	1
5. Slow responses	2	3
6. Rapid responses	0	0
7. Clear tone	24	114
8. Soft tone	0	0
9. Loud tone	0	0
10. Slurred, mumbled	0	0
11. Specific statements of feeling tired	10	26
Ambulation		
1. Slow pace with assistance	0	0
2. Slow pace alone	11	36
3. Fast pace	7	27
4. Shuffles feet	0	0
Posture		
1. Upright posture	24	132
2. Lying on back	0	0
3. Lying on right side	0	0
4. Lying on left side	0	0
5. Shoulder slumped forward	2	12
6. Head Hanging	0	0
7. Body not arranged in comfortable position	0	0
Food and Fluid Intake		
1. NPO	0	0
2. Refuses meal	0	0
3. Eats at a fast pace	0	0
4. Eats at slow pace	0	0
5. Verbalizes about hunger	0	0
6. Verbalizes about lack of hunger	0	0
Attitude		
1. Interested	24	112
2. Easily aroused	24	144
3. Cooperative	24	144
4. Apathetic	2	4
5. Hard to arouse	0	0
6. Irritable	3	8
7. Sleep seeking	0	0
8. Emotional outbursts	0	0
9. Somatic complaints	4	9
10. Flat affect	3	5
11. Indecisive	0	0

CHAPTER IV

DISCUSSION

The results of this study are discussed as they relate to the two primary variables: 1) fatigue levels and 2) symptoms of fatigue.

Fatigue levels

Fatigue is a common symptom in illness. It is also common after a period of inactivity. It would be expected that patients experiencing an acute cardiac event and a period of hospitalization with reduced activity would experience some fatigue even at rest The subjects in this study reported fatigue levels both before (at rest) and after exercise. The expression of fatigue was generally in the middle range of the Pearson and Byers Fatigue Checklist. However, a few subjects reported higher levels of fatigue at rest. It is of interest to note that all three subjects who reported the highest levels of fatigue (9--extremely tired) also had a weight gain that might signal fluid retention and early CHF. Of the two subjects who reported fatigue levels of 7--fairly well pooped, one had experienced a large anterior MI and had a reduced ejection fraction (EF) of <50% and the other one had associated illnesses that might have increased his fatigue (COPD, recent surgery for CA).

Exercise uses energy and one would expect it to increase the level of fatigue experienced. At this early stage of recovery the workloads were appropriately low at 1.4-3.2

METS. Subjects also generally perceived the workloads as light (11) on the Borg Perceived exertion scale. One would expect only a moderate increase in fatigue levels at these workloads. Most of the subjects (20) did experience some increase in fatigue with exercise on one or more of the reporting days. Of these, the majority (91%) experienced only a 1-2 level increase in fatigue with exercise. However, four subjects reported an increase in fatigue of 3-4 levels one or more times. One subject was subsequently diagnosed with a pulmonary embolus. One other subject required reduction in dosage of a beta blocker. Both of these situations are known to be associated with increased fatigue and might explain the greater increase in fatigue experienced by these subjects when they exercised. It seems apparent that when more than moderate increases in fatigue are experienced with exercise, further investigation into the possible causes is in the best interest of patients.

Fatigue decreased with exercise on at least one occasion for seven subjects. Of the total number of times reported, nearly 10% showed a decrease in the level of fatigue with exercise. Interestingly over one-half of the subjects (4) reporting a decrease in fatigue with exercise were the same subjects who reported high levels of fatigue at rest. Fatigue is multifaceted and many things can increase or decrease fatigue. For example, depression is known to be associated with increased fatigue. Exercise is thought to

decrease depression and may therefore decrease fatigue. (Depression was not measured in this study.) Exercise is also associated with an increased sense of well being which might be perceived as decreased fatigue.

In 33% of the times reported (18 subjects), fatigue remained the same with exercise. Perhaps this is due to the low level of exercise performed at this early stage of recovery. It may also be due to a combination of factors that compete to increase and decrease fatigue with exercise and in effect cancel each other's effect.

In this study, the level of fatigue reported both at rest and with exercise gradually decreased over the six days. As patients recover from an acute event of their illness one would expect their fatigue to decrease at rest. However, with the gradually increased level of exercise over the six days, it was less predictable that the post-exercise fatigue levels would also gradually decrease. The fact that the perceived exertion increased over the six days along with the increased workloads but the fatigue levels decreased points out that the concept of perceived exertion and fatigue are not the same thing. Perhaps subjects perceived the workloads in the beginning as being lighter than they normally would be able to do and reported light exertion levels, even though their fatigue levels were increased. Over the time they may have reported increased perceived exertion levels because they recognized the

increased workloads, even though the workloads were not more difficult for them to perform as they recovered and did not produce increased fatigue.

No other studies have measured fatigue in patients with coronary artery disease so it is unkown how this population would compare with other similar subjects. Patients receiving localized radiation (Haylock & Hart, 1979) reported mean fatigue levels on the Pearson and Byars Fatigue Checklist with a range of 3.5 to 7 over the 35 treatment days with most in the 4 to 6 range. This is the same as the mean fatigue levels of 4 to 6 reported in this study over the six days of data collection. The level of fatigue in the patients receiving radiation was higher during the week days when they received treatments and lowest on Sundays when they were not receiving treatment. The subjects in this study were not receiving any similar cyclic treatment and their fatigue levels showed no similar pattern. Hart (1978) measured fatigue levels in patients with multiple sclerosis (MS) at different intervals during the day. Their mean levels varied from 4 to 7 during the day and got as high as 8 by bedtime.

Exercise usually moderately increased fatigue levels in this study. However, on some occasions it decreased fatigue. These results are similar to those found in a study of patients with MS (Freal, Kraft, & Coryell, 1984). Most had an increase in fatigue with vigorous (71%) and moderate

(57%) exercise. However, 27% of the patients used exercise to relieve fatigue and over one-half (57%) found it successful. Hart (1978) also reported that some patients with MS used exercise to relieve fatigue.

Symptoms of Fatigue

The most frequently reported symptom of fatigue after exercise, using the Fatigue Symptoms Checklist (Yoshitake, 1971) was tired legs. This is not a surprising response since the exercise, walking on a treadmill or riding a staionary bicycle required the use of the leg muscles. The other frequently reported symptoms were primarily physical rather than mental in nature, such as being thirsty, tired in the whole body, no energy, and short of breath/ difficulty breathing.

Psychological symptoms were reported much less than physical symptoms. The most frequently reported mental symptom was irritability but even it was only reported by four subjects a total of eight times. Several other mental symptoms were not reported at all. These included inability to concentrate, feeling apt to make mistakes, and anxiety about things. The emphasis on reporting physical symptoms by the subjects in this study may suggest that the fatigue they were describing was mostly related to the physical exercise performed and perhaps to the pathology of their disease rather than to mental or emotional factors such as depression, motivation, and boredom. The symptoms may also

be specific to the context in which they were reported. Subjects were asked to mark their symptoms after the exercise. While some of the mental symptoms such as being anxious about things may have been experienced by the subjects during the course of their recovery, they may not have seemed important just after exercising. Perhaps if data had been collected at another time, more mental symptoms would have been included.

Patients with MS also described their symptoms of fatigue as mostly physical rather than mental (Hart 1978; Freal, Kraft, & Coryell, 1984). Some of the physical symptoms reported were similar to those reported by patients with CAD such as general fatigue and tired legs. Some symptoms were different. The patients with MS frequently reported balance problems and rigid, clumsy movements which were not reported by those with CAD. Patients with CAD reported difficulty breathing/shortness of breath more frequently than those with MS. This is likely due to the differences in disease pathology. While the patients with MS reported more physical than mental symptoms, they did report more mental symptoms than those with CAD. The most commonly reported mental symptoms were lack of patience, forget things, nervous, difficulty thinking, and unable to concentrate. Few if any subjects in this study reported these symptoms although several reported irritability which is similar to lack of patience. Perhaps subjects experience

more psychological symptoms in the context of a chronic, progressively deteriorating illness like MS than they do while recovering from an acute episode such as MI.

Haylock and Hart (1979) studied patients receiving localized radiation for cancer. These patients also reported more physical than mental symptoms. Some of the most frequently reported symptoms were similar to those reported in this study such as tired in the whole body, tired legs, and feel thirsty. Of the mental symptoms reported the most common were lack of patience which is similar to the irritable symptom reported in this study, and anxious about things which was not reported in this study.

The number of fatigue symptoms reported on any one day varied from zero to seven symptoms. However, most subjects (75%) reported four or less symptoms each day. This correlates well with the moderate levels of fatigue reported. Two subjects never reported any symptoms. Their fatigue levels were correspondingly low at 3--very refreshed to 4--quite fresh. Only one subject reported as many as seven symptoms. This subject also reported high fatigue levels both before and after exercise at 9--extremely tired. The positive correlation between the number of symptoms reported and the level of fatigue found in this study ($p < 0.002$) is similar to other studies. Yositake (1971) found the correlation between the frequency of the symptoms and the levels of concurrent fatigue feeling reached the 0.01

level of significance in industrial workers. Patients receiving radiation therapy (Haylock and Hart, 1979; Kobashi-Schoot, Hanewald, VanDam, & Bruning, 1985) and patients with MS (Hart 1978) also had a high correlation between the number of symptoms and the levels of fatigue reported.

Observation of Fatigue

Health professionals that base decisions upon the evaluation of fatigue must have adequate tools to assess fatigue. Identifying manifestations of fatigue that can be observed and objectively assessed is an important piece of that assessment. Rhoten developed an Observation Checklist to assist nurses in assessing fatigue in the post-surgical patient. The items on the list were chosen by the investigator based upon her experience and the experience of other nurses caring for surgical patients. Items on the checklist that showed major differences between most fatigued and least fatigued patients were general appearance, eyes, facial expression, speech, movements and attitude. Food and fluid intake and ambulation were the least helpful in identifying fatigue.

Food and fluid intake were not helpful in identifying fatigue in this study either. Subjects participating in this study were not eating during data collection so there was no way to assess this component. These items may be context specific but generalization across groups may not be

possible. Posture, breathing and coloring showed moderate differences in fatigue in post-surgical patients. In this study rapid breathing and sighs were also associated with increased levels of fatigue. These subjects also reported symptoms of difficulty breathing/short of breath on the Fatigue Symptoms Checklist. Posture and coloring were not as helpful in identifying fatigue in this study. Color may relate to many other factors such as cardiac output and ability to oxygenate blood. While these factors may be associated with fatigue, they may not always correlate well with the subjective feeling. The only Caucasian subject in this study that deviated from the normal pink color did not report particularly high levels of fatigue (5-6) range). He did have severe disease and that may have been the reason for his ashen color. Color of itself may not be a good indication of the level of fatigue experienced. It may also be racially biased and not very helpful in non-white populations.

Several subjects were observed as being quiet on the first day of participation in the study. This did not correlate well with the levels of fatigue reported. Perhaps this was more related to their adjusting to the new situation of cardiac rehabilitation than to fatigue.

In summary, some measure of fatigue using objective observable manifestations would help the health professional make an accurate assessment. The Rhoten Observation

Checklist needs to be modified for use in the ambulatory patient.

Limitations of the study

The small number of subjects in this study and the convenience sample limit the generalizability of this study. This study was based upon the assumption that individuals could recognize and report their symptoms and levels of fatigue accurately using the tools provided. It assumed that the symptoms listed on the checklist were representative of symptoms experienced by these patients. It is possible that the subjects experienced other symptoms of fatigue but did not report them because they were not on the list of symptoms provided.

All of the subjects in this study were enrolled in an outpatient phase II cardiac rehabilitation program. They may not be representative of other patients with coronary artery disease. Fatigue was measured at only two specific times, before and after exercise on six occasions during early recovery from an acute event. The fatigue described may not be characteristic of the fatigue experienced by patients with coronary artery disease at other times during the day or at other periods of time during their recovery. While this study did not measure fatigue at other times, it did study fatigue at an important period in these patients' recovery. Assessing fatigue is an important factor in the overall assessment of rehabilitation and increasing activity.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This descriptive study was undertaken to measure the levels and the specific symptoms of fatigue experienced by patients with coronary artery disease. Twenty-four (24) subjects who had recently experienced an acute cardiac event and were enrolled in a phase II cardiac rehabilitation program were asked to measure their levels of fatigue before and after exercise. They were also asked to describe the specific symptoms of fatigue they were experiencing.

Most subjects reported mild to moderate fatigue. A few patients reported high levels of fatigue before and after exercise. Most of these were associated with lower ejection fractions, other illnesses, or complications of CAD. Most patients reported a small increase in fatigue with exercise. A few reported larger increases with exercise, usually associated with possible complications. A significant number of subjects had no change in fatigue levels with exercise and a few even decreased their fatigue with exercise.

Patients reported mostly physical symptoms rather than mental symptoms. Those who reported increased numbers of symptoms also reported increased fatigue levels.

Fatigue levels generally decreased over the six days of reporting, while perceived exertion levels and workloads (METS) increased.

Implications for Nursing

Caution should be used in making generalizations from the convenience sample and small sample size used in this study. However, the findings do have some implications for nursing practice, research and theory. Even though fatigue is not well defined, patients are able to recognize it and to describe it in terms of symptoms and intensity. Patients with coronary artery disease may be expected to experience some fatigue after an acute event such as MI or CABG. As patients recover, their levels of fatigue and the number of fatigue symptoms they experience should gradually diminish. Excessive fatigue may signal potential complications and may need to be further assessed.

While fatigue is a common symptom in illness, it may not present with the same symptoms in various patient groups. For example, problems with balance may be more prevalent in patients with MS, and other symptoms such as shortness of breath may be common in patients with CAD. Patients with chronic, progressively debilitating illnesses may experience different symptoms, particularly psychological symptoms, than those that are recovering from an acute illness episode. These differences must be taken into account when assessing fatigue in varying patient populations.

Fatigue should not be confused with exertion. Both may provide important information in the assessment of patients but they need to be differentiated.

Recommendations for further study

There is much about fatigue that needs further study. Better tools to measure and describe fatigue need to be made available. Patients' own descriptions need to be incorporated into these tools. Most current tools use descriptions made up by the investigators and draw mostly from the investigators' experience, rather than patients' descriptions of their own fatigue experiences. Individuals who are ill and fatigued need to have tools available that are not too difficult and time consuming to use. Care should be taken to design tools without cultural bias and without colloquial or outdated terms.

Some of the tools currently available may need to be updated. The Pearson and Byars Fatigue Checklist was designed in 1956, 22 years ago. While most subjects seemed able to differentiate their level of fatigue on this scale, some made comments about the unusual language used. Some of the descriptive words are colloquial and are not in common usage today such as "fairly well pooped", and "petered out". Subjects liked having the descriptive words rather than just numbers on the scale but these terms need to be updated.

Fatigue needs to be studied over a longer period of time. In this study, fatigue levels were measured only before and after exercise at the same time on six days over a two-week period. Learning how fatigue affects patients at different times during the day such as upon rising, after

meals, or at the end of day might provide a better description of fatigue in these patients. Studying fatigue over several weeks would provide information regarding how fatigue changes as healing takes place and as patients become better conditioned. Is fatigue still a factor affecting their quality of life? In what patients? And what is the significance? Future studies of fatigue may be enhanced by including some measurement of depression and/or quality of life.

There are many questions regarding fatigue that need further study. What is the etiology, incidence, significance and best treatment for fatigue in this population? In which patients does fatigue assessment become more important? In patients with coronary artery disease, what is normal fatigue and what is excessive fatigue that might signal the need for further assessment? How do the charateristics of fatigue differ in various patient populations?

Although much work remains, fatigue is a clinically significant phenomenon.

REFERENCE LIST

American College of Sports Medicine (1986). Guidelines for exercise testing and prescription (3rd ed.). Philadelphia: Lea & Febiger.

American Heart Association, (1987). Heart facts. Pamphlet printed by AHA's office of communications, AHA National Center, Dallas Texas.

Bartley, S.H. (1981). IV. Fatigue, V. Perception. Perceptual and Motor Skills, 53,958,966.

Bartley, S.H. & Chute, E. (1947). Fatigue and impairment in man. New York: McGraw-Hill.

Borg, G.A. (1973). Perceived exertion: a note on "history" and methods. Medicine and Science in Sports Exercise, 5(2),90-93.

Brown, J.R. (1964). Environmental aspects of fatigue. Applied Therapeutics, 6,905-910.

Burkhardt, E.A. (1956). Fatigue-diagnosis and treatment. New York Journal of Medicine, 56,62-67.

Cameron, C. (1973). A theory of fatigue. Ergonomics, 16,633-648.

Chen, M.K. (1986). The epidemiology of self-perceived fatigue among adults. Preventive Medicine, 15, 74-81.

Coates, D.B. (1964). The management of tiredness. Applied Therapeutics, 6,916-919.

Daley, B.J. & Wilson, C.A. (1983). The effect of fatigue on the vigilance of nurses monitoring electrocardiograms. Heart and Lung, 12,384-388.

Donaldson, S.K. (1975). Critigue: "Effects of noise on fatigue in healthy middle-aged adults". Communicating Nursing Research, 8,35-40.

Dorland's Illustrated Medical Dictionary (26th ed.), 1981. Philadelphia: W.B. Saunders.

Eidelman, D. (1980). Fatigue: Towards an analysis and a unified definition. Medical Hypotheses, 6,517-526.

Freal, J.E., Kraft, G.H. & Coryell, J.K. (1984). Symptomatic fatigue in multiple sclerosis. Archives of Physical Medicine Rehabilitation, 65,135-137.

Gilbert, J.R. (1971). Highlights from a recent seminar on fatigue. Canada Medical Association Journal, 105, 309-310.

Grandjean, E. (1968). Fatigue: Its physiological and psychological significance. Ergonomics, 11,427-436.

Grandjean, E.P. (1970). Fatigue. American Industrial Hygiene Association Journal, 31,401-411.

Guilford, J.P. (1954). Psychometric methods(2nd ed.). New York: McGraw-Hill.

Hart, L. (1978). Fatigue in the patient with multiple sclerosis. Research in Nursing and Health, 1(4),147-157.

Hart, L.K. & Freel, M.I. (1981). Fatigue. In C.M. Norris (Ed.), Concept clarification in nursing (pp. 251-261). Rockville, Maryland: Aspen Systems Corporation

Haylock, P.J. & Hart, L.K. (1979). Fatigue in patients receiving localized radiation. Cancer Nursing, 2,461-467.

Hertanu, J.S., Davis, L. & Focseneanu, M. (1986). Cardiac Rehabilitation exercise program: outcome assessment. Archives of Physical Medicine Rehabilitation, 67, 431-435.

Hueting, J.E., & Sarphati, H.R. (1966). Measuring Fatigue. Journal of Applied Psychology, 50(6), 535-538.

Kashiwagi, S. (1971). Psychological rating of human fatigue. Ergonomics, 14,17-21.

Kennedy, H.G. (1987). Fatigue and fatigability. The Lancet, 8542(1), 1145.

Kinsman, R.A. & Weiser, P.C. (1976). Subjective symptomatology during work and fatigue. In E. Simpson & P.C. Weiser (Eds.), Psychological aspects and physiological correlates of work and fatigue (pp. 336-405). Springfield, Illinois: Charles C. Thomas.

Kobashi-schoot, J., Hanewald, G., Van Dam, F. & Bruning, P. (1985). Assessment of malaise in cancer patients treated with radiotherapy. Cancer Nursing, 8(6)306-313.

McCorkle, R. & Young, K. (1978). Development of a symptom distress scale. Cancer Nursing, 5:373-378.

McFarland, R.A. (1971). Section I: Fatigue in industry, understanding fatigue in modern life. Ergonomics, 14, 1-10.

McKool, K. & Nelson, K.M. (1985). A practice of cardiac rehabilitation. Cardiology Clinics, 3(2), 269-280.

Meyerowitz, B.E., Watkins, I.K. & Sparks, F.C. (1983). Quality of life for brest cancer patients receiving adjuvant chemotherapy. American Journal of Nursing, 83: 232-235.

Morris, M.L. (1982). Tiredness and fatigue. In C.M. Norris (Ed.), Concept clarification in nursing (pp. 263-275). Rockville, Maryland: Aspen Systems Corporation.

Nixon, P.G.F. (1986). Exhaustion: cardiac rehabilitation's starting point. Physiotherapy, 72(5), 224-228.

Noble, B.J. (1982). Clinical applications of perceived exertion. Medicine and Science in Sports and Exercise, 14, 406-411.

O'Sullivan S.B. (1984). Perceived exertion-a review. Physical Therapy, 64, 343-346.

Pearson, R.G. & Byars, G.E. (1956). The development and validation of a check list measuring subjective fatigue. (Report no. 56-115). School of Aviation Medicine, USAF, Randolph AFB, Texas.

Pearson, R.G. (1957). Scale analysis of a fatigue checklist. Journal of Applied Psychology, 41(3), 186-191.

Piper, B.F (1986) Fatigue. In Carrieri, V.K., Lindsey, A.M. & West, C.M. (eds.) Pathophysiological phenomena in nursing, Human responses to illness. Philadelphia: W.B. Saunders Co.

Piper, B.F., Lindsey, A.M. & Dodd, M.J. (1987). Fatigue mechanisms in cancer patients: developing nursing theory. Oncology Nurse Forum, 14(6), 17-23.

Poteliakhoff, A. (1981). Adrenocortical activity and some clinical findings in acute and chronic fatigue. Journal of Psychosomatic Research, 25(2),91-95.

Potempa, K., Lopez, M., Reid, C., & Lawson, L. (1986). Chronic Fatigue. Image, 18(4), 165-169.

Putt, A.M. (1975). Effects of noise on fatigue in healthy middle-aged adults. Communicating Nursing Research, 8,24-34.

Rhoten, D. (1982). Fatigue andd the postsurgical patient. In C.M. Norris (Ed.), Concept clarification in nursing (pp. 277-300). Rockville, Maryland: Aspen Systems Corporation.

Simonson, E. & Weiser, P.C. (1976). Psychological aspects and physiological correlates of work and fatigue. Springfield, Illinois: Charles C. Thomas.

Spaulding, W.B. (1964). The clinical analysis of fatigue. Applied Therapeutics, 6,911-915.

Takatuma, E. (1982). Evaluation of fatigue and the function of maintaining concentration (TAF). Sapporo, Japan: Kokoku Printing Co.

Tsaneva, M. & Markov, S. (1971). A model of fatigue. Ergonomics, 14,11-16.

Varricchio, C.G. (1985). Selecting a tool for measuring fatigue. Oncology Nursing Forum, 12(4), 122-127.

Wenger, N.K., Hurst, J.W. & McIntyer, M.D. (1984). Cardiology for nurses. New York: McGraw-Hill.

Yoshitake, H. (1971). Relations between the symptoms and the feelings of fatigue. Ergonomics, 14,175-186.

APPENDIX A

CONSENT FORM

THE OREGON HEALTH SCIENCES UNIVERSITY

School of Nursing
Department of Adult
Health and Illness

3181 S W Sam Jackson Park Road Portland, Oregon 97201 (503) 225-7839/225-7846

INFORMED CONSENT

I _____ agree to participate in a study entitled "Fatigue in Early Post-Myocardial Infarction Patients." The study is being conducted by Eloise Gatchet R.N., B.S.N. under the supervision of Carol Burckhardt R.N., Ph.D. The purpose of the study is to learn more about the symptoms people experience with activity after a heart attack.

I understand that my blood pressure, heart rate and respiratory rate will be measured before and after an activity that has been prescribed, such as walking on a treadmill or riding a stationary bicycle. In addition, I will be asked to spend about five minutes answering some questions about my feelings of fatigue. This information will be requested on six occasions over a two week period of time. I understand that I may refuse to answer any questions that I do not wish to answer.

My participation in the study may not benefit me directly but it may contribute to the knowledge about feelings experienced with activity after a heart attack.

I understand that all information about myself or my participation in this study will remain confidential. Code numbers will be assigned to me to protect my privacy and any identifying information will be destroyed when the project is completed. The information will be reported in ways that do not associate me with my answers.

My questions about the investigation have been answered. If I have any further questions I may contact Eloise Gatchet R.N. at 833-7711 ext 259 or Carol Burckhardt R.N., Ph.D. at (503) 225-7840.

The Oregon Health Sciences University, as an agency of the State, is covered by the State Liability Fund. If you suffer any injury from the research project, compensation would be available to you only if you establish that the injury occurred through the fault of the University, its officers or employees. If you have further questions please call Dr. Michael Baird, M.D. at (503) 225-8014.

I understand that I may refuse to participate or withdraw from the study at any time without in any way affecting my care at Auburn General Hospital or my relationship with Oregon Health Sciences University.

I have read the foregoing and agree to participate in this study.

Date: _____ Signature: _____

Witness: _____

APPENDIX B

BIOGRAPHICAL DATA AND HEALTH HISTORY

Case No: ___

Date of Birth: _____

Age: ___

Sex: 1 (male), 2 (female)

Marital status: 1(married), 2(single), 3(divorced), 4(widowed).

Diagnosis: 1(MI), 2(CABG), 3(PTCA), 4(cardiomyopathy), 5(MI & PTCA).

Date of MI or CABG: _____

MI type: 1(inferior), 2(anterior), 3(lateral), 4(nontransmural), 5(none).

Peak Enzyme level: _____

Complications: 1(CHF), 2(bradycardia), 3(heart block), 4(atrial dysrhythmias), 5(ventricular dysrhythmias), 6(other).

Special procedures: 1(thrombolytic Rx), 2(PTCA, emergent), 3(pacemaker), 4(cardiac cath), 5(other).

Current medications: 1(beta blocker), 2(calcium blocker), 3(diuretic), 4(antiarrhythmic), 5(captopril/enalapril), 6(persantin), 7(digoxin), 9(aspirin), 10(long acting nitroglycerin), 11(other).

Health History: 1(HTN), 2(prior MI), 3(prior CABG), 4(DM, non-insulin), 5(DM, insulin), 6(COPD), 7(arthritis), 8(neurological disorders), 9(other)

Smoking History: 1(never smoked), 2(quit smoking 2 or more yrs. ago), 3(quit smoking with current cardiac episode), 4(currently smoking).

Previous activity status: 1(very active), 2(moderately active), 3(sedentary).

Cardiac Cath report: 1(single vessel disease), 2(multiple vessel disease)

Ejection Fraction: 1(>50%), 2(<50%), 3(unkown).

APPENDIX C

DATA COLLECTION FORM

Date:_____ Subject No:_____ Recorder's Initials: _____

Date of MI: _____

	Before Activity	During Activity	After Activity
Heart Rate	_____	_____	_____
Heart Rhythm	_____	_____	_____
Blood Pressure	_____	_____	_____
Respirations	_____	_____	_____
Fatigue level	_____	_____	_____
Symptoms or patient complaints	_____	_____	_____
Observations	_____	_____	_____
Activity type	_____	_____	_____
Activity duration	_____	_____	_____
Perceived exertion		_____	

Comments:_____

_____

_____

APPENDIX D

FATIGUE CHECKLIST

ON THIS SCALE OF 1 TO 10
PLEASE INDICATE HOW YOU ARE FEELING RIGHT NOW.

1. EXTREMELY PEPPY
2. VERY LIVELY
3. VERY REFRESHED
4. QUITE FRESH
5. SOMEWHAT FRESH
6. SLIGHTLY POOPED
7. FAIRLY WELL POOPED
8. PETERED OUT
9. EXTREMELY TIRED
10. READY TO DROP

Pearson and Byars, 1956

APPENDIX E

BORG'S PERCEIVED EXERTION SCALE

7	VERY, VERY LIGHT
8	
9	VERY LIGHT
10	
11	LIGHT
12	
13	SOMEWHAT HARD
14	
15	HARD
16	
17	VERY HARD
18	
19	VERY, VERY HARD
20	

APPENDIX F

FATIGUE SYMPTOMS CHECKLIST

Drowsiness	Difficulty in Concentrating	Bodily Complaints
Feel heavy in the head	Difficulty thinking	Headache
Feel tired in the whole body	Became weary while talking	Stiffness in the shoulder
Tired legs	Irritable	Low back pain
Yawning	Unable to concentrate	Thirsty
Feel confused	No interest in things	Difficulty breathing
Become drowsy	Apt to forget things	Husky voice
Eye strain	Apt to make mistakes	Dizzy
Become rigid or clumsy when moving	Anxious about things	Eyelid spasms
Feel unsteady while standing	Unable to maintain a straight posture	Limb tremors
Want to lie down	No energy	Feel ill

Industrial Fatigue Research Committee of Japan 1967
(Yoshitake, 1971)

Date: _____ Subject no: _____

APPENDIX G
RHOTEN'S OBSERVATION CHECKLIST

GENERAL APPEARANCE

Physical Appearance
1. Alert
2. Awake
3. Drowsy
4. Disheveled
5. Quiet

Coloring
1. Flushed
2. Pink
3. Pale
4. Ashen

Breathing
1. Normal rate
2. Rapid
3. Slow
4. Regular
5. Irregular
6. Shallow
7. Deep
8. Sighs

COMMUNICATION

Eyes
1. Opened wide
2. Closed
3. Eye contact present
4. Eyelids droppy
5. Fixed, staring
6. Look vacant

Facial Expression
1. Grimacing
2. Eyes rolling
3. Brow wrinkling
4. Mouth open
5. Jaw tight
6. Smiling
7. Musculature relaxed
8. Yawning frequent

Speech
1. Complete sentences
2. Incomplete sentences
3. Short, abbreviated answers
4. Frequent pauses
5. Slow responses
6. Rapid responses
7. Clear tone
8. Soft tone
9. Loud tone
10. Slurred or mumbled speech
11. Statements of feeling tired

ACTIVITY

Movements
1. Spontaneous changes in position
2. Minimal movements initiated
3. Sluggish movements
4. Restless movements

Ambulation
1. Slow pace with assistance
2. Slow pace alone
3. Fast pace
4. Shuffles feet

Posture
1. Upright posture
2. Lying on back
3. Lying on right side
4. Lying on left side
5. Shoulders slumped forward
6. Head hanging
7. Body not arranged in comfortable position

Food and Fluid intake
1. NPO
2. Refuses meal
3. Eats at a fast pace
4. Eats at slow pace
5. Verbalizes about hunger
6. Verbalizes about lack of hunger

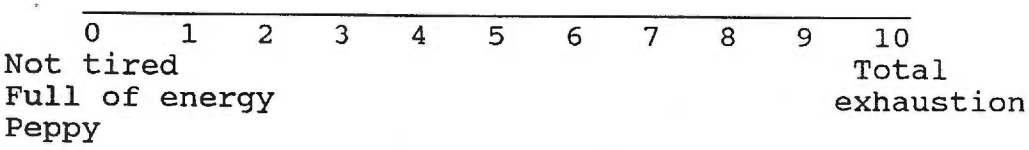
ATTITUDE

1. Interested
2. Easily aroused
3. Cooperative
4. Apathetic
5. Hard to arouse
6. Irritable
7. Sleep-seeking
8. Emotional outbursts
9. Somatic complaints
10. Flat affect
11. Indecisive

(Rhoten, 1982) Circle items that apply.

APPENDIX H

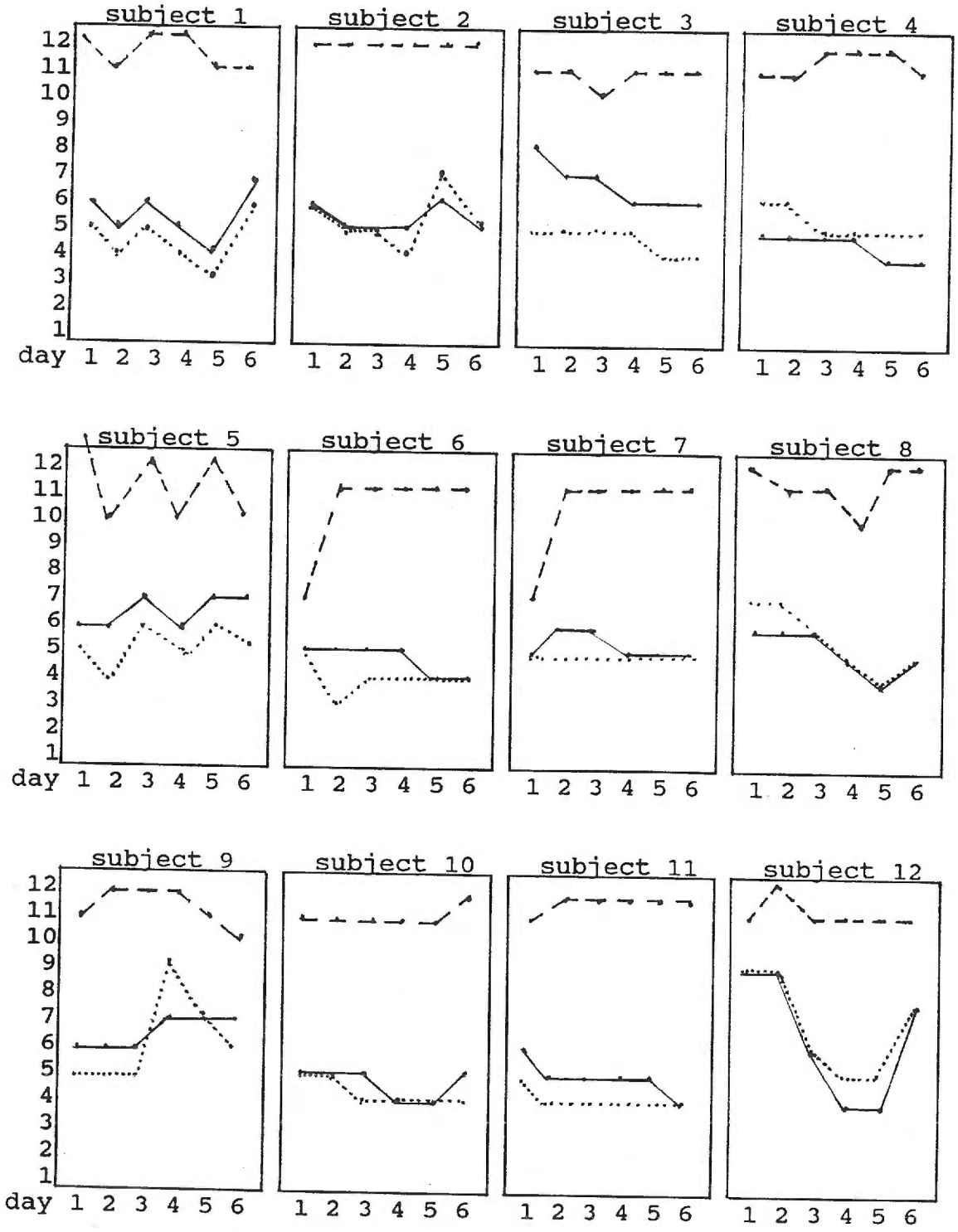
RHOTEN FATIGUE SCALE



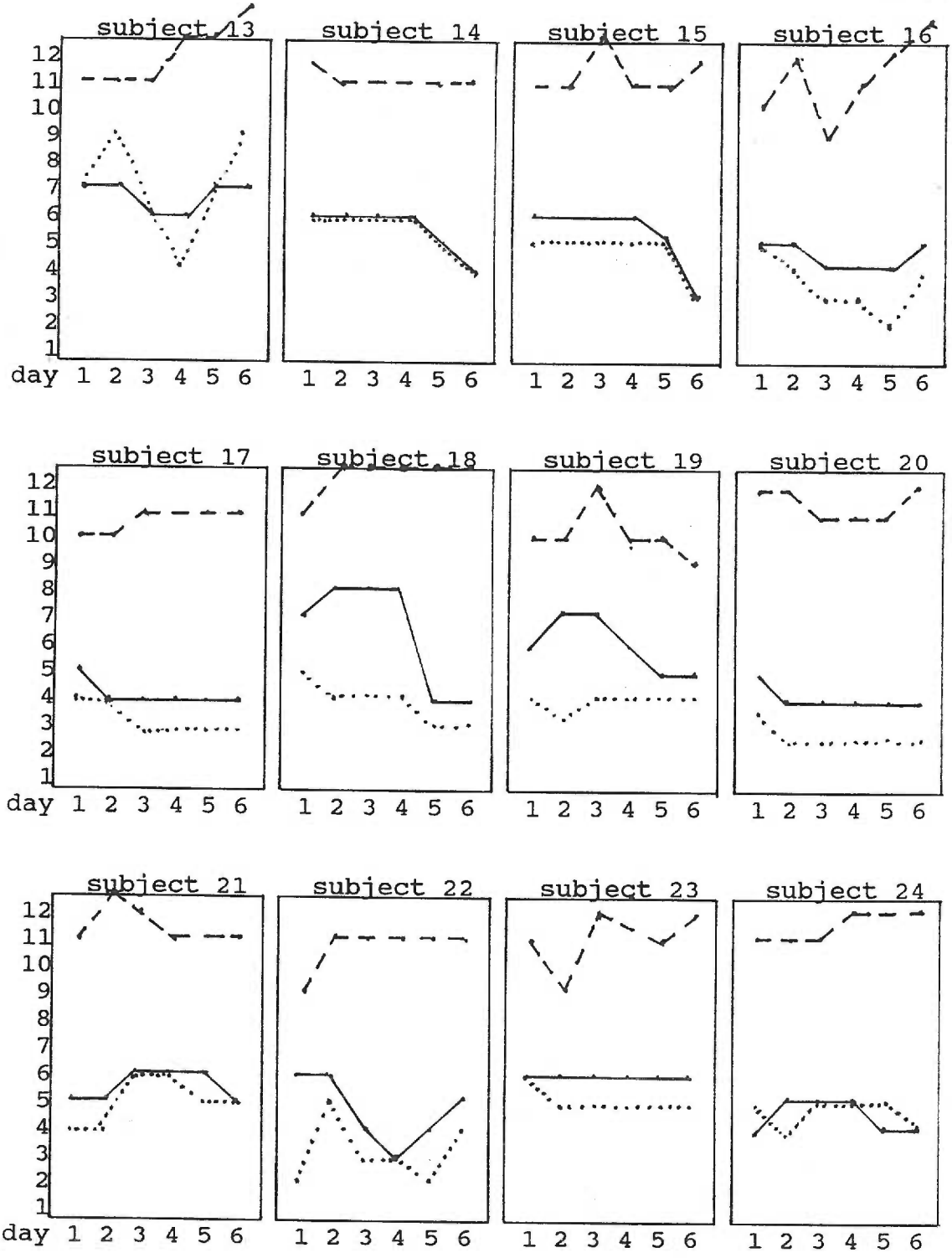
APPENDIX I: DEMOGRAPHIC DATA, HEALTH HISTORY - INDIVIDUAL SUMMARIES

Subject number	age	sex	marital status	diag.	M.I. type	medical history	previous activity	smoking history	eject. fract.	disease extent
1.	47	F	M	M.I. PTCA	inf.		mod.	quit now	>50%	1 ves.
2.	72	F	M	M.I.	inf	COPD Ca-throat	sed.	quit now	>50%	1 ves.
3.	67	M	M	M.I.	ant		mod.	quit now	>50%	multi. vessel
4.	44	F	M	M.I.	inf.		mod.	quit now	>50%	1 ves.
5.	59	M	M	M.I.	inf	DM+I	v.act.	quit now	>50%	multi vessel
6.	46	M	M	M.I.	lat	HTN	sed.	quit before	>50%	multi vessel
7.	52	M	S	myop		MI, CABG COPD, CVA DM+I	sed	smok-ing	<50%	multi-vessel
8.	58	M	D	M.I.	ant.	DM+I	mod.	never	<50%	1 ves.
9.	46	M	D	M.I.	inf.	COPD	sed.	smok-ing	>50%	multi-vessel
10.	60	M	M	CABG			v.act.	quit before	>50%	multi-vessel
11.	51	M	M	M.I.	inf	MI	mod.	quit now	>50%	multi-vessel
12.	66	M	M	M.I.	non-Q-wave	MI	sed.	quit before	<50%	multi-vessel
13.	44	M	M	M.I.	inf.	Liver Dx	sed.	smok-ing	<50%	multi-vessel
14.	66	M	M	M.I.	inf	HTN, MI CABG	sed.	quit before	<50%	multi-vessel
15,	63	M	M	M.I.	inf	CVA	mod.	quit before	>50%	1-ves.
16.	59	M	S	M.I.	ant		mod.	never	>50%	1-ves.
17.	44	M	M	CABG		DM-I	mod.	quit before	>50%	1-ves.
18.	35	F	M	MI/ PTCA	ant		mod.	quit now	>50%	1-ves.
19.	67	M	M	CABG		DM-I	sed.	quit now	>50%	1-ves.
20.	45	M	M	MI	inf	HTN	v.act.	never	>50%	1-ves.
21.	50	M	M	CABG		MI, CABG	sed.	quit before	<50%	multi-vessel
22.	34	M	M	MI	inf.	HTN	mod.	quit before	>505	1-ves.
23.	55	M	M	MI PTCA	inf.	MI, CABG	sed.	quit before	<50%	multi-vessel
24.	68	F	W	MI	inf	HTN	sed.	quit now	>50%	1-ves.

APPENDIX J: INDIVIDUAL FATIGUE AND EXERTION LEVELS



APPENDIX J: INDIVIDUAL FATIGUE AND EXERTION LEVELS (con't)



...pre-exercise fatigue --- rate of perceived exertion
___post-exercise fatigue

AN ABSTRACT OF THE THESIS OF

Eloise Mittleider Gatchet

For the MASTER OF NURSING

Date of Receiving this Degree: June 9, 1989

TITLE: FATIGUE IN PATIENT WITH CORONARY ARTERY DISEASE

Approved: [redacted]
Mary McFarland, R.N., Ed.D., Thesis Advisor

This descriptive study was conducted to measure the levels and specific symptoms of fatigue experienced by patients with coronary artery disease.

Twenty-four subjects, ages 35-72, who had recently experienced an acute cardiac event and were enrolled in a phase II cardiac rehabilitation program were recruited for the study. Participants were asked to measure their fatigue levels on the Pearson and Byars Fatigue Checklist (Pearson & Byars, 1956) before (at rest) and after controlled exercise. They were also asked to indicate their specific symptoms of fatigue on the Fatigue Symptoms Checklist (Yoshitake, 1971).

Subjects reported fatigue levels ranging from 2--very lively to 9--extremely tired. However, 80% of the responses fell in the middle range of the scale from 4--quite fresh to 6--slightly pooped. There were five subjects who reported increased levels of fatigue at rest, ranging from 7--fairly well pooped to 9--extremely tired. Subjects with the highest fatigue levels at rest also had a weight gain

that might signal fluid retention and early congestive heart failure.

Post exercise fatigue levels were generally 1-2 levels higher than pre-exercise. However, four subjects increased their fatigue 3-4 levels with exercise. A few subjects reported the same level of fatigue before and after exercise and a few even decreased their fatigue with exercise.

Fatigue levels gradually decreased over the six days of data collection. However, the rate of perceived exertion (RPE) as measured by the Borg Exertion Scale, and the intensity of exercise measured in METS gradually increased over the six days.

The most frequently reported symptom of fatigue was tired legs. Other frequently reported symptoms were feeling tired in the whole body, being thirsty, short of breath, no energy, and irritable. Physical symptoms were reported more commonly than psychological symptoms.

The number of fatigue symptoms reported ranged from zero to seven symptoms. More than 50% of the subjects never reported more than three symptoms. There was only one subject who reported as many as seven symptoms. This subject also reported an increased level of fatigue at 9--extremely tired. The number of symptoms reported were positively correlated with fatigue levels with a Pearson's r of 0.6733 ($p<0.002$).

The convience sample and small sample size are limitations of this study. Caution must be used in making gneralizations, however there are some implications for nursing. Even though fatigue is not well defined, patients are able to recognize and decribe it. Patients with coronary artery disease may be expected to experience some fatigue after an actue even such as MI or CABG. As patients recover, their levels of fatigue and the number of fatigue symptoms they experience should gradually diminish. Excessive fatigue may signal potential complications and the need for further assessment.

While fatigue is a common symptom in illness, it may not be accompanied by the same symptoms in all patient groups. These differences must be taken into account when assessing fatigue. Fatigue should not be confused with exertion. Both may provide important information in the assessment of patients but they need to be differentiated.

Better tools to measure and describe fatigue are needed for future studies. Care should be take to design tools without cultural bias and without colloquial or outdated terms that are easy to use and not too time consuming.

Fatigue in patients with coronary artery disease needs to be studied at more times throughout the day and over a longer period of time.