

**QUALITY OF LIFE THREE MONTHS AFTER
CORONARY ARTERY BYPASS SURGERY:
EFFECTS OF PRESURGICAL
PHYSICAL FITNESS**

By

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(ABSTRACT)

Coronary artery bypass grafting (CABG) is a procedure used to help improve and save the lives of thousands of coronary artery diseased patients every year. Measuring health-related quality of life (HRQL) significantly contributes to understanding patient perceptions of outcomes attributable to this surgery. Previous research on patient outcomes for CABG has included the evaluation of changes in HRQL at intervals of 3-6 mo postsurgery. There is a lack of research, however, that evaluates how physical fitness levels of CABG patients prior to surgery, may affect these HRQL outcomes. The purpose of this study was to develop a prediction equation, using fitness in addition to other combined variables, that predicts HRQL 3 mo after CABG. This study evaluated the influences of prior physical fitness, when these attributes are considered in combination with other clinical variables. Moreover, whether these variables would be possible predictors of health-related quality of life outcomes 3 mo after CABG were evaluated. These variables consisted of heart disease risk factors, physical fitness measures, and whether or not the patients had histories of various comorbid conditions, including that of prior history of myocardial infarction. The HRQL was assessed using the Medical Outcomes Study Short Form 36 (MOS SF-36), and concurrently, questionnaire data were collected with several other patient perceived measures expected to have potential confounding influences on HRQL; the MOS Social Support Scale; Beck Depression Inventory; Health Complaints Scale; the Life Orientation Test for optimism/pessimism. In all, 45 men and 10 women, were evaluated just prior to and 3 mo following CABG. Two of the eight subscales of the MOS SF-36 were predicted at an adjusted R^2 of greater

than 50%. The sum of three skinfolds was the only physical fitness measure combined with current smoker, Beck Depression Inventory, presurgical General Health Perception and the Medical Outcomes Study Social Support Scale, that contributed most to predicting General Health Perception ($R^2=.68$). Elbow flexion was the only physical fitness variable, combined with four presurgical MOS SF-36 subscales (Mental Health, Role Physical, Social Functioning and General Health Perception) that contributed to predicting the subscale of mental health ($R^2=.61$). Physical fitness did contribute to predicting the global scope of health perception and mental health. Physical and social domains of HRQL, however, were not significantly predicted. Presurgical HRQL was most significant when predicting postsurgical HRQL. Therefore, in order to predict postsurgical HRQL, presurgical HRQL should be used. Physical fitness variables can be utilized to contribute to predicting certain aspects of HRQL.

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CHAPTER I
INTRODUCTION

OVERALL PROJECT DESCRIPTION

The following paper was derived from a small portion of a larger research project taking place under Dr. Joseph Cook at the Carolinas Medical Center in Charlotte, NC. Therefore, it is necessary to briefly explain that project. However, all the content beyond this page should be evaluated as a completely different study. The purpose of Dr. Cook's study was to test the validity of the observation by clinicians that the physical, psychological and nutritional status of the patient are important factors in outcomes after coronary artery bypass grafting (CABG) procedures. To this end, a battery of short standard tests of physical fitness, exercise tolerance, psychological function and quality of life were selected and administered to a group of CABG patients preoperatively and at three and twelve mo post-operatively. Dual energy x-ray absorptiometry (DEXA) scan to measure body composition and bone density were a component of this battery of test.

Controlling for comorbid diseases known to influence surgical outcomes, the results of preoperative were analyzed to ascertain if any or all were independent predictors of outcome of surgery and/or late recovery. These patients were followed for one year. The objectives were to determine the degree to which measures of exercise capacity and physical activity could be measured in patients about to undergo CABG and to determine if those measures were variables influencing surgical morbidity, mortality and quality of life after CABG.

INTRODUCTION

In the United States alone more than 900,000 deaths per year are due to cardiovascular disease. Millions suffer from angina due to coronary artery blockages. In most cases, coronary artery disease causes a significant decline in physical capacity. These individuals may also suffer from angina, shortness of breath, fatigue and dizziness with or without the onset of physical activity, and experience a diminished ability to perform the usual activities of daily living. One of the major procedures utilized to alleviate the effects of cardiovascular disease is coronary artery bypass grafting (CABG). The CABG is not only a procedure used to diminish the negative effects of coronary artery disease and reduce the risk of further damage to the heart (i.e. myocardial infarction or congestive heart failure), but also a procedure used to improve patients health related quality of life (HRQL) and avoid early mortality due to this disease.

A number of studies (Scheir et al. (1989), Ayanian et al. (1995), Shapira et al. (1995)) have looked at the effects of CABG on patients' health related quality of life. Health related quality of life (HRQL) as defined by Wilson et al. (1995) includes the dimensions of physical capacity, social functioning, mental health and general health perceptions and incorporates such concepts as vitality, pain and cognitive functioning.

STATEMENT OF THE PROBLEM

The purpose of this section is to explain the importance of this paper. There are two studies (Peterson et al. (1992), Chocron et al. (1996)) which attempted to measure predictors of HRQL after bypass surgery. Predicting postsurgical HRQL would be of great value because studies (Scheir (1989), Ayanian (1995), Shapira (1995), Peterson (1992), Chocron (1996)) have shown widely varying results of CABG. The majority of these studies have shown the positive effects of CABG on artery diseased patients; however, the studies also show that many patients manifest no change in HRQL, a diminished quality of life, or even death.

Although much research has been conducted on CABG and the resulting HRQL, the following questions have not been answered. Do patients who undergo CABG surgery differ in their HRQL outcomes depending on their presurgical levels of fitness? And what fitness predictors could be used to allow surgeons to determine which patients will have positive outcomes after CABG? If these questions can be answered, surgeons could make more informed decisions, whether or not to perform CABG on certain patients.

If there were some way to be reasonably sure that CABG would benefit and improve the HRQL of a patient, heart surgeons could have considerable pressure lifted from them. Many surgeons judge the potential benefit of CABG to a patient on past experience, medical history, age and patient appearance. Although these variables may have validity, a prediction equation that could be applied to each

CABG candidate to determine, with a degree of certainty, the outcomes of CABG would greatly benefit both surgeon and patient. With such a prediction equation a surgeon could minimize the risk, pain and cost for individuals who may not benefit from CABG and maximize confidence for those who are likely to benefit from the procedure.

RESEARCH OBJECTIVE

To determine if presurgical fitness measures (strength, VSAQ (predicted METS and METS prior to limitations), skinfold measurements, BMI and hip/waist ratio) can be used as valid predictors of one's health related quality of life 3 mo after CABG. There are several confounding factors that may influence fitness and how it relates to the HRQL. Therefore, in order to control for these factors, they were used in the regression analysis along with the pure fitness measures. These confounding factors include:

Risk Factors

The risk factors included as possible predictors of HRQL were smoking history, current smoker, diabetes, hypertension, family history, hypercholesterolemia and hypertension.

Diseases and Complications

The diseases and complications of the patients that were included as possible predictors of HRQL were; Cerebral Vascular Accident (CVA), Cardiopulmonary disease (COPD), Peripheral Vascular Disease (PVD), Myocardial Infarction (MI),

Time since MI, Angina, Angina type (stable, unstable) and Congestive Heart Failure (CHF).

Psycho-social Characteristics

Psycho-social characteristics used as possible predictors for HRQL were; Beck Depression Inventory (BDI II), Life Orientation Test (LOTT), Health Complaints Scale (Cognitive (CHC) and Somatic (SHC)), Medical Outcomes Study Short Form 36 (MOS SF-36) and Medical Outcomes Study Social Support (MOS SS).

Descriptive Characteristics

Additional descriptive characteristics used as possible predictors for HRQL were; Ejection Fraction, Age and Gender.

SIGNIFICANCE OF STUDY

As previously mentioned, considerable research (Scheir, 1989, Ayanian, 1995, Shapira, 1995, Chocron, 1996, Peterson, 1992) has been done to analyze the effects of CABG on the HRQL of coronary diseased individuals, few research studies have looked at the presurgical factors that may predict postsurgical HRQL outcomes. Guadagnoli et al. (1992) found that patients, who reported a better HRQL before CABG, usually showed better post-operative HRQL. The question that needs to be answered is what particular factors can be assessed to predict whether CABG will benefit the HRQL of an individual? This information could assist doctors in

determining who should have CABG performed and who would be better off using another method.

There are many factors that could influence HRQL in general. Exercise and various other forms of physical activity offer promising interventions for the enhancement of HRQL (Rejeski, 1996). It is well known that physical fitness is one of the best ways to prevent cardiovascular disease. However, even those who are physically fit can face the disease, because of genetic factors, diet, smoking or even bad habits from the past, such as smoking history or sedentary lifestyles, that have since been improved.

It is important to evaluate whether or not physical fitness prior to surgery has any impact on the post-operative HRQL outcomes. If persons are stronger and have a greater functional capacity prior to surgery will they have a quicker, easier and more beneficial recovery with less chance for mortality following surgery? Many studies evaluate HRQL and CABG. Few researchers have analyzed HRQL predictors of outcomes after surgery. There is little if any research looking at fitness variables along with other confounding factors, such as age, comorbidity, risk factors, depression, optimism/pessimism and HRQL measures, that may influence the HRQL after surgery.

Glomer and associates in 1992 looked at outcomes after CABG in patients aged 80-83 years old. They concluded that pre-operative risk factors such as comorbid disease and recent infarction are useful in a prognosis, but the role of many risk factors in patient selection remains to be demonstrated. There are so many factors that influence the overall postsurgical HRQL. These factors need to be

analyzed in some depth in order to understand the influences they have on CABG patients.

The purpose of this thesis is to address the extent to which fitness predictors and psycho-social predictors impact the HRQL after CABG. Does a patient's HRQL improve, remain unchanged or diminish following surgery. What factors if any may be used as predictors to determine whether the patient would benefit from CABG?

DELIMITATIONS

1) The following subjects were excluded from the study

- Subjects who did not survive CABG surgery, 3 mo after the procedure
- Subjects younger than 45 years of age
- Subjects who were blind or could not read
- Subjects who had an MI fewer than 5 days prior to surgery

2) Subjects only included volunteers having CABG approximately two weeks to 1 day prior to surgery on site at the Carolinas Medical Center, Charlotte, NC.

LIMITATIONS

1) Since patients who had an MI fewer than 5 days prior to surgery or who were too much at risk were excluded from the study, the subjects may not be fully representative of the actual population of patients undergoing CABG.

- 2) The VSAQ was based on self-reporting rather than an actual treadmill test to determine functional capacity. A treadmill test would put the patient too much at risk. The VSAQ is a valid tool, however, prior to surgery any anxiety or pain could possibly alter what the patient may perceive their functional capacity to be.
- 3) Fear, anticipation and anxiety of the upcoming surgery could have influenced the results of presurgical the HRQL assessment.

ASSUMPTIONS

- 1) The assumption was made that the patients are reporting correct and accurate information and answering the questionnaires honestly.
- 2) The assumption was made that the researchers taking the various measurements of strength and skin folds followed standard procedures and were reliable in this technique.

DEFINITIONS

Body Composition Domain

BMI (Body Mass Index).

A measure of body composition [weight(kg)/height²(m)].

Skinfold Measurements.

A technique developed to measure the subcutaneous fat. Five body sites are measured on men (chest, abdominal and thigh) and women (triceps, suprailiac and thigh) The values are added together to make up the predictor used as the sum of 3 skin folds.

Waist/Hip Circumference Ratio.

The circumference of the waist (level of umbilicus) divided by circumference of the hip (widest site below waist).

VSAQ (The Veterans Specific Activity Questionnaire).

A questionnaire used to estimate the patients perceived peak functional capacity measured in METS, currently and prior to limitations.

Grip Strength.

Isometric grip strength as measured with a hand held standard grip dynamometer.

Elbow Flexion Strength.

Maximal static strength of the elbow flexors measured with a hand held dynamometer.

Leg Extension Strength.

Maximal static strength of the leg extensors measured with a hand held dynamometer.

SUMMARY

With the rapid increase in the mean age of the population, the incidence of heart disease is also increasing. CABG is an option that faces many of these diseased individuals regardless of age. It is important for both surgeons and patients to have the best possible prediction of postsurgical survival rates and the postsurgical HRQL. Selected measures of physical fitness may be good predictors of the postsurgical HRQL. If patients who suffer from coronary artery disease are fit, generally, they may have a better chance of surviving and having a high quality of life following surgery, compared to those who are not as fit. The research completed in this paper establishes prediction equations for postsurgical HRQL. These equations utilize selected fitness measures along with other behavioral and clinical variables.

CHAPTER II

LITERATURE REVIEW

INTRODUCTION

Physical activity and one's HRQL is a topic of growing interest in the health field, particularly in the presence of disease. Ewart, Taylor, Reese and DeBusk (1983) stated that "exercise and various other forms of physical activity offer promising interventions for the enhancement of HRQL. Exercise can enhance one's confidence to undertake the various activities of daily living." Exercise, therefore, could influence one's view of the quality of his/her life. Although the HRQL is not a medical evaluation and is based strictly on self-reporting, the HRQL is important in assessing the medical outcomes of CABG. The HRQL has become an accepted measure of how medical intervention affects the patient mentally and physically.

Physical activity improves the quality of one's life by, in part, improving physical performance and fitness. The Surgeon General stated that physical activity appears to improve HRQL by enhancing psychological well being and by improving physical functioning in persons compromised by poor health. Physical activity is related to perceived improvement in physical function and activities of daily living. Compared to those who are weak, frail, and physically inactive, physically fit persons are likely to respond better to surgery, in this case, CABG.

In order to analyze the significance of the research carried out in this thesis, it was first crucial to understand and evaluate previous research that had been published relating to the topics of HRQL and CABG. Within this chapter two categories of research are reviewed. These categories are a review of literature on the

instrumentation used in the current study and a variety of studies reviewing postsurgical quality of life.

INSTRUMENTATION USED IN CURRENT STUDY

Questionnaires

Johan Denollet (1994) developed the Health Complaints Scale (HCS) to provide valuable information on coronary heart diseased (CHD) patients. The specific purpose stated was to identify common health complaints among 535 men with CHD. The scale evolved from responses to 24 questions to assess 12 somatic and 12 cognitive complaints. The 12 somatic health complaints were scored separately from the 12 cognitive complaints. The maximum score is 48 and the minimum is 0. The somatic health complaints focused on questions pertaining to physical pains and discomforts. Denollet stated that the somatic health complaints were associated with myocardial infarction and cardiac death, and with coronary risk factors, such as hypercholesterolemia. Cognitive health complaints focused on the amount patients worry about their health and their concern about how much the illness will interfere with their life. Denollet's research concluded that the "Health Complaints Scale is accurate, relevant from the patient's point of view, and a tool that is sensitive to common problems of patients with coronary heart disease and the changes perceived in the weeks and mo after a coronary event." The HCS displays high internal consistency ($\alpha \geq .89$), adequate test reliability ($r \geq .69$) and validity ($r = .53-.60$).

The Life Orientation Test (LOT) that was used herein was developed by Schier et al. (1989) in order to analyze the importance of measuring dispositional optimism in CABG patients. It is made up of 4 items, 2 designed to measure optimism and 2 to measure pessimism. The internal consistency showed an alpha = .76 and test reliability alpha = .79. It is thought that if patients are more optimistic than pessimistic about their surgery and the outcomes of the surgery, than they are more likely to recover quickly. Measuring optimism/pessimism is extremely important and can predict how people handle stresses in their lives. Schier et al. (1989) found many predictors both of coping efforts and of surgical outcomes. The researchers found that:

- There is a positive correlation with manipulating problem-focused coping and negative correlation with the use of denial.
- Dispositional optimism was associated with faster rate of physical recovery during hospital stay and a faster rate of returning to normal after discharge.
- There is a positive association between level of optimism and post surgical quality of life at 6 mo after surgery.

The Medical Outcomes Survey Short Form 36 item questionnaire (MOS SF-36) was developed by Tarlov et al. (1989). The MOS SF-36 measures eight dimensions of health: General Health Perception, Bodily Pain, Energy/Fatigue, Physical Functioning, Social Functioning, Mental Health, Role Physical and Role Emotional.

For each of the eight dimensions, 2-10 questions were included and scored on a scale from 0-100. Each dimension was scored independently. The dimensions are not added together, but evaluated as eight separate measures of one's HRQL.

McHorney, Ware, Rachel, and Sherbourne (1994) tested the validity and reliability of the MOS SF-36 with 3445 patients with different societal characteristics, diagnoses and disease severity (reliability = 0.85, validity = 0.92). They also used the MOS SF-36 to analyze various HRQL issues pertaining to the patients. The researchers found evidence to support the MOS SF-36 over a diverse population. As a result of this study, the MOS SF-36 has become one of the most widely used tools for examining HRQL after surgery (Johnson, Goldman, Orav, Garcia, Pearson and Lee, 1995). Johnson et al. (1995) used the MOS SF-36 to study the performance of 1160 white and black patients with the chief complaint of acute chest pain. Once again the SF-36 proved to be a valid tool, this time in black and white patients.

The MOS Social Support Survey contains 10 questions that pertain to emotional/informational, tangible, affectionate, and positive social interaction. The scale is scored from 0-40, 0 indicating the least social support and 40 the most. This tool is reliable and valid (all alphas >.91) and is stable over time (Sherbourne and Stuart, 1991). Social support before surgery may have a tremendous impact on how patients recover from surgery and perceive their HRQL. If patients are alone and scared and have few people to count on for support both mentally and physically, they might have less hope and positive expectations, and therefore, may not perform as well after CABG.

The Beck Depression Inventory II (BDI-II) is used widely among medical patients for assessing depression. Beck, Steer and Brown recently revised the BDI, developed in 1978, into the BDI-II in 1996. The BDI-II is frequently used as a self-reporting inventory. Until recently, the survey only consisted of seven questions, was very general but could determine the severity of depression hidden among the usual medical complaints. The BDI-II now consists of a wider range of 21 question, allowing for more specific analyses of the patients. The 21 questions are rated on a four-point intensity scale. The level of depression is measured as follows: <10 points suggest none or minimal depression, 10-18 points mild or moderate depression, 19-29 points moderate to severe depression, and 30-63 points severe depression. When the BDI was tested, the specificity was 82% and sensitivity and validity in detecting major depression disorders was 83%. No other scale of depression has been established for accurately measuring depression in the medically ill (Clark, Cavanaugh and Gibbons, 1983). The BDI-II was compared to the BDI and showed test-retest reliability of be 93% ($p < .001$) and correlation 0.93. The BDI-II however, consists of questions that more thoroughly evaluate different aspects of depression based on the DSM-IV. This tool does not analyze symptoms of fatigue and irritability but the HRQL measures used in this thesis do. The BDI does however, portray confidence for determining the depth of depression in medically ill, such as CABG patients. Therefore, the BDI is the most reliable and valid tool that can be used in studying depression levels of these patients.

The Veterans Specific Activity Questionnaire (VSAQ) was developed by Meyers, Do, Herbert, Ribisl and Froelicher (1994). This questionnaire was developed to predict maximal treadmill performance in patients with coronary artery disease, and is found to be very accurate (age adjusted $R^2=0.83$, actual $R^2=0.62$) The VSAQ is made up of different levels of activity increasing in difficulty. These activities range from recreation and exercise activities to house and yard work. The different levels of activities are organized in increasing MET levels. The scale ranges from 2-13 METS, but limited patients are expected to score within 3-7 METS. The score of less than or equal to 5 METS is considered a risk of early cardiovascular mortality.

Physical Measures

The sum of skinfolds technique was developed by Jackson and Polleck (1985) to allow the measurement of body composition to be easy and inexpensive to obtain. Underwater weighing is considered the gold standard of measuring body density, but it is time consuming and expensive. Jackson et al. (1985) developed a table that allowed researchers to use a sum of three skinfolds, for men and women, that would most accurately predict body density determined by underwater weighing. “The skinfold method relies on the observation that within any population, a certain fraction of the total body fat lies just under the skin (subcutaneous fat) and by obtaining a representative sample of that fat, overall body fatness can be predicted” (Powers and Howly, 1994).

A second measure used to determine physical fitness was strength. Strength is the ability of a muscle to exert force. Muscular strength can be measured during performance of either static or dynamic muscle contraction. It is important when evaluating muscular strength, that more than one major muscle group is tested, including both upper and lower body (Wilmore and Costill, 1994). The measures used for the present study were isometric elbow flexion and knee extension (CSV200, Chatillion Co., Greensborough, NC) and isometric grip strength (Baseline dynamometer, Country Tech, Inc., Gaymsills, WI). The purpose of measuring strength isometrically, is to measure force in a variety of muscle groups, in which the contraction of the muscle develops tension, but does not shorten. In an isometric contraction, no movement occurs. "Isometric measurement of strength usually consists of three trials of maximal contractions (lasting approximately 5 seconds); the best of these trials is considered to be the measure of strength" (Powers et al. 1994).

STUDIES EVALUATING POSTSURGICAL QUALITY OF LIFE

A review by Rejeski (1996) suggests that patients who are fit and confident about their health prior to surgery show above average quality of life results after surgery, because they recover more quickly than patients who have been weak or frail prior to surgery do. Similarly, patients who feel they have more support, that is, others to depend on to help them throughout their recovery, have more positive psychosocial scores before and after surgery. For example, Guadagnoli et al. (1992)

found that patients undergoing CABG surgery had better post-operative functioning if married versus those who were not married. Therefore, it is valuable to evaluate how a patient perceives their situation when predicting the quality of life after surgery.

Ayanian et al. (1995) determined whether physical and psychosocial function differs between men and women after CABG. The subjects used were 454 consecutive CABG patients (109 women and 345 men) who completed a questionnaire that was mailed to their home. The questionnaire consisted of a six-item scale of activities of daily living, a three-item social activity scale, a five-item mental health scale, and a four-item vitality scale. This questionnaire was obtained from the Functional Status Questionnaire (Jette, Davies and Cleary, 1986) and the Medical Outcomes Study 36-item short form survey (MOS SF-36). The researchers concluded that the women were more ill at the time of CABG than the men, but that recovery in the men and women, six months after surgery, was very similar both physically and psychosocially. A study by Shapira et al. (1995) evaluated the medium and long-term results of CABG in patients with left ventricular dysfunction. This study is important because it analyzed the physical ramifications of the quality of life. The results concluded that CABG positively influenced patients by decreasing angina, decreasing the severity of congestive heart failure and increasing the left ventricular ejection fraction. These changes allowed the patients to function with less pain and with a greater capacity for the activities of daily living.

Physical, psychological, social and economic outcomes 6 mo after CABG were evaluated by Jenkins, Stantan, Savageau, Denlinger and Klein (1983). The purpose of this study was to assess the benefits of CABG to patients less than 70 years of age. Improvements were found in many variables. Of those patients who were employed prior to surgery, 75% of them returned to work. Angina was relieved completely in up to 85% of the patients and disability days decreased 80%. Anxiety, depression, fatigue and sleep problems declined in the majority of the patients. The researchers concluded that the majority of patients displayed normal economic and social functioning 6 mo after CABG.

Allen, Fitzgerald, Swank and Becker (1990) measured functional status, work performance, social activity, mental health and quality of social interaction 1, 6 and 12 mo after surgery. This study was unique because it evaluated work performance and how it reflected quality of life. Statistically significant improvements of functional status and psychological functioning were found over the one-year follow-up period. Employment decreased in these patients, but for those who returned to work, improvement in performance was reported.

In a given population, with an increase in age there is an increase in cardiovascular disease and generally speaking, an increase in surgical risk. There are more than 200,000 bypass surgeries performed per year on patients 80 years old or older. Guadagnoli et al. (1992) compared the quality of life in post-CABG patients greater than 65 years of age versus those less than 65 years of age. Surprisingly, in

this study, results revealed that the two age groups had similar improvements, from pre-admission to post-CABG, in activities of daily living, and emotional and social functioning. The only significant difference was found in mental health status. The age group less than 65 years scored lower, possibly because it expected to recover more quickly and had greater expectations of the benefits of the surgery.

Patients older than 80 years, were evaluated by Merrill, Stewart, Frist, Hammon and Bender (1989). Angina pectoris and congestive heart failure were operative indicators for the patients in this study. Thirty-two out of the 40 patients survived the surgery. CABG improved the functional status and long-term survival after the patient was past the risks of initial surgery.

Peterson et al. (1992), compared age groups 65-70 versus >80 years of age as predictors of patients' quality of life after CABG. They found that the >80 years of age group had a significantly longer post operative hospital stay, higher expenses, and a higher one year mortality rate. Although the older group had a greater initial surgical risk, it had higher long-term survival rates. Mullany, Darling, Pluth, Orszulak et al. (1990), studied patients >80 years of age following CABG. The investigators found positive results with a one year survival rate of 84%, a 5-year survival rate of 71%; they also found 79% of the patients became angina free, 81% showed improved overall health, and 16% showed unchanged or worse health.

Glower et al. (1992) evaluated the physical performances and outcomes after CABG in an older population of patients aged 80-93 years. Preoperative and postoperative characteristics and performances were examined. The characteristics included gender, coronary artery disease, angina class, presence of comorbid disease, and in-hospital complications. Results showed that the median physical performance improved from 20-70% on the Karnofsky score. Failure to achieve a successful functional outcome was associated with 1 or more preoperative comorbid conditions. The researchers concluded that CABG is a beneficial procedure for selective patients based on preoperative characteristics.

Katz and Chase (1997) researched complications in cardiac (CABG and PTCA) operations with patients < and > 70 years of age. They found that the frequency with which complications occurred following surgery was not significantly different in the two age groups. However, the subjects, who were a select group of low risk patients, may have influenced these results. Chocron et al. (1996) performed a prospective study of the quality of life of 215 patients before and 3 mo after open-heart operations. This investigation used the Nottingham Health Profile to assess the quality of life. This questionnaire was administered prior to surgery and 3 mo after surgery. Age, gender, type of disease, the status of any with comorbid disease, ejection fraction, and the Nottingham Health Profile were used as predictors in this study. They found that overall, the cardiac operations did improve the quality of life.

The predictors, for a subset of patients who were improved less or worsened after surgery, were age >70 years, poor functional class, female gender, and the presence of at least one comorbid disease.

As mentioned in Chapter I there is little research analyzing predictors of the quality of life of patients after CABG. Rejeski (1996) stated the need to determine which predictors are responsible for changes in the quality of life and which dimensions of the quality of life are changing. Heidrich, Fosthoff and Ward (1994) looked at cancer patients and their ability to adjust to their illness. The way that they mentally accepted or rejected the idea of their illness greatly affected their quality of life. There have also been studies to suggest that optimistic patients tend to show better outcomes following surgery. Scheir et al. (1989) discussed the manner in which the stresses of surgery affect patients. The results suggested that patients who were optimists showed significantly fewer complications than pessimists did after CABG. Optimists also showed a quicker rate of recovery, greater satisfaction with treatment and better coping strategies. This study also showed that 6 mo following surgery levels of optimism, had a positive correlation with the quality of life.

It is important to compare patients who had a high functional capacity prior to their surgery versus those who had a low functional capacity for months or years, before surgery. Hammond, Kelly, Froelicher and Pewen (1985) completed a study that predicted a patient's postoperative exercise capacity. After cardiac rehabilitation the researchers found that patients with low fitness levels before surgery showed the most improvement. The patients with high preoperative fitness levels maintained or only slightly improved fitness because they did not have as much room to improve. The important issue, however, about how presurgical fitness and psychological aspects effect the HRQL 3 mo after surgery was not studied.

SUMMARY

First, it was important to evaluate the questionnaires used in this study. The reliability and validity are important measures needed to justify the use of these questionnaires for research purposes. Second, physical fitness is an important variable to used when evaluating its effects on HRQL after CABG. The research mentioned in this chapter, thoroughly reviewed psychological effects on HRQL and physical fitness and physiological predictors of HRQL. The existing literature, however, does not consist of physical fitness measurements and whether or not level of fitness can predict HRQL after CABG. A combination of variables to predict HRQL after CABG, such as functional capacity, psychological status and physiological status, including existence of comorbidity, has not previously been analyzed. It is important

to determine if physical fitness combined with other confounding factors, mentioned in the sentence above, can predict the HRQL of a patient after CABG. This information could be extremely beneficial to allow surgeons to predict if CABG would improve a patients' HRQL or if the patients would be better off without the surgery. Therefore, more research is needed in order to accomplish these goals.

CHAPTER III
JOURNAL MANUSCRIPT
FOR
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**QUALITY OF LIFE THREE MONTHS AFTER
CORONARY ARTER BYPASS SURGERY:
EFFECTS OF PRESURGICAL PHYSICAL FITNESS**

By,

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ABSTRACT

Coronary artery bypass grafting (CABG) is a procedure used to help improve and save the lives of thousands of coronary artery diseased patients every year. Measuring health-related quality of life (HRQL) significantly contributes to understanding patient perceptions of outcomes attributable to this surgery. Previous research on patient outcomes for CABG has included the evaluation of changes in HRQL at intervals of 3-6 mo postsurgery. There is a lack of research, however, that evaluates how physical fitness levels of CABG patients prior to surgery, may affect these HRQL outcomes. The purpose of this study was to develop a prediction equation, using fitness in addition to other combined variables, that predicts HRQL 3 mo after CABG. This study evaluated the influences of prior physical fitness, when these attributes are considered in combination with other clinical variables. Moreover, whether these variables would be possible predictors of health-related quality of life outcomes 3 mo after CABG were evaluated. These variables consisted of heart disease risk factors, physical fitness measures, and whether or not the patients had histories of various comorbid conditions, including that of prior history of myocardial infarction. The HRQL was assessed using the Medical Outcomes Study Short Form 36 (MOS SF-36), and concurrently, questionnaire data were collected with several other patient perceived measures expected to have potential confounding influences on HRQL; the MOS Social Support Scale; Beck Depression Inventory; Health Complaints Scale; the Life Orientation Test for optimism/pessimism. In all, 45 men and 10 women, were evaluated just prior to and 3 mo following CABG. Two of the eight subscales of the MOS SF-36 were predicted at an adjusted R^2 of greater

than 50%. The sum of three skinfolds was the only physical fitness measure combined with current smoker, Beck Depression Inventory, presurgical General Health Perception and the Medical Outcomes Study Social Support Scale, that contributed most to predicting General Health Perception ($R^2=.68$). Elbow flexion was the only physical fitness variable, combined with four presurgical MOS SF-36 subscales (Mental Health, Role Physical, Social Functioning and General Health Perception) that contributed to predicting the subscale of mental health ($R^2=.61$). Physical fitness did contribute to predicting the global scope of health perception and mental health. Physical and social domains of HRQL, however, were not significantly predicted. Presurgical HRQL was most significant when predicting postsurgical HRQL. Therefore, in order to predict postsurgical HRQL, presurgical HRQL should be used. Physical fitness variables can be utilized to contribute to predicting certain aspects of HRQL.

INTRODUCTION

In the United States alone greater than 900,000 deaths per year are due to cardiovascular disease. Millions suffer from angina due to coronary artery blockages. One of the major procedures used in attempt to alleviate this disease is coronary artery bypass grafting (CABG). In most cases, coronary artery disease causes a significant decline in physical functioning. This population may suffer from angina, shortness of breath, fatigue and dizziness with or without the onset of activity. Therefore, these symptoms decrease their ability to perform what used to be regular activities of daily living. Coronary artery bypass grafting is a procedure used to decrease the negative effects of coronary artery disease, reduce risk of further damage to the heart (i.e. myocardial infarction or congestive heart failure), and avoid early mortality related to this disease. In addition to the physical benefits, CABG is also used to improve patients health-related quality of life. Health-related quality of life (HRQL) is defined as the dimensions of physical functioning, social functioning, mental health, and general health perceptions, including important concepts such as vitality, pain and cognitive functioning (1). Therefore, HRQL has many dimensions that contribute to its overall definition. A number of studies (2,3,4) have evaluated the effects of CABG on patients' health related quality of life. Of the few studies (2,5,6,7,8,9) that attempt to measure predictors of HRQL after surgery, none of these evaluate physical fitness measures as predictors of HRQL after CABG.

METHODOLOGY

Fifty-five patients (45 men and 10 women) undergoing first time coronary artery bypass grafting were recruited from the Carolinas Medical Center in Charlotte, NC. This recruitment took place anywhere from 1 wk to one day prior to surgery. The patients who agreed to be in the study completed a group of questionnaires and series of physical fitness measures prior to and 3 mo following CABG.

The variables recorded were as follows: age, sex, BMI, isometric grip strength (Grip baseline dynamometer, Country Tech Inc., Gaymsmills, WI), isometric elbow flexion strength and isometric knee extension strength (CSV200, Chatillion Co., Greensboro, NC), skinfold measurements (Harpenden, Country Tech. Inc., Gaymsmills, WI), hip/waist ratio, and METS predicted from the Veterans Specific Activity Questionnaire (VSAQ) (10). The following psycho-social questionnaires were also completed: the Medical Outcomes Study Short Form 36 item (MOS SF-36) (11), Medical Outcomes Study Social Support (12), Life Orientation Test (optimism and pessimism scale) (2), Health Complaints Scale (cognitive and somatic health complaints scale) (13), and the Beck Depression Inventory II (14). In addition to all of the variables above, major comorbid disease (See Table 2) were also identified and included as potential predictors of HRQL after CABG. The response variables used to measure HRQL after surgery were the eight subscales of the MOS SF-36 only.

The MOS SF-36 was selected as the criterion outcome measure due to its

well-established use in studies to evaluate HRQL after health interventions with chronic disease groups. In 1994, McHorney and associates used 3445 patients with different societal characteristics, diagnoses and disease severity (15). The researchers found evidence to support the use of the MOS SF-36 for quality of life outcome assessment over a diverse population. Item-internal consistency was 0.97 and sensitivity was 0.92. The test-retest reliability was 0.85. (15) As a result of this study by McHorney et al., the MOS SF-36 has become one of the most widely used tools for examining HRQL in clinical settings (16). The MOS SF-36 is made up of eight subscales. Each sub-scale measures a different aspect of HRQL and is scored separately on a scale from 0-100, with zero being the worst and 100 the best possible score.

Prediction equations were generated using each of the eight MOS SF-36 subscales with stepwise linear regression. All analyses were performed on JMP statistical software written by SAS (SAS Institute, Inc., Cary, NC). The probability for inclusion was alpha no higher than 0.25 in any measure. Any measure with the probability greater than 0.25 was excluded from the study. Outliers were also eliminated using the R-Student method.

RESULTS

Characteristics of the Study Sample

Only patients with complete data sets were included in this study. Anyone who was not able to return 3 mo after CABG was excluded from this study. Patients who had suffered a myocardial infarction less than 5 days prior to surgery were not

asked to participate in the study. Tables 1-2 display the descriptive characteristics of the 55 patients who participated in this study. Eighty two percent of the patients were male while only 18% were female. It is important to point out that the mean BMI was 29. A BMI greater than 27 is widely considered to be associated with high risk for heart disease. Therefore, and average BMI of this magnitude is what would be expected in a CABG population.

The VSAQ was used to predict METS. The mean METS appear low at 5.4. Anything less than five METS is considered at risk for cardiovascular disease and poor functional capacity. The VSAQ was based on self-reporting rather than an actual treadmill test to determine functional capacity. A treadmill test would put the patient too much at risk. The VSAQ is a reliable tool (age adjusted $R^2=0.83$, actual $R^2=0.62$), however, the patients may have reported their functional capacity to be lower if they felt anxiety, pain and discouragement prior to surgery. The mean reported METS prior to limitations was reported to be eight.

Table 2 displays the percentage of the patients who suffered other disease and risk factors. Myocardial Infarction (MI), smoking history, family history of heart disease, hypercholesterolemia, and hypertension (HTN) were prevalent in greater than 50% of the 55 patients observed. Table 2 displays the distribution of myocardial infarction by the number of days in which it took place prior to CABG. This table also displays the percentage of patients with unstable or stable angina versus none. Table 3 describes the non-research versus the research patient sample receiving CABG at the Carolinas Medical Center during the same time period. The purpose of this table is to emphasize how similar the research sample was to a CABG

population. The only major difference is that there are people in the total sample who experienced more recent myocardial infarctions prior to CABG, than in the research population. A patient was not recruited for this study if they had experienced a myocardial infarction less than 5 days prior to CABG.

Health Related Quality of Life Outcomes

Table 4 displays the descriptive statistics for the eight presurgical subscales of the Medical Outcomes Study Short Form 36 questionnaire. Each of the eight subscales was scored on a scale from 0-100, zero being the lowest and poorest score and 100 the highest and best possible score. Table 4 also displays the descriptive statistics of the MOS SF-36 subscales 3 mo after surgery and the change score in the MOS SF-36 subscales between pre and post CABG. All of the mean sub-scale scores improved from pre-surgery to 3 mo post-surgery. The most improved score occurred in the General Health Perception, Physical Functioning, Role Physical, Bodily Pain and Energy/Fatigue subscales ($p < 0.05$). Interestingly, these domains all reflected some level of physical functioning. Therefore, CABG definitely improved the overall quality of life of these patients, which supports prior research that the MOS SF-36 scale overall was sufficiently sensitive to pick up group changes for HRQL(15).

The only MOS SF-36 subscales that were predicted at an adjusted R^2 of greater than 50% of the variance were General Health Perception and Mental Health. As shown in Table 5 and Fig. 1, presurgical predictors for General Health Perception included whether or not the patient was a current smoker, the Beck Depression Inventory, General Health Perception sub-scale prior to surgery, the sum of three skin

fold sites and the MOS Social Support. Combined, these predictors produced an adjusted $R^2 = 0.68$, indicating that the variables explained 68% of the group's perception of overall health functioning.

Mental Health 3 mo after CABG was predicted by four presurgical MOS SF-36 subscales (Role Physical, General Health Perception, Social Functioning and Mental Health), and elbow flexion, as shown in Fig. 2. Together these five variables predict an adjusted R^2 of .61. Table 5 also displays the power of each predictor used in the equations for general health perception and mental health outcomes. The lower the p-value the more significant the predictor and the more powerful. The sum of three skinfolds ($p = 0.0067$) was the second most powerful predictor for postsurgical general health perception, while presurgical general health perception ($p=0.000$) was the first. Elbow flexion ($p \leq 0.051$) was the fourth out of five in sequence of power for predicting mental health after CABG. Physical fitness was much more significant in predicting general health perception than in predicting mental health because the sum of three skinfolds was higher in sequence of power for predicting General Health Perception than elbow flexion was for predicting Mental Health.

DISCUSSION

A fundamental objective of this study was to determine the feasibility of assessing physical fitness by a set of simple and objective tests with patients in the hospital awaiting CABG. Given success with taking measurements, the primary objective was to determine the potential to predict HRQL at 3 mo after CABG, when these fitness measures were considered in combination with other clinical variables. It

is important to use quality of life as a tool in contemporary healthcare, because in the past, mortality and morbidity were the main measures used to determine surgical outcomes. Quality of life has become a growing issue of interest among clinicians to determine how patients perceive that specific interventions have changed their health. If certain patients did not feel as if their quality of life improved after CABG, this information merits important consideration in determining the efficacy of the treatment. Anecdotally, many cardiovascular surgeons, have expressed the view that if patients look frail and weak prior to surgery, those patients' outcome after surgery may show poor results. If patients appear vital and physically robust, however, surgeons expect that the outcome will be better and the patients will be more apt to enjoy good function and a higher quality of life after surgery. In this study, use of a simple set of physical fitness tests in an effort to predict HRQL after CABG, provided an objective means for evaluating these expectations. The sum of three skinfolds and elbow flexion strength were both found to significantly predict two aspects of HRQL.

In the prediction equation for General Health Perception, the sum of three skinfold measurements was the only physical fitness variable which added significantly to the predictor set to justify inclusion in the regression equation. The measurement of subcutaneous fat, combined with current smoking, The Beck Depression Inventory, the pre-surgery score for General Health Perception and the MOS Social Support score provided the best five item predictor set. This predictor set explained 68% of the variance in the predicted outcome of General Health Perception score 3 mo after CABG. No other fitness measures were found to have sufficient predictive value to be selected for the prediction equation for this General

Health Perception outcome. Therefore, someone who is a current smoker, higher in fat, more depressed, has little social support and views themselves with poor general health prior to surgery, will most likely show poor General Health Perception after surgery.

In the prediction equation for Mental Health, elbow flexion was the only physical fitness variable that added sufficiently to the predictor set. Therefore, the measurement of four presurgical MOS SF-36 subscales (Mental Health, General Health Perception, Social Functioning) and elbow flexion were the best five item predictor set for Mental Health. This model explained 61% of the variance in the predicted outcome of Mental Health 3 mo after CABG. No other fitness measures were found to have sufficient predictive value to be selected for the prediction equation for this Mental Health outcome. Therefore, patients who are score higher in Role Physical, General Health Perception, Social Functioning and Mental Health prior to surgery and have higher presurgical strength show better results in Mental Health after surgery.

Combined with other variables, the sum of three skinfolds and elbow flexion were the only fitness variables that contributed to predicting only two of the MOS SF-36 subscales (General Health Perception and Mental Health). Interestingly, General Health Perception and Mental Health were less expected to be predicted by physical fitness measures than the subscales that focused on the physical aspects of the patient's HRQL. Even though the MOS SF-36 contains outcome measures in the physical domain, such as Physical Functioning and Role Physical, presurgical fitness variables did not predict these subscales. Both the sum of three skinfolds and elbow

flexion strength are related to lean body mass. If patients have more muscle mass, most likely they have more strength and less body fat. Therefore, based on the prediction equations, if patients have less body fat they will score higher in general health perception and if they are stronger in the arms, then their mental health scores will be higher. This model supports the subjective idea that the more fit people are the better they feel about their health and self-image. This research does not support the idea of specificity. If a patient is strong, the most practical hypothesis would be that strength would predict high Physical Functioning or Role Physical scores. Instead the General Health Perception and Mental Health subscales were predicted by physical fitness measures.

One reason why specificity was not demonstrated in terms of better predictive between physical fitness predictors and the physical domains of the MOS SF-36 is because there was a ceiling effect on each subscale. For example, those patients who scored near 100 in physical functioning and role physical subscales prior to surgery, could not score any higher than 100 after surgery. As seen in Table 4, Social Functioning, Role Physical, Role Emotional and Bodily Pain subscales all had a high percentage of patients scoring the maximum number of points. Those patients may have displayed significantly more improvement if the scale was not limited. Therefore, the subscales of the MOS SF-36 may not display true representation of the patients potential to improve. McHorney et al. (1994) found very similar results when testing the reliability of the MOS SF-36 across diverse patients groups(15). The researchers reported that six of the eight subscales displayed a floor of less than 5% except in Role Physical and Role Emotional scales. The ceiling effects between

McHorney et al. and this study were also similar. Ceiling was rare in General Health Perception, Energy/Fatigue and Mental Health, modest in Physical Functioning and Bodily Pain and substantial for Role Physical, Role Emotional and Social Functioning subscales. The only major difference between McHorney's research and the current study was a higher ceiling in Bodily Pain in the current study. Therefore, the ceiling effects of the MOS SF-36 remains a limitation in rating progression. Physical fitness measures prior to surgery may have the capability to predict physical and social quality of life domains after surgery using a scale without a ceiling effect. Therefore, the MOS SF-36 may not be the best tool when predicting quality of life after surgery.

In addition to the two physical fitness variables that contributed to predicting General Health Perception and Mental Health, it is important to emphasize the relevance of presurgical quality of life predictors. For both General Health Perception and Mental Health, the matching presurgical subscales prior to surgery were significant predictors. Presurgical General Health Perception was the most powerful and significant contributor for predicting General Health Perception after surgery and presurgical Mental Health was the most powerful and significant contributor for predicting Mental Health after surgery. Presurgical subscales were all highly correlated with postsurgical subscales ($\geq 50\%$) except in Role Physical, Role Emotional and Social Functioning. These two role domains and one social domain were also limited by the ceiling effect mentioned above. Therefore, when measuring quality of life as a tool for postsurgical outcomes, presurgical quality of life predictors prove to be a reliable tool.

Other research has been used to predict HRQL after CABG. Other researchers support the current findings that CABG improves HRQL from pre to postsurgery (4,6,14). Chocron and associates, attempted to predict whether a patient improved or worsened in HRQL scores before and 3 mo after open-heart operations. These researchers used age, sex, occupation, heart disease, angina pectoris status, comorbid diseases, ejection fraction, left ventricular wall motion, surgical procedures and operative complications. The major difference between Chocron's research and the current project is that Chocron analyzed the change score in HRQL without using physical fitness as a predictor, whereas, this paper only attempted predicting the raw HRQL score after CABG and focused on physical fitness. As mentioned before, age was used as a predictor in this research. Age, however, did not show as a significant predictor for any of the MOS SF-36 subscales, as it did in Chocron's research (17).

Therefore, the research objective to determine if physical fitness measures can predict the HRQL outcomes 3 mo after CABG can not be proven based on this research. Physical fitness measures did help predict two subscales significantly. The eight different subscales cover the broad range of contributors that make up HRQL as a whole. Therefore, only being able to predict two subscales is not enough to predict HRQL as an entirety. Physical fitness measures, however, do contribute to predicting general health perception and mental health dimensions of HRQL. If a surgeon were to use these prediction equations on candidates for surgery, physical fitness measures could be used to help predict General Health Perception at 68% confidence and Mental Health at only 61% confidence. The surgeon risks too much error to rely on physical fitness measures alone. Presurgical quality of life scores in combination

with physical fitness would be more accurate in predicting quality of life 3 mo after CABG.

There are several limitations that may have influenced the results of this study. The measurement of HRQL only 3 mo after surgery could have been assessed too soon, due to post CABG soreness of incision in the chest and/or leg and overall anxiety from the surgery itself. Possibly waiting 6 mo after CABG would separate those patients whose physical fitness levels were higher versus those whose were lower prior to CABG and determine how this may affect HRQL after surgery. Another limitation is that the patient selection was somewhat biased. As seen in Table 3 the patients used in this research were very similar to an overall CABG population. The bias occurred in order to refrain from placing frail, ill patients or those who suffered a myocardial infarction < 5 days prior to CABG (11% of study sample vs. 24% overall surgical group). This caused the research population to display less incidence of disease than the non-research population. It would be unethical to recruit these patients and put them at greater risk. Therefore, the results may have been influenced because a broad range of typical CABG patients could not exist in this study. A final limitation was using only the response of the MOS SF-36 3 mo after surgery. As mentioned earlier, Chocron (1996), found significant predictors for whether or not a patient's HRQL improved or worsened after surgery. Perhaps if physical activity were to be used as predictors of the change in HRQL between pre and post CABG, significant results would have been found in this study.

CONCLUSION

The purpose of this study was to determine if presurgical physical fitness measures could be used as valid predictors of one's HRQL 3 mo after CABG. The different variables combined did not significantly predict six of the eight MOS SF-36 subscales. General Health Perception and Mental Health subscales, however, could be predicted with $R^2 = 0.68$ and 0.61 respectively. The baseline HRQL subscales were, however, major predictors that can be used to estimate how people will do after CABG. For example, in order to predict General Health Perception after surgery, measure it prior to surgery. This method will give a better basis to figure out how a patient will do on General Health Perception compared to four or five other variables measured in the physical domain.

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Table 1: Descriptive Statistics N=55^a

	Mean	Standard Deviation
Age, yr	62	8
BMI	29	6
SSF ^b , cm	69	24
METS	5.4	2.5
Prior METS ^c	8	2

^a Male:Female = 45:10

^b Sum of 3 skinfolds

^c METS prior to physical limitations

Table 2: Clinical Characteristics

	Occurrence, percent
Myocardial Infarction	42
Recovery of MI,days ^a	
5-7 days	11
7-21 days	4
> 21 days	27
Diabetes	35
CVA ^b	9
PVD ^c	9
CHF ^d	5
COPD ^e	5
Angina	87
Angina Type	
Stable	65
Unstable	20
Smoking History	67
Current Smoker	18
Family History	14
Hypercholesterolemia	65
Hypertension	67

^a The number of days myocardial infarction took place prior to CABG

^b CVA-Cerebral Vascular Accident

^c PVD- Peripheral Vascular Disease

^d CHF- Congestive Heart Failure

^e COPD- Cardiopulmonary Disease

**Table 3: Clinical Characteristics in Research Patients
versus Non-Research Patients**

Risk Factors	Research Patients in percent (N=55)	Non-Research Patients in percent (N=904)
Male	82	67
Female	18	33
Family History	64	64
Hypercholesterolemia	65	65
PVD ^a	9	17
Diabetes	35	35
COPD ^b	5	15
Myocardial Infarction	42	49
Recovery of MI, days ^c		
1-7 days	11	24
7-21 days	4	4
>21 days	27	19
CHF ^d	5	12
Smoking History	67	65
Current Smoker	25	18

^a PVD- Peripheral Vascular Disease

^b COPD- Cardiopulmonary Disease

^c The number of days myocardial infarction took place prior to CABG

^d CHF- Congestive Heart Failure

Table 4: Descriptive statistics and t-tests for change score between presurgery and postsurgery MOS SF-36 (N=55)

	Presurgery Mean	Postsurgery Mean	Mean Change	t- statistic	p-value	Ceiling (%)	Floor (%)
MOS SF-36 subscales							
GHP ^a	64	71	7	4	.0006	5	0
PF ^b	64	78	14	5	.0001	5	0
SF ^c	79	82	3	1	.2945	38	0
RP ^d	34	46	12	2	.037	22	31
RE ^e	72	73	1	0.2	.84	60	13
BP ^f	60	78	18	7	.001	29	0
MH ^g	78	82	4	3	.0123	7	0
E/F ^h	52	64	12	4	.002	0	0

^a GHP- General Health Perception	^e RE-Role Emotional
^b PF- Physical Functioning	^f BP- Bodily Pain
^c SF- Social Functioning	^g MH-Mental Health
^d RP- Role Physical	^h E/F- Energy/Fatigue
ⁱ LOT- Life Orientation Test	
^j BDI-II- Beck Depression Inventory	

**Table 5: Predicted Three Month Patient Outcomes:
Contribution of Physical Fitness at the Time of CABG**

Outcome: Health-Related Quality of Life Subscales (N=55)

General Health Perception (GHP) = 59.76 -3.18 (current smoker) + .65 (BDI^a) + .72 (Presurgical MOS GHP^b score) -.17(sum of three skinfold measurements) -.82 (MOS SS^c score)

- **Adjusted R² = .68**
 - **Probability >F for predictors**
 current smoker: p= 0.0883
 BDI : p = 0.0447
 GHP: p = 0.000
 Sum 3 skinfolds: p = 0.0067
 MOS Social Support: p = 0.0137
-

Mental Health (MH) = 37 + .05 (Presurgical MOS RP^d score) + .14 (Presurgical MOS GHP^b score) -.25 (Presurgical MOS SF^e score) + .76 (Presurgical MOS MH^f score) -.095 (elbow flexion)

- **Adjusted R² = .61**
 - **Probability > F for predictors**
 GHP: p = 0.0358
 SF: p = 0.0005
 RP: p = 0.1634
 MH: p = 0.0000
 Elbow: p = 0.0509
-

^a Beck Depression Inventory II ^b General Health Perception ^c MOS Social Support Scale ^d Role Physical	^e Social Functioning ^f Mental Health
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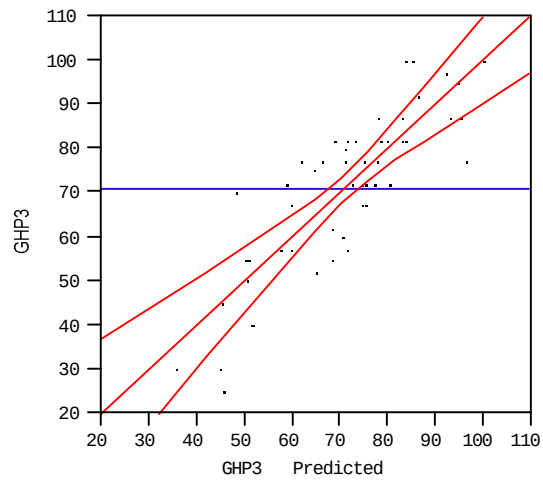


Figure 1: Actual vs. Predicted General Health Perception 3 mo after CABG (GHP3)

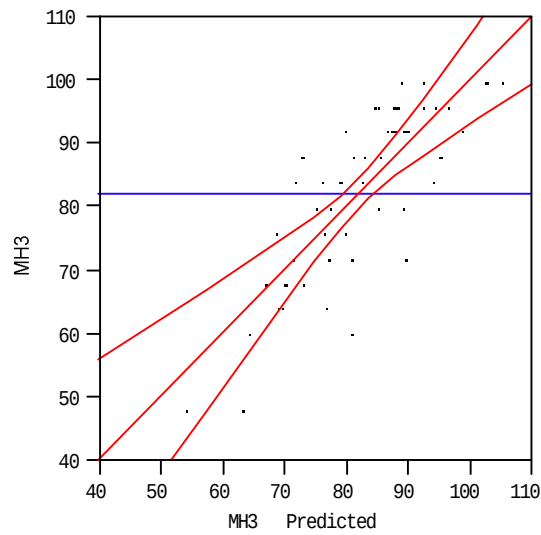


Fig. 2: Actual vs. Predicted Mental Health
3 mo after CABG (MH3)

CHAPTER IV
SUMMARY, CONCLUSIONS
AND
RECOMMENDATIONS FOR FUTURE RESEARCH

SUMMARY

With a rapid increase in the mean age of the population, the incidence of heart disease is also increasing. Coronary artery bypass grafting (CABG) is an option that faces many of these diseased individuals, regardless of age. Before surgery, it is important for both surgeons and patients to be able to predict postsurgical survival rates and the postsurgical quality of life. More specifically, if patients who suffer from coronary artery disease are relatively fit, it is beneficial to know if they also have a better chance of surviving and having a high quality of life following surgery. Therefore, it was the purpose of this study to determine if presurgical physical fitness measures could be used as valid predictors of one's HRQL 3 mo after CABG.

Fifty-five patients (45 men and 10 women) undergoing first time coronary artery bypass grafting were recruited from the Carolinas Medical Center in Charlotte, NC. This recruitment took place anywhere from one week to one day prior to surgery. The patients who agreed to be in the study completed a group of questionnaires and series of physical fitness measures prior to and 3 mo following CABG.

The variables recorded were as follows: age, sex, BMI, isometric grip strength (Grip baseline dynamometer, Country Tech Inc., Gaysmills, WI), isometric elbow flexion strength and knee extension strength (CSV200, Chatillion Co., Greensboro, NC), skinfold measurements (Harpenden, Country Tech. Inc., Gaysmills, WI), hip/waist ratio and METS predicted from the Veterans Specific Activity Questionnaire (VSAQ) (Meyers et al. 1994). The following psycho-social

questionnaires were also completed: The Medical Outcomes Study Short Form 36 item (MOS SF-36) (Tarlov et al. 1989), Medical Outcomes Study Social Support (Sherbourne et al. 1991), Life Orientation Test (optimism and pessimism scale) (Scheier et al. 1989), Health Complaints Scale (cognitive and somatic health complaints scale) (Denollet 1994) and the Beck Depression Inventory II (Beck et al. 1996). In addition to all of the variables above, major comorbid factors (See Table 2) also identified and included a potential predicting HRQL after CABG. The response variable used to measure HRQL after surgery were the eight subscales of the MOS SF-36 only.

CONCLUSIONS

The purpose of this study was to determine if presurgical physical fitness measures could be used as valid predictors of one's HRQL 3 mo after CABG. The different variables combined did not significantly predict six of the eight MOS SF-36 subscales. General Health Perception and Mental Health subscales, however, could be predicted with $R^2 = 0.68$ and 0.61 respectively. The baseline HRQL subscales were, however, major predictors that can be used to estimate how people will do after CABG. For example, in order to predict General Health Perception after surgery, measure it prior to surgery. This method will give a better basis to figure out how a patient will do on General Health Perception compared to four or five other variables measured in the physical domain. Physical fitness variables can be utilized to contribute to predicting certain aspects of HRQL.

RECOMMENDATIONS FOR FUTURE RESEARCH

It is difficult to explain why the physical fitness measures did not display significance in 6 of the 8 MOS SF-36 subscales. This research used a response variable only 3 mo after surgery. Perhaps, 3 mo is too soon after surgery to evaluate and distinguish differences between CABG patients. Patients are still sore where the incisions are healing both in the chest area and the leg (if the Greater Saphenous Vein is used for the bypass graft). The patients are also timid, still worried and anxious about the recovery and worn out with hospital visits. These issues, in turn, could all mentally affect the HRQL, which physical fitness levels most likely would not affect. If the MOS SF-36 questionnaire was completed, greater than or equal to 6 mo after CABG, the HRQL scores may be influenced differently by physical fitness levels. More time after surgery may be a necessity to determine HRQL outcomes. Therefore, the prediction equations developed for this paper should not be used to predict the HRQL of patients 3 mo after CABG.

One limitation of this study is that the patient selection was biased in order not to place very ill or frail patients at any unnecessary risk by performing the strength measurements and moving the patients. Any patient who had a Myocardial Infarction less than or equal to 5 days prior to surgery was not included in the study. The infarcted heart muscle is very weak and exertion could cause further serious injury.

Therefore, the CABG population used for this study most likely does not exactly match the regular CABG population. Frail, weak people may be more likely to be less fit and/or result in mortality. Their fitness measures were not logical to obtain ethically. Those patients who's CABG resulted in complication, not allowing them to return 3 mo after surgery for post-surgery evaluation, were excluded from the study. Also, if a patient data set was incomplete it was excluded. Therefore, the patient population used for this study was biased. It is recommended that future research is needed to develop ways around these biases.

Another recommendation for future research is to evaluate the patient's physical fitness over a longer period of time prior to surgery. A strategy to interpret the activity status within the past 5-10 years would be beneficial. Long term exercise may affect a person's health more so than exercise participation just a few months prior to CABG. Those who exercised a majority of their lives and are recently sedentary may show significant differences than those who were always sedentary. Evaluating long-term exercise routines may help to predict the HRQL after CABG.

A third recommendation for future research is to attempt to predict a change score of HRQL between pre-surgery and post-surgery. As shown in Table 6, there is a significant improvement in change scores for the MOS SF-36 subscales from pre-surgery to 3 mo post CABG. It is important to predict whether or not a patient is going to improve in their HRQL after CABG. If a patient is already scoring very low in their HRQL prior to surgery, their scores may still be low after surgery. However, if the scores were still low after surgery but significantly improve, than to many patients, the CABG would be well worth the money and discomfort of surgery. If the

patient decreases in score or their score does not change from pre to post surgery; however, CABG may not be the procedure that would most benefit that patient. Therefore, an equation to predict the change score of HRQL 3 mo after surgery, could be very valuable information.

A final recommendation for future research, is to use a different tool to measure HRQL after CABG. One reason why specificity did not occur between physical fitness predictors and the physical domains of the MOS SF-36 is because there was a ceiling effect on each subscale. For example, those patients who scored near 100 in physical functioning and role physical subscales prior to surgery, could not score any higher than 100 after surgery. Those patients may have displayed significantly more improvement if the scale was not limited. Therefore, the subscales of the MOS SF-36 may not display true representation of the patients potential to improve. Physical fitness measures prior to surgery may have the capability to predict physical quality of life domains after surgery using a scale without a ceiling effect. Therefore, the MOS SF-36 may not be the best tool when predicting quality of life after surgery.

RECOMMENDATIONS FOR CLINICAL PRACTICE

The research objective to determine if physical fitness measures can predict the HRQL outcomes 3 mo after CABG can not be proven based on this research. Physical fitness measures did help predict two subscales significantly. The eight different subscales cover the broad range of contributors that make up HRQL as a whole. Therefore, only being able to predict two subscales is not enough to predict

HRQL as an entirety. Physical fitness measures, however, do contribute to predicting general health perception and mental health dimensions of HRQL. If a surgeon were to use these prediction equations on candidates for surgery, physical fitness measures could be used to help predict General Health Perception at 68% confidence and Mental Health at only 61% confidence. The surgeon risks too much error to rely on physical fitness measures alone. Presurgical quality of life scores in combination with physical fitness would be more accurate in predicting quality of life 3 mo after CABG.

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APPENDIX A

METHODOLOGY

INTRODUCTION

Patients were recruited before CABG was performed. Recruitment usually took place anywhere from one week prior to surgery to the same day of surgery. The patients were asked to participate in a prospective study for Dr. Joseph Cook at the Carolinas Medical Center, Charlotte, NC. By using the following selected measures from that study, this thesis was completed. The patients were subsequently told about the study and asked to participate in the presurgical fitness tests and a follow-up 3 mo after surgery. Patients were selected to be in the study if they were candidates for CABG but no other surgery. If patients were having a CABG redone, had had a myocardial infarction within the past 5 days, were blind or could not read, they were not asked to participate in the study. After the study was explained and if the patients agreed to participate they signed a informed consent form describing any possible risks and giving permission for the researchers to read their medical files, if necessary. Following the orientation, the questionnaires and fitness measures were performed and used as predictors for this study. Three months after the CABG, the patients returned to the hospital and completed Part E of the questionnaires (the MOS SF-36 explained below).

VETERANS SPECIFIC ACTIVITIES QUESTIONNAIRE (VSAQ)

This questionnaire lists various activities in MET equivalents. The list progresses from less strenuous activities to more strenuous activities. The study

coordinator explained the list to the patients and ask them to underline the activities they had been able to perform, within 2 weeks prior to the interview, without any physical limitations, i.e. angina, dyspnea, fatigue, dizziness. If they had any limitations, they were asked to explain them. Patients were also asked which activities they were able to perform prior to their stated limitations. The questionnaire is made up of different levels of activities increasing in difficulty. These activities range from recreation and exercises to house and yard work. The different levels of activities correspond to increasing MET levels. The scale ranges from 2-13 METs, with the patient expected to score within the range of 3-7 METs (age adjusted $R^2=0.83$, actual $R^2 = 0.62$)(Meyers et al. 1994). The score of less than or equal to 5 METs is considered to indicate a risk of early cardiovascular mortality. With the help of the study technician, the patients read and underlined the activities that they could perform within the last couple of weeks without any discomfort (i.e. shortness of breath, fatigue, and chest pain). They also reported how long they had this limited activity due to discomfort and describe what activities they could participate in before they experienced these limitations. The VSAQ was developed to predict maximal treadmill performance in patients with coronary artery disease, and has been found to be very accurate.

ELBOW FLEXION STRENGTH TEST

(CSV200, Chatillion Co., Greensboro, NC)

1. The patient was seated with feet flat on the floor.
2. The patient was instructed to keep his/her preferred elbow at a 90-degree angle and to push up against the dynamometer once they were cued.
3. It was emphasized that the patients breathe normally and not hold his/her breath when exerting any force.
4. The dynamometer was positioned against the anterior surface of the forearm and the patient was instructed to push up against the dynamometer.
5. Once maximal force was achieved, the number (in pounds) was recorded and steps 1-5 were repeated 3 times. The highest force exerted (in pounds) was the score used.

KNEE EXTENSION STRENGTH TEST

(CSV200, Chatillion Co., Greensborough, NC)

1. The patient was seated on a table so that the back of his/her knees were against the edge of the table with the feet off the ground. The patients hands were not allowed to assist in this activity, but instead were positioned in his/her lap.

2. The patient was instructed to breathe normally and not hold his/her breath during the activity.
3. The researcher positioned the dynamometer against the patient's shin on his/her preferred leg.
4. When the researcher gave the cue, the patient pushed up against the dynamometer with maximal effort.
5. The force (in pounds) was recorded and steps 1-5 were repeated 3 times. The highest of the three recorded efforts was used.

GRIP STRENGTH ASSESSMENT

(Grip Baseline Dynamometer, Country Tech. Inc., Gaysmills, WI)

1. The handgrip was adjusted to mid-range. Usually position 2 for women and position 3 for men.
2. The patient sat in a chair with his/her elbow at a 90-degree angle.
3. The patient held the dynamometer with dominant hand and squeezed it with maximal effort. During this time the patient should not be holding his/her breath.
4. The patient was constantly monitored and asked if he/she was having any discomfort from the exertion.
5. The force measurement was recorded and the test was repeated 3 times. The highest of the 3 recorded efforts were used.

SKINFOLD MEASUREMENTS

(Harpenden Vital Signs, Country Tech. Inc., Gaysmills, WI)

1. Skinfold measurements were taken with Harpenden calipers, John Bull, Ltd. Men had measurements taken at 3 sites (chest, abdomen and thigh). Women had measurements take at 3 sites (triceps, suprailiac and thigh).
2. All measurements were made on the patient's right side.
3. The calipers were placed 1 cm away from the thumb and finger, perpendicular to the skinfold, and halfway between the crest and the base of the fold.
4. The researchers waited 1 to 2 seconds before reading the caliper.
5. The measurements were recorded to the nearest 0.2 mm on data collection sheet.
6. Two measurements for each site were taken, rotating through all the sites before repeating a measurement at a specific site.
7. If repeated measures for a specific site were not within ± 2 mm, then retest the site was re-tested, allowing time for skin to regain normal texture and thickness between measurements. The average of the two or three recorded skin fold measurements was recorded.

Skinfold Sites and Description of Location

1. **Chest:** Diagonal fold, one-half the distance between the anterior axillary line and the nipple.
2. **Abdominal:** Vertical fold, 2 cm to the right of the umbilicus.

3. **Triceps:** Vertical fold on the posterior midline of the upper arm, halfway between the acromion and the olecranon processes, with the arm hanging freely to the side of the body.
4. **Suprailiac:** Diagonal fold, in line with the natural angle of the iliac crest, taken on the anterior axillary line immediately superior to the iliac crest.
5. **Thigh:** Vertical fold, on the anterior axillary midline of the thigh, midway between the proximal border of the patella and the inguinal crease

HIP/WAIST CIRCUMFERENCE MEASUREMENTS

The waist and hip circumferences were taken with a measuring tape and recorded to the nearest 0.1 cm. The waist circumference was taken at the level of the umbilicus. The hip circumference was taken at the largest region of the hips and buttocks. The patient stood erect and relaxed as the measurement was taken. The circumference was only measured once. Waist/hip circumference ratios above .95 for men and .86 for women are ratios indicating increased health risks.

BMI (Body Mass Index)

BMI was calculated by the patient's weight (Kg) divided by height (m^2). These measures were taken on a scale at the Sanger Clinic. BMI was used in this study

as a presurgical fitness assessment. A study performed by Framingham et al. showed significant association between a high BMI and cardiovascular disease. According to the American College of Sports Medicine (1991) the desirable BMI range for women is 21-23 kg/m² and for men, 22-24 kg/m². With BMI ranges greater than or equal to 27.8 kg/m² for men and 27.3 kg/m² for women, the risk of cardiovascular disease significantly increases.

QUESTIONNAIRES

The patients were asked to fill out the following questionnaires (see Chapter II for review of literature on these tools). These questionnaires were also used as predictors in this study. The MOS SF-36 (Part E) was the only questionnaire used as a response measure 3 mo after CABG. Each questionnaire was scored individually and was compared to researched means. The first group of HRQL questionnaires completed by the patients consisted of four parts.

- Part A and B: Health Complaints Scale
- Part C: Medical Outcomes Study (MOS) Social Support
- Part D: Life Orientation Test (LOT)
- Part E: Medical Outcomes Study Short Form-36

The second questionnaire completed by the patients was the Beck Depression Inventory II, which contained questions measuring depression. This questionnaire was also used as a possible predictor of HRQL 3 mo after CABG.

APPENDIX B

HEALTH RELATED QUALITY OF LIFE

QUESTIONNAIRES

Health-Related Quality of Life Questionnaire

Patient Name_____

Date_____

Patient ID#_____

This survey asks for your views about your health and other areas of your life. This information will help keep track of how you feel and how well you are able to do your usual activities.

Part A

Below are a number of complaints that people with health problems often have. Please read each item carefully and indicate how much each problem has bothered you lately: (circle answer).

How much were you bothered by the following **specific** problems:

1) Sleep that is restless or disturbed

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

2) Tightness of the chest

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

3) Feeling that you are not rested

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

4) Fatigue

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

5) Trouble falling asleep

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

6) Inability to take a deep breath

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

7) Stabbing pain in the heart

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

8) Feeling exhausted without and reason

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

9) Shortness of breath

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

10) Pain in heart or chest

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

11) Feeling weak

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

12) Feeling you can't sleep

- 0. Not at all
 - 1. A little bit
 - 2. Moderately
 - 3. Quite a bit
 - 4. Extreme
-

Part B

How much have the following **general** problems bothered you lately:

1) The idea that your bad health is the biggest problem in your life

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

2) Not being able to work fluently, also with hobbies

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

3) Being afraid of illness

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

4) The idea that you were able to take on much more work formerly

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

5) Feeling blocked in getting things done

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

6) The idea that you have a serious illness

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

7) Feeling you are not able to do much

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

8) The idea that something serious is wrong with your body

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

9) Feeling that you are no longer worth as much as you used to be

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

10) Feeling despondent (having lost all hope)

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

11) Worrying about you health

- 0. Not at all
- 1. A little bit
- 2. Moderately
- 3. Quite a bit
- 4. Extreme

12) Thinking that all your worries would be over if you were physically healthy

- 0. Not at all
 - 1. A little bit
 - 2. Moderately
 - 3. Quite a bit
 - 4. Extreme
-

Part C

Below are some questions about the support that is available to you.

1. About how many close friends and close relatives do you have (people you feel at ease with and can talk about what is on your mind)? Write the number of close friends and relatives: _____

2. What is you CURRENT marital status (circle one)

- 1. Never married
- 2. Presently married
- 3. Living in a marriage-like relationship
- 4. Divorced or separated
- 5. Widowed

3. INCLUDING YOURSELF, how many people are NOW living in your home?

People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it? (circle answer)

4. Someone to confide in or talk to about yourself or your problems.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

5. Someone to prepare your meals if you were unable to do it yourself.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

6. Someone to help with daily chores if you were sick.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

7. Someone to share your most private worries and fears with.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

8) Someone to turn to for suggestions about how to deal with a personal problem.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

9. Someone to do something enjoyable with.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

10) Someone to love and make you feel wanted.

1. None of the time
2. Little of the time
3. Some of the time
4. Most of the time
5. All of the time

Part D

Circle the answer that best describes how you feel about each statement.

1. I always look on the bright side of things.

- 0. Strongly Disagree
- 1. Disagree
- 2. Neutral
- 3. Agree
- 4. Strongly Agree

2. I'm always optimistic about my future.

- 0. Strongly Disagree
- 1. Disagree
- 2. Neutral
- 3. Agree
- 4. Strongly Agree

3. I hardly ever expect things to go my way.

- 0. Strongly Disagree
- 1. Disagree
- 2. Neutral
- 3. Agree
- 4. Strongly Agree

4. Things never work out the way I want them to.

- 0. Strongly Disagree
 - 1. Disagree
 - 2. Neutral
 - 3. Agree
 - 4. Strongly Agree
-

Part E

Below are questions that ask your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Please Circle your answers.

1. In general, would you say your health is:

- 1. Excellent
- 2. Very Good
- 3. Good
- 4. Fair
- 5. Poor

2. Compared to one year ago, how would you rate your health in general now?

- 1. Much better than one year ago
- 2. Somewhat better than one year ago
- 3. About the same as one year ago
- 4. Somewhat worse now than one year ago
- 5. Much worse now than one year ago

3. The following items are activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

c. Lifting or carrying groceries

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

d. Climbing *several* flights of stairs

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

e. Climbing *one* flight of stairs

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

f. Bending, kneeling or stooping

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

g. Walking *more than a mile*

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

h. Walking *several blocks*

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

i. Walking *one block*

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

j. Bathing or dressing yourself

1. Yes, limited a lot
2. Yes, limited a little
3. No, not limited at all

4. Have you had any of the following problems with your regular daily activities lately, as a result of your physical health?

a. Cut down on the amount of time you spend on work or other activities

1. Yes
2. No

b. Accomplished less than you would like

1. Yes
2. No

c. Were limited in the *kind* of work or other activities

1. Yes
2. No

d. Had difficulty performing your work or other activities (extra effort)

1. Yes
2. No

5. Have you had any of the following problems with your work or other regular daily activities lately, as a result of any emotional problems (such as feeling depressed or anxious)?

- | | |
|---|---|
| a. Cut down the amount of time
you spent on work or other activities | b. Accomplished less than you would
like |
| 1. Yes | 1. Yes |
| 2. No | 2. No |

- b. Didn't do work or other activities as carefully as usual**
1. Yes
 2. No

6. To what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

1. Not at all
2. Slightly
3. Moderately
4. Quite a bit
5. Extremely

**7. How much bodily pain have you
had lately?**

1. None
2. Very mild
3. Mild
4. Moderate
5. Very Severe

**8. How much bodily pain interfered
With your normal daily activities?**

1. Not at all
2. A little bit
3. Moderately
4. Quite a bit
5. Extremely

- 8. The following questions are about how you fell and how things have been with you lately. For each question, please give the one answer that comes the closest to the way you have been feeling.**

Lately, how much of the time:

a. Did you feel full of pep?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

b. Have you been a very nervous person?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

c. Have you felt so far down in the dumps that nothing could cheer you up?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

d. Have you felt calm and peaceful?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

e. Did you have a lot of energy?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

f. Have you felt downhearted and blue?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

g. Did you feel worn out?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

h. Have you been a happy person?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

i. Did you feel tired?

1. All of the time
2. Most of the time
3. A good bit of the time
4. Some of the time
5. A little of the time
6. None of the time

10. Lately, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

1. All of the time
2. Most of the time
3. Some of the time
4. A little of the time
5. None of the time

11. How TRUE or FALSE is each of the following statements for you?

a. I seem to get sick a little easier than other people.

1. Definitely True
2. Mostly True
3. Don't Know
4. Mostly False
5. Definitely False

b. I am as healthy as anybody I know.

1. Definitely True
2. Mostly True
3. Don't Know
4. Mostly False
5. Definitely False

c. I expect my health to get worse.

1. Definitely True
2. Mostly True
3. Don't Know
4. Mostly False
5. Definitely False

d. My health is excellent.

1. Definitely True
2. Mostly True
3. Don't Know
4. Mostly False
5. Definitely False

12. Please answer Yes or No for each question.

- a. In the past year, have you had 2 weeks or more during which you felt sad, blue or depressed; or when you lost all interest or pleasure in things you usually cared about or enjoyed?**
 - 1. Yes
 - 2. No

- b. Have you had 2 years or more in your life when you felt depressed or sad most days, even if you felt okay sometimes?**
 - 1. Yes
 - 2. No

- c. Have you felt depressed or sad much of the time in the past year?**
 - 1. Yes
 - 2. No

APPENDIX C

VETERANS SPECIFIC ACTIVITY QUESTIONNAIRE
(VSAQ)

The Veterans Specific Activity Questionnaire (VSAQ)

Draw one line below the activities you are able to do routinely with minimal or no symptoms such as shortness of breath, chest discomfort, fatigue

- 1 MET - Eating, getting dressed, working at a desk.
- 2 METs - Taking a shower, walking down eight flights of steps.
- 3 METs - Walking slowly on a flat surface for one or two blocks. A moderate amount of work around the house, like vacuuming, sweeping the floors or carrying groceries
- 4 METs - Light yard work, i.e., raking leaves, weeding or pushing a power mower. Painting or light carpentry
- 5 METs - Walking briskly, i.e., four miles in one hour; social dancing; washing the car; spreading dirt with a shovel; carrying, loading, or stacking wood.
- 6 METs - Play nine holes of golf carrying your own clubs. Heavy carpentry; mow lawn with a push mower.
- 7 METs – Perform heavy outdoor work, i.e., digging, spading soil, etc. Play tennis (singles), carry 60 pounds, shoveling 10-15 pounds per minute.
- 8 METs – Move heavy furniture, job slowly, climb stairs quickly, carry 20 pounds upstairs.
- 9 METs - Bicycling at a moderate pace, sawing wood, jumping rope (slowly), heavy shoveling (digging ditches).
- 10 METs. – Brisk swimming, bicycle up a hill, walking briskly up a hill, job 6 miles per hour.
- 11 METs – Cross country ski, play basketball (full court), running 9 minutes per mile.
- 12 METs - Running briskly, continuously (level ground, 8 minutes per mile)
- 13 METs - Any competitive activity, including those which involve intermittent sprinting. Running competitively, rowing, backpacking.

1. Looking at the VSAQ, underline the activities that you are now able to do routinely with minimal or not symptoms such as shortness of breath, chest discomfort, or fatigue.

Not look down the page and find the activity that you just underlined that appears closest to the bottom. What is the number that appears to the left of that activity?

_____ METs

2. Did you notice any new and unusual feelings of discomfort, pain, fatigue, or anything else in the past that seems to be associated with your heart disease condition, and caused you to have to reduce your physical activity? Please describe these feelings; _____

3. Please estimate (as best as you can) when you first experienced these feelings. (month, day, year) _____

4. How long have you been at a reduced level of physical activity because of the sign/symptom?

5. Look back at the VSAQ. Think back to the period of time before you began to experience the symptoms that you just described. Find the activity that appears closest to the bottom of the page that you were able to routinely do with minimal or no symptoms such as shortness of breath, chest discomfort or fatigue. What is the number that appears to the left of this activity? _____ METs

APPENDIX D

INFORMED CONSENT

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Clinical, Physical, and Quality of Life Variables in Patients after Coronary Artery Bypass Graft Surgery

INTRODUCTION

You are being asked to participate in a research study to be conducted by Joseph Cook, M.D. at the Carolinas Heart Institute (CHI). The purpose of this study is to determine if physical, psychological, and nutritional status are important factors in determining how well patients do after coronary artery bypass surgery. This will involve completing questionnaires and having non-invasive measurements made before and after your surgery. You will be one of approximately 200 people involved in this research at CHI, and your participation will last approximately 1 year.

PROCEDURE

Two types of test will be used. Some will involve answering questions about yourself and will include evaluation of how you feel about your ability to tolerate activities involving exercise, your ability to perform self care and daily living activities at home, your feeling of well being, your health, your quality of life, and your diet. Other non-invasive tests will include determining your body composition by measuring the thickness of a skin fold, grip strength by squeezing a hand-held device, and upper body strength by pushing against or pulling on a small machine with your hands.

These test will be done at the time of your surgery and/or at 3 and 12 months after surgery. Also a at three months after your surgery and again at 12 months, you will be tested to maximum effort on a treadmill, and your ECG, heart rate, and blood pressure will be evaluated by a physician. In addition, at surgery and at 12 months, you will receive a non-invasive low-energy x-ray scan (DEXA) to determine the percentage of your body that is fat or muscle and to determine the quality of your bones.

RISKS

None of the test should cause any foreseeable risks or discomfort. The strength tests are of low intensity and the treadmill test will be the same maximal effort evaluation you took before you surgery. These test will be closely monitored during their administration. The amount of x-ray exposure from the DEXA scan will be very low.

Patient/Guardian
Initials

EXCLUSION CRITERIA

You should not participate in this study if:

You have any circulatory, joint, nerve, or emotional disorders that would not allow completions of the items being tested.

You are taller than 6' or you weigh more than 220 lb.

BENEFIT

There may be not direct benefit to you for participating in this study, but the information gained may benefit others with your condition. Being able to better predict who will benefit most from coronary artery bypass surgery would result in better treatment and rehabilitation planning for future patients. At the conclusion of participation in the study, your results will be forwarded to your personal physician and may be used in planning your future health care.

ADDITIONAL COST

There will be no additional cost to you for participating in this study.

COMPENSATION

In the event that physical injury occurs as a result of this research project, medical treatment will be available. This treatment, as well as other medical care expenses, will be your responsibility or may, in some instances, be paid for you by your health insurance. No compensation or reimbursement will be available from the Carolinas HealthCare System, or from Joseph Cook, M.D., John Fedor, M.D., Parks Griffith, M.A., William Herbert, Ph.D., Warren Ramp, Ph.D., Gary Keibzak, Ph.D., or James Norton, Ph.D.

WITHDRAWAL

Participation in this study is voluntary. You may refuse to participate or you may withdraw from the study at any time. This will result in no penalty or loss of benefits to which you are otherwise entitled. You will be notified of significant new findings that may affect your treatment or your willingness to continue in the study.

CONFIDENTIALITY

The record of your visits will be in your medical record and is accordingly confidential. Other study records will be maintained by the investigator in a likewise confidential manner. Records pertaining to this study may be examined and/or copied by Joseph Cook, M.D. This research may result in scientific presentations and publications, but precautions will be taken to make sure that you are not identified by name.

Patient/Guardian
Initials

FINANCIAL INTEREST OF THE INVESTIGATOR

As the principal investigator, I (Joseph Cook, M.D.), as well as the co-investigators (John Fedor, M.D., Parks Griffith, M.A., William Herbert, Ph.D., Warren Ramp, Ph.D, Gary Kiebzak, Ph.D., and James Norton Ph.D.), will not receive compensation for your involvement in this study.

QUESTIONS

For more information concerning the research and research-related risks or injuries, you may contact the principal investigator, Dr. Joseph Cook at (704) 373-1500. In addition, you may contact the chairman of the Institutional Review Board of the Carolinas HealthCare System for information regarding patient rights in a research study. You can obtain the name and number of this person by calling (704) 355-3158.

CONSENT

I hereby give my consent to participate in this study. I have read all of the above or have heard it read to me. I have had the opportunity to ask questions about this study, and my questions have been answered. A copy of this consent form has been provided to me.

Patient Printed Name

Patient/Guardian Signature

Date

Witness Signature

Date

Investigator Signature

Date

APPENDIX E

STRENGTH ASSESSMENT DATA SHEET

Dynamometer Strength & Body Composition Data Collection Form

Patient Name _____

Test Date ____/____/____

Patient ID _____

Test Interval _____

Strength Assessment

Grip: Position _____ Trial 1 ____ lbs Trial 2 ____ lbs Trial 3 ____ lbs **Average** ____ lbs

Elbow Flexion: Trial 1 ____ lbs Trial 2 ____ lbs Trial 3 ____ lbs **Average** ____ lbs

Knee Extension: Trial 1 ____ lbs Trial 2 ____ lbs Trial 3 ____ lbs **Average** ____ lbs

Skinfold Assessment

Skinfold Sites for Men:

Chest: Trial 1 ____ mm Trial 2 ____ mm Trial 3 ____ mm **Average** ____ mm

Abdominal: Trial 1 ____ mm Trial 2 ____ mm Trial 3 ____ mm **Average** ____ mm

Thigh: Trial 1 ____ mm Trial 2 ____ mm Trial 3 ____ mm **Average** ____ mm

Sum of 3 sites: ____ mm

Skinfold Sites for Women:

Triceps: Trial 1 ____ mm Trial 2 ____ mm Trial 3 ____ mm **Average** ____ mm

Suprailliac: Trial 1 ____ mm Trial 2 ____ mm Trial 3 ____ mm **Average** ____ mm

Thigh: Trial 1 ____ mm Trial 2 ____ mm Trial 3 ____ mm **Average** ____ mm

Sum of 3 sites: ____ mm

Circumferences:

Waist Circumference: ____ mm

Hip Circumference: ____ mm

Waist/Hip Ratio = ____

Body Mass Index:

Weight: ____ kg

Height: ____ m

BMI=kg/(m²) = ____

APPENDIX F

PATIENT INFORMATION SHEET

Patient Information

Full Name _____

Today's Date _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: (____) _____

Date of Birth _____ Age _____

Please check the highest education level that you obtained:

Grade _____	_____ completed high school
___ associate college degree	___ bachelor's degree
___ master's degree	___ Ph.D or M.D.

Race: ___ Caucasian ___ Black ___ Hispanic

___ Native American ___ Asian ___ Other

Gender: ___ Male ___ Female

APPENDIX G

DESCRIPTIVE CHARACTERISTICS OF

PRESURGICAL PYSCHOSOCIAL QUESTIONAIRES

Table 1: Presurgical Psychosocial Characteristics (N=55)

Questionnaire	Mean	SD	Max	Min
MOS Social Support	31	5	35	13
Health Complaints Scale				
Somatic Health Complaints	11	6	30	1
Cognitive Health Complaints	14	10	44	0
Life Orientation Test	11	3	16	5
Beck Depression Inventory	7	5	26	0

APPENDIX H

STATISTICAL TABLES OF

PREDICTION EQUATIONS FOR

HEALTH RELATED QUALITY OF LIFE

(MOS SF-36)

**Table 2: Predicted Three Month Patient Outcomes:
Contribution of Physical Fitness at the Time of CABG**

Outcome: Health-Related Quality of Life Subscales (N=55)

General Health Perception (GHP) = 59.76 -3.18 (current smoker) + .65 (BDI^a) + .72 (Presurgical MOS GHP^b score) -.17(sum of three skinfold measurements) -.82 (MOS SS^c score)

- **Adjusted R² = .68**
- **Probability >F for predictors**
current smoker: p= 0.0883
BDI : p = 0.0447
GHP: p = 0.000
Sum 3 skinfolds: p = 0.0067
MOS Social Support: p = 0.0137

Mental Health (MH) = 37 + .05 (Presurgical MOS RP^d score) + .14 (Presurgical MOS GHP^b score) -.25 (Presurgical MOS SF^e score) + .76 (Presurgical MOS MH^f score) -.095 (elbow flexion)

- **Adjusted R² = .61**
- **Probability > F for predictors**
GHP: p = 0.0358
SF: p = 0.0005
RP: p = 0.1634
MH: p = 0.0000
Elbow: p = 0.0509

^a Beck Depression Inventory II ^b General Health Perception ^c MOS Social Support Scale ^d Role Physical	^e Social Functioning ^f Mental Health
--	---

**Table 3: Predicted Three Month Patient Outcomes of Remaining
MOS SF-36 Subscales**

Outcome: Health-Related Quality of Life Subscales (N=55)

Physical Functioning (PF) = 53.58 + -3 (Family History) + -2.95 (Diabetes) + .10 (Pre Role Physical) + .31 (Pre General Health Perception)
Adjusted R² = .27

Social Functioning (SF) = 11 + -5.88 (smoking history) + 1.59 (BDI-II) + .373 (Pre Physical Functioning) + -6.64 (Gender) + .478 (Pre Mental Health)
Adjusted R² = .23

Role Physical (RP) = -45.47 + -16.34(CVA) + .66 (Pre Physical Functioning) + .68 (Pre Bodily Pain) + 1.92 (Somatic Health Complaints)
Adjusted R² = .20

Role Emotional (RE) = 18.77 + .223 (Pre Role Emotional) + .713 (Pre Mental Health) + -.325 (Knee Flexion)
Adjusted R² = .15

Bodily Pain (BP) = 95 + 8.02 (CVA) + .25 (Pre General Health Perception) + .33 (Bodily Pain) + -1.21 (BMI) + .20 (Sum of 3 skinfolds) + -.48 (Ejection Fraction)
Adjusted R² = .39

Energy/Fatigue (E/F) = 38 + .17 (Pre Energy/Fatigue) + .27 (Pre General Health Perception) + -2.9 (current smoker)
Adjusted R² = .33

APPENDIX I

RAW DATA

DEFINITIONS FOR VARIABLES IN RAW DATA

1. Smoking = Smoking History
2. Current Smoker = If the patient is a current smoker
3. Family Hx = Family History
4. Hyperchol = Hypercholesterolemia
5. CVA = Cerebrovascular accident (stroke)
6. COPD = Cardiopulmonary disease
7. PVD = Peripheral vascular disease
8. CVD = Cardiovascular disease
9. MI = myocardial infarction
10. MI-when = Number of days prior to CABG that MI took place
11. Stable = stable angina
12. Unstable = unstable angina
13. Pre BDI = presurgical Beck Depression Inventory-II score
14. Pre LOT = presurgical Life Orientation Test score
15. BMI = body mass index
16. TricepAve = average of tricep skinfolds
17. AbAve = average of abdominal skinfolds
18. ChestAve = average of chest skinfolds
19. SupraAve = average of supriliac skinfolds
20. ThighAve = average of thigh skinfolds
21. 1 waist circ = presurgical waist circumference
22. 1 hip circ = presurgical hip circumference
23. Grip = Grip strength
24. Grip/weight = grip strength divided by weight
25. Elbow = elbow flexion strength
26. Elbow/weight = elbow flexion strength divided by weight
27. Knee = knee extension strength
28. Knee/weight = knee extension strength divided by weight
29. MOS SS = Medical Outcomes Study Social Support
30. CHCS = cognitive health complaints scale
31. SHCS = somatic health complaints scale
32. Actual METS = METS reported by patient from VSAQ
33. Prior METS = METS reported by patient prior to limitations from VSAQ
34. Predicted METS = METS reported by patient from VSAQ adjusted for age
35. 1 in front of variable = presurgical measure
36. 3 in front of variable = postsurgical measure
37. GHP = General Health Perception
38. PF = Physical Functioning
39. SF = Social Functioning
40. RP = Role Physical
41. RE = Role Emotional
42. BP = Bodily Pain
43. MH = Mental Health
44. E/F = Energy/Fatigue

VITA

Ila Kristen Bass was born on January 18, 1974 in Buffalo, NY. She has an older brother, Derek, and a younger sister, Melinda. Kristen is engaged to be married to Max Fletcher on August 22nd, 1998. Kristen moved to Chester, NJ in the second grade where she grew to love physical activity and athletics. Kristen attended Mendham High School where she played soccer and basketball. Upon completion of high school, Kristen moved to Blacksburg, VA where she attended Virginia Polytechnic Institute and State University. While at VA Tech, she became involved in various activities, some of which include: Delta Delta Delta sorority, sorority Activities Chair, volunteer work and intramural sports. Kristen received a Bachelor of Science in Human, Nutrition, Foods and Exercise in May 1996.

Early that Spring, Kristen decided to continue her education at Va. Tech and begin working on her Masters degree in Clinical Exercise Physiology, with an emphasis on cardiac rehabilitation. Upon completion of her degree, Kristen plans to continue work in this field. Kristen's career goal is to work in the field of cardiac rehabilitation, preferably in a hospital setting.

Ila Kristen Bass

