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Coronary Heart Disease Risk Stratification in Full-time Miami Valley Hospital Employees

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CORONARY HEART DISEASE

RISK STRATIFICATION IN FULL-TIME

MIAMI VALLEY HOSPTIAL EMPLOYEES

A thesis submitted in partial fulfillment
of the requirements for the degree of
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By

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Vicki K. Streng ENTITLED Coronary Heart Disease Risk Stratification in Full-Time Miami Valley Hospital Employees BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science.

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ABSTRACT

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Introduction: Heart disease is the number one killer in the United States (American Heart Association, 2005). The purpose of this study was to demonstrate the results of a twelve-week exercise program on coronary heart disease risk factors in full-time hospital employees. **Methods:** The participants were given cardiovascular, weight training, and flexibility recommendations to follow during a twelve-week period. The main heart disease risk factors measured before and after the completion of the exercise program were blood pressure, total cholesterol, HDL-cholesterol, and body mass index. The information was put into the Framingham Heart Score to estimate the participants' 10-year risk of developing heart disease. Other factors measured to show the benefits of exercise included resting heart rate, weight, body fat percentage, waist and hip ratio, maximal oxygen uptake (VO_2), and flexibility. **Results:** There were no significant results from any measurements taken.

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I. INTRODUCTION

The established major risk factors for coronary heart disease include obesity, high blood pressure, impaired fasting glucose, smoking, physical inactivity, high cholesterol, and family history (Centers for Disease Control, 2005). According to a recent report by the Surgeon General (2005), “More than 61 million Americans suffer from some form of cardiovascular disease, including high blood pressure, coronary heart disease, stroke, congestive heart failure, and other conditions. More than 2,600 Americans die every day because of cardiovascular diseases, about 1 death every 33 seconds.” In addition, approximately 13.5 million Americans have diagnosed coronary heart disease (Center for Disease Control, 2005). In 2003, approximately 1.1 million Americans suffered from a new or recurrent coronary attack (Center for Disease Control, 2005). Today, substantial data exist on the benefits of physical activity in both primary and secondary prevention of cardiovascular disease (Fletcher, 1997, p.355).

Wannamethee and Shaper (2001, p.102) used epidemiological evidence to demonstrate the value of leisure time physical activity in reducing heart disease and death in middle age adults, regardless of population subgroup. The Surgeon General (2005) further determined that a moderate amount of physical activity on most, if not all, days of the week would be beneficial in improving health and wellness of all Americans. Even with a vast amount of corroborating evidence demonstrating the positive effects of exercise on health, the American people continue to lead sedentary lives. A major problem for most individuals was determining just “how much” exercise was appropriate.

To assist beginning exercisers, The American College of Sports Medicine (ACSM) and the Centers for Disease Control (CDC) developed general exercise prescription recommendations. In short, adults were encouraged to accumulate thirty minutes or more of moderate-intensity physical activity on most, if not all, days of the week (Pate, et al., 1995). More and more, Americans were being encouraged to exercise for health, not fitness. Still, in 2001, The Morbidity and Mortality Weekly reported that 54.6% of people were not active enough to meet the recommendations of a minimum of 30minutes of moderate-intensity activity on most days of the week.

Obesity is at an all time high in the United States and physical inactivity is the major cause. The latest statistics gathered from the National Health and Nutrition Examination Survey for 1999–2002 and reported by the CDC, demonstrate that more than 30% of adults are obese with a body mass index (BMI) greater than 30 kg/m^2 and another 65% are considered overweight or obese with a BMI greater than 25 kg/m^2.. In 1985, the CDC began collecting data on obesity (Behavioral Risk Factor Surveillance System) from individual states. At that time, with few states participating, no state reported an obesity prevalence at or above 20%. In 2004, thirty-three states reported a prevalence of 20 to 25 percent and nine states reported a prevalence of 25 percent.

Statement of Problem

For several years, (find out how many) coronary heart disease has been the single leading cause of death in the United States (American Heart Association, 2005). In 2001, heart disease was the most common cause of death in Ohio; accounting for 32,453 deaths or 30% of all deaths (Center for Disease Control, 2005). Often times, doctors and nurses treating patients with CHD have the disease themselves and have to be treated by their peers. A former patient at the hospital commented, “The doctors and nurses at this particular hospital are overweight and it is hard to take advice from them when they do not take their own advice to be healthy.” Many employees at this same hospital may be at equal risk for coronary heart disease.

Significance and Justification

It is well established that physical inactivity and a sedentary lifestyle significantly contribute to the development of CHD (Kokkinos and Fernhall, 1999, p. 308). The prevalence of risk factors for coronary heart disease is increasing, which reflects the growing occurrences of CHD incidences every year (American Heart Association, 2005). Some of these risks for coronary heart disease can be reduced or minimized through programs that include physical fitness (Bertoli et al. 2003). A study conducted by Powell and colleagues (year) reported that adults who are physically active were half as likely to have CHD compared to adults who were sedentary. This study also stated that two-thirds of (previous) studies relating to heart disease and physical activity noted that a sedentary lifestyle encourages the onset of the disease. All current studies report that adults who are physically active have a significantly lower rate of CHD when compared to their sedentary counterparts; thus, exhibiting a relationship between level of physical activity and the risk of CHD (Puffer, 2001, p. 1). The authors reported that the highest reduction in CHD risk occurred when adults involved in training studies advanced from the least fit fitness group to a moderately active fitness group. Overall, a lower death rate from cardiovascular disease was found among higher fitness groups (Puffer, 2001, p. 2).

The Surgeon General has reported that physical activity reduces risks of CHD such as developing diabetes, high blood pressure, obesity, and high cholesterol (Center for Disease Control, 2005). In addition, data suggest that physical activity will decrease the likelihood of dying prematurely from heart disease (Center for Disease Control, 2005). The American Heart Association encourages physicians and their staff to discuss physical activity with their patients and provide an exercise prescription for the patients and family. The discussion of exercise prescription for the patients should take place at the physician's office. If appropriate for the patient, suggestions could be made about implementing physical activity recommendations at the worksite (Fletcher, 1997, p.355).

Statement of Purpose

The purpose of this study was to demonstrate the results of a regular exercise program on coronary heart disease risk factors in full-time hospital employees. Hospital employees provided an excellent way to demonstrate that although employees know exercise is important, rarely put that knowledge into practice. It was also a purpose of this study to determine if health care professionals in a major metropolitan hospital were susceptible to coronary heart disease.

Hospital employees who did not meet the exercise minimum recommendation of the CDC and ACSM and those who considered themselves sedentary (no physical activity) were used as subjects in this study. The subjects were then assigned to a group based upon BMI. The risk factors studied included obesity, hypertension, and cholesterol levels. The Framingham Heart Score was then calculated to determine the participants' 10-year risk of CHD.

Hypotheses

Several hypotheses were developed to answer the concerns of this study.

Null Hypothesis: The overall 10-year risk of coronary heart disease will not be lowered as demonstrated by the Framingham Heart Score

H_{01}: Incorporating a regular exercise program will not decrease the subjects' total cholesterol.

H_{02}: Incorporating a regular exercise program will not increase the subjects' individual high-density lipoprotein level.

H_{03}: Incorporating a regular exercise program will not affect the subjects' individual body mass index.

H_{04}: Incorporating a regular exercise program will not affect the subjects' individual blood pressure.

Definitions

For the purpose of the study, the following variables were defined.

Blood Pressure – the force of blood against the walls of arteries. Blood pressure is recorded as two numbers—the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats). (National Heart, Lung, and Blood Institute, 2005)

Body Mass Index – a clinical indicator of obesity; determined by dividing the individual's weight in kilograms by height in meters squared (ACSM, 2006, p. 58), operationally, for this study, subjects were divided into two groups based upon BMI: BMI 1 $\leq$ 30 kg/m^2 and BMI 2 > 30 kg/m^2

Cardiorespiratory Exercise Program – a program designed so that participates will remain active for prolonged periods of time in large muscle, dynamic, and moderate-to-high intensity exercise (ACSM, 2006, p. 66)

Cholesterol – soft, fat-like, waxy substance found in the bloodstream and in all body cells (American Heart Association, 2005)

High-Density Lipoprotein Cholesterol (HDL-C) - a subfraction of total cholesterol; considered the "good" cholesterol and important in heart health (American Heart Association, 2005)

Coronary Heart Disease (CHD) - the process of the hardening and narrowing of the blood vessels that supply blood to the heart (National Heart, Lung, and Blood Institute, 2005)

Framingham Heart Score - identifies the common factors or characteristics that contribute to cardiovascular disease by using a predictive algorithm to estimate a 10-year risk for developing heart disease (National Heart, Lung, and Blood Institute, 2005)

CHD Risk Stratification–

Low Risk – Men ≤ 45 years of age and women ≤ 55 years of age who are asymptomatic and meet no more than one risk factor threshold from CHD risk factors (ACSM, 2006, p. 27)

Moderate Risk – Men $<$ 45 years of age and women $<$ 55 years or those who meet the threshold for two or more CHD risk factors (ACSM, 2006, p. 42)

High Risk – Individuals with one or more signs and symptoms or known cardiovascular, pulmonary, or metabolic disease (ACSM, 2006, p. 42)

Hospital Employee – a person who works a minimum of 35 hours a week as a nurse, doctor, or in similar health professional positions

Physical Activity - planned or structured; involves repetitive bodily movement done to improve or maintain one or more of the components of physical fitness - cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body fat percentage. Operationally, initial levels of physical activity for the participants in this study were based upon meeting the activity recommendations of ACSM and the CDC (Center for Disease Control, 2005).

Risk Factor – a condition or habit that makes a person more likely to develop a disease; can also increase the chances that an existing disease will get worse (National Heart, Lung, and Blood Institute, 2005).

Assumptions

There were assumptions regarding the validity of the study results and subject behavior and adherence. It was assumed that:

1. The exercise logs truthfully represented the subjects' exercise routine.
2. The subjects completed all three assessments during the designated weeks.
3. Those who assisted with testing and assessments followed the prescribed protocols precisely as trained from pre- to post-testing sessions.

Summary

Physical activity is associated with a reduction in CHD mortality (Kokkinos and Fernhall, 1999, p.307). Numerous data demonstrate a direct relationship between physical inactivity and obesity as established risk factors for heart disease and cardiovascular mortality (Fletcher et al. 1996). The purpose of this study was to implement a twelve-week guided exercise program and monitor the reduction in CHD risk factors from a pre- to post-assessment result comparison. The study used hospital employees who know how to decrease their risks for heart disease, yet remain relatively sedentary and like their patients, may be at risk for CHD. The study focused on the risk factors for coronary heart disease by using the 10-year Framingham Heart Score to predict the development of

CHD. A secondary goal of the study was to have hospital employees experience physical activity and observe first-hand the benefits of exercise. It was believed that if these health professionals could experience the benefits of physical activity, they would then be able to share with patients the positive health changes expected.

II. REVIEW OF THE LITERATURE

Coronary Heart Disease

Coronary heart disease is the process of the hardening and narrowing of the blood vessels that supply blood to the heart. Atherosclerosis causes the hardening of the arteries by plaque buildup on the inner walls. The narrowing reduces the blood flow to the heart muscles, often resulting in a myocardial infarction (NHLBI, 2005). Observable symptoms of CHD include pain (angina) in the chest, arms, shoulder, neck, jaw, or back, and a shortness of breath. The display of the symptoms varies depending on the severity of the plaque buildup. Some individuals do not display any symptoms until a myocardial infarction occurs (NHLBI, 2005).

Coronary heart disease is the single leading cause of death in the United States (Report of the Surgeon General, 1999). In 2002, one in every five deaths in the United States was directly related to CHD. Coronary heart disease accounts for over half of cardiovascular events for men and women under the age of 75 years. Women have a 32% chance of developing CHD while men have 40 to 49% chance of developing CHD. Individuals, who experience a coronary incident, have a 41% chance of dying from the event (American Heart Association, 2005). Coronary heart disease risk increases with age (Wood, 2001). Individuals who have a number of mildly elevated risk factors have an absolute greater CHD risk than those with one high risk factor (Wood, 2001). The presence of multiple risk factors increases the mortality rate (Bertoli et al. 2003).

Coronary heart disease is significantly related to the following risk factors: obesity, inactivity, smoking, diabetes, and smoking (Thaulow and Fredriksen, 2004, p.35).

The Adult Treatment Panel (ATP) III guidelines classify individuals into three categories: (1) established CHD and CHD risk equivalent, (2) multiple (2+) risk factors, (3) zero to one risk factor (Grundy et al. 2004). Coronary heart disease risk equivalent established by ATP III are noncoronary forms of clinical atherosclerotic disease, diabetes, and multiple (2+) CHD risk factors. Individuals that have CHD or CHD risk equivalents are referred to as high risk (Grundy et al. 2004).

Risk Factors

Physical Inactivity

The National Institutes of Health defines physical activity, in general, as "bodily movement produced by skeletal muscles that requires energy expenditure and produces progressive health benefits" (Prochaska et al. 2000). The American College of Sports Medicine recommends that everyone should accumulate 30 minutes or more of moderately intense physical activity on most days of the week. There is strong evidence from multiple observational studies that physical activity can reduce the risk for coronary heart disease. Programs that include physical fitness appear to initiate a significant reduction in coronary heart disease in addition to a decreased mortality rate from any cause (Bertoli et al. 2003). Physical inactivity reduces caloric expenditure and is likely to contribute to obesity, which is associated with lipid and nonlipid risk factors (NHLBI, 2005).

Physical inactivity is an important risk factor for developing CHD (Puffer, 2001, p.1). Even moderate activity has a profound influence on health for sedentary individuals

(Puffer, 2001, p. 3). Sedentary men had a 64% higher risk for myocardial infarction than those who expended 2000 kilocalories of energy per week in physical activity. People who are 60 to 70 years of age and are moderately active show a reduction in death rate compared to sedentary individuals (Puffer, 2001, p.2).

Only about 20% of the adult population accumulate adequate amounts of physical activity that results in the promotion of health benefits while approximately 25% of adults are sedentary and the remainder 55% of the population are not sufficiently active (Puffer, 2001, p. 1). These data show that 75% of the populations across most age groups are possibly at a significant risk for developing CHD according to their relative physical inactivity level (Puffer, 2001, p. 1). This percentage of the population at risk has a profound effect on public health. The medical cost of physical inactivity was $29 billion in 1987 compared to $76.6 billion in 2000 (Centers for Disease Control, 2005).

Epidemiological studies over the past 50 years have unanimously shown that low physical activity is associated with high cardiovascular and total mortality. Low physical activity is also shown with an increase incidence of diabetes mellitus and nonfatal cardiovascular diseases (Erikssen, 2001, p. 571-576). Physical activity reduces risk of dying prematurely from heart disease, developing diabetes, high blood pressure, colon cancer, reduce feelings of depression and anxiety, controls weight, maintains healthy bones, muscles, and joints, and promotes psychological well-being (Centers for Disease Control, 2005).

The National Heart, Lung, and Blood Institute suggest that a history of regular physical activity should be counted as a negative risk factor. An increase in physical activity should be included in an overall healthy lifestyle therapy to reduce the risk of

CHD (NHLBI, 2005). A sedentary life style may be as detrimental to health as smoking. Studies indicate that changes in physical activity, and especially changes that bring increases in physical fitness, can reverse the worsening CHD risk factors (Erikssen, 2001, p. 571-576).

It has been established that a high exercise capacity is related to a reduction in CHD risk factors (Thaulow and Fredriksen, 2004, p. 37). Physical activity helps reduce other risk factors for coronary heart disease, such as cholesterol levels, obesity, and hypertension. Physical activity increases high-density lipoprotein (good cholesterol) levels and decreases the low-density lipoprotein (bad cholesterol) and total cholesterol levels (Puffer, 2001, p. 5).

Obesity

"Obesity refers to a condition of excess body fat or a state above normal adiposity at which health problems are likely to prevail" (Thomas et al., 2003, 635). Obesity is excessive fat on the body and has been a known risk factor for coronary heart disease since the early 1990s (Whitemer et al. 2002). "Obesity is a chronic condition that evolves over a number of years" (Thomas et al., 2003, 635). During the past 20 years, the incidence of obesity in the United State's adults has risen significantly. According to the American Heart Association, seven out of every ten adults in the United States are overweight while about three out of every ten U.S. adults are obese. "Prevalence of obesity and overweight continues to rise throughout the world" (Miller, 2001, p.722). Obesity has increased 75% since 1991 in every age and ethnic group (NHLBI, 2005). "The findings that weight increased steadily over a 3-year period is consistent with the well-established observation that weight tends to increase with age in young and middle-aged adults” (Sternfeld et al. 2004, 918). The obesity trend is worsening every year (Centers for Disease Control, 2005). The Centers for Disease Control and Prevention show that 33% of adult women are obese compared to 28% of men.

Obesity is recognized as a major risk factor for coronary heart disease, which can lead to heart attack. Some reasons for this higher risk are known, but others are not. For example, obesity raises blood cholesterol and triglyceride levels, lowers HDL "good" cholesterol [HDL cholesterol is linked with lower heart disease and stroke risk, so reducing it tends to raise the risk], raises blood pressure, can induce diabetes. In some people, diabetes makes these other risk factors much worse. The danger of heart attack is especially high for these people. Obesity harms more than just the heart and blood vessel system. It is a major cause of gallstones and can worsen degenerative joint disease (American Heart Association, 2005). The yearly cost of obesity in the United States was about $117 billion in 2000 (Centers for Disease Control, 2005).

A widely used marker for obesity is body mass index (BMI). BMI is calculated by taking weight in kilograms divided by the squared height in meters of an individual. A BMI score between 25.1-29.9 kg/m^2 is considered overweight and any number above 30 kg/m^2 is considered obese (ACSM, 2006, p. 58). In 2002, 30% of adults had a body mass index of 30 kg/m^2 or greater compared to the 23% in 1994 (Centers for Disease Control, 2005).

Studies have shown that as the population’s weight increases the occurrence of CHD increases too (Thaulow and Fredriksen, 2004, p. 35). Overweight and obesity, together, are the number two preventable cause of death in the United States. Being overweight or obese increases the risk of diseases and other health issues, including hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, and cancers such as endometrial, breast, and colon (Centers for Disease Control, 2005).

Smoking

The association between smoking and coronary heart disease has been known since the mid-20th century (Zieske et al. 2005). The Surgeon General calls smoking the leading preventable cause of disease and deaths in the United States. Smoking is a primary risk factor for coronary heart disease and stroke, which are the first and third leading causes of death in the United States (Centers for Disease Control, 2005). The toxins in cigarettes that enter the blood contribute to the development of atherosclerosis. This formation of atherosclerosis leads to coronary heart disease (Centers for Disease Control, 2005). In both men and women, cigarette smoking is associated with sudden cardiac deaths of all types (Report of the Surgeon General, 1999).

It is the most important risk factor for young men and women because it causes additional health problems later in life. About 8.6 million people in the United States have at least one serious illness caused by smoking (Centers for Disease Control, 2005). Smoking may lead to increases in risk for hypertension, a decrease in exercise tolerance, a decrease in high-density lipoprotein cholesterol, and an increased tendency for the blood to clot (American Heart Association, 2005). People who smoke are more likely to have advanced diseases than non-smokers (Zieske et al. 2005). The direct and indirect costs of smoking-related illnesses totaled more than $157 billion each year (Centers for Disease Control, 2005).

People who stop smoking have fewer cardiac events and have a lower mortality (Attebring et al. 2004). In a random clinical study, those subjects who quit smoking had substantial reductions in the risk of cardiac events compared with those who did not quit (NHLBI, 2005). “Quitting smoking has major and immediate health benefits for men and women of all ages. Smokers who quit will, on average, live longer and have fewer years of disability” (Centers for Disease Control, 2005). The National Heart, Lung, and Blood Institute recommend that the prevention of smoking and smoking cessation should be a primary emphasis in a clinical setting to reduce CHD risk.

In the study performed by Lauer et al. (1995), the researchers compared aerobic impairment in smokers versus nonsmokers and ex-smokers. Aerobic impairment was defined as the inability to perform 85% of the age-predicted exercise capacity. The study resulted in a 38% aerobic impairment in smokers compared to 27% in ex-smokers and 24% in non-smokers.

Hypertension

The prevalence of hypertension in adults increases with age and living in more-developed countries (Vasan et al., 2001, p. 1682). Resting blood pressure is evaluated from two separate measurements at two separate office visits. To establish hypertension in patients, doctors will take blood pressure readings at separate visits. If the patients’ blood pressures consistently reads 140/90 mmHg or more, then the doctor can diagnose the patients’ as hypertensive (NHLBI, 2005). The relationship between blood pressure and cardiovascular events is consistent and independent of other risk factors (ACSM, 2006, p. 213). Normal blood pressure, according to ACSM guidelines, is 115/75 mmHg; any values between 120-139/80-89 mmHg are considered pre-hypertensive. Hypertension is a blood pressure of 140/90 mmHg and above. Approximately 50 million Americans have hypertension.

The higher the subject's blood pressure, the greater the chance of heart attack, heart failure, stroke, and kidney disease (American Heart Association, 2005). Despite the guidelines starting at 140/90 mmHg for high blood pressure, an increase risk of coronary heart disease begins as low as 120/80 mmHg. The study performed by Vasan et al., 2001, (p. 1682) reported that patients with normal or high normal diastolic blood pressure are two to three times more likely to develop hypertension than those with normal diastolic blood pressure (75mmHg).

Approximately 45 million people are pre-hypertensive or at high risk for developing high blood pressure (Centers for Disease Control, 2005). About 70% of people who have high blood pressure do not have it under control (Centers for Disease Control, 2005). It is vital to have blood pressure checked regularly so that appropriate measures can be initiated in order to prevent morbidity and the mortality associated with hypertension (Vasan et al., 2001, p. 1682). Variables that influence individuals' future risk of developing hypertension are body mass index and weight gain (Vasan et al., 2001, p. 1684). "Epidemiological studies have found a progressive increase in the prevalence of elevated blood pressure with increasing adipose tissue" (Yalcin, Shin, and Yalcin, 2005, p. 541). Anti-hypertensive therapy includes dietary modifications such as a reduction in sodium intake, an increase in physical activity, and weight reduction (ACSM, 2006, p. 213-214).

High Cholesterol

The Adult Treatment Panel III, developed by the National Cholesterol Education Program (NCEP), has provided national guidelines for the management of cholesterol based upon evidence-based studies. These studies used large, randomized, controlled clinical trials and in the past decade have yielded a substantial data for the recommendations (Grundy et al. 2004). Epidemiological surveys have shown a consistent correlation between CHD risk and serum total cholesterol levels over a broad range of cholesterol values (Grundy et al., 2004). The recommended classifications for LDL-C, total, and HDL cholesterol by the Adult Treatment Panel III are found in *Appendix A, Table 17*. The Centers for Disease Control and Prevention state that 80% of people who have high cholesterol do not have it under control. A decrease of 10% in the total cholesterol level can reduce the incidence of coronary heart disease by approximately 30% (Centers for Disease Control, 2005).

Low-Density Lipoprotein Cholesterol (LDL-C)

High levels of low-density lipoprotein cholesterol contribute to coronary heart disease through the accumulation of plaque on the coronary walls resulting in narrowed and/or blocked arteries. ATP reports that all their studies have shown that low-density lipoprotein cholesterol (LDL-C) is the primary target of cholesterol-lowering therapy (Grundy et al., 2004). Random, controlled, clinical trials (RCTs) performed by the NCEP show that reducing LDL-C level reduces the risk of major coronary events. The ATP III panel recommends having a LDL-C level of below 100 mg/dL as optimal (Grundy et al. 2004). It is recommended that individuals D with a LDL-C of $\geq$100 mg/dL are recommended to begin dietary therapy to begin while those whose have levels of $\geq$130 mg/dL are recommend to initiate cholesterol lowering drugs in addition to dietary changes (Grundy et al. 2004).

High-Density Lipoprotein Cholesterol (HDL-C)

"High-density lipoprotein cholesterol (HDL-C) levels are strongly, inversely, and independently associated with CHD" (Kokkinos and Fernhall, 1999, p. 307). HDL-C (good cholesterol) breaks down low-density lipoprotein levels and enhances fat clearance for those who exercise (Puffer, 2001, p. 5). High-density lipoprotein cholesterol recommendations are to have a level above 60 mg/dL, with a minimum level 40 mg/dL (Grundy et al. 2004). High levels of HDL-C are shown to have an inverse relationship with CHD while low levels of HDL-C are detrimentally affects the body's ability to remove excess cholesterol (Thomas et al., 2003, p. 637). A two to three percent increase in CHD is associated with every 1.0 mg/dL decrease in HDL-C levels (Kokkinos and Fernhall, 1999, p. 308).

Those who are physically active have a 25% higher HDL-C protein level than those who are sedentary (Puffer, 2001, p. 5). The change of HDL-C level may also be related to the amount of exercise performed per week. Active individuals who ran 7-10 miles/week had significantly higher HDL-C levels compared to sedentary individuals of similar age, bodyweight, and alcohol intake (Kokkinos and Fernhall, 1999, p. 309). In a twelve-week exercise program, participants who exercised at 75% maximum heart rate had a significant improvement in HDL-C levels (Kokkinos and Fernhall, 1999, p. 308).

Low levels of HDL cholesterol may result from elevated serum triglycerides, overweight/obesity, physical inactivity, cigarette smoking, high carbohydrate intake, type 2 diabetes, genetics, and certain drugs like beta-blockers, anabolic steroids, and progestational agents (NHLBI, 2005). Having a HDL-C level above 60 mg/dL is regarded as a ‘negative’ risk factor. This level removes one risk factor from the total collective count of all risk factors such as hypertension, smoking, obesity, family history, age, and diabetes (Grundy et al. 2004). According to the ACSM guidelines, a low HDL cholesterol level is strongly associated with the increased risk of coronary heart disease.

Total Cholesterol (TC)

Total cholesterol plays an important role in the development of CHD (Thomas et al., 2003, p. 637). High cholesterol is classified as 240 mg/dL or higher (NHLBI, 2005). Roughly, 105 million Americans have above the desired level. Ideally, an individual’s cholesterol level should be below 200 mg/dL with a high-density lipoprotein cholesterol (HDL-C) level of 40 mg/dL or higher (American Heart Association, NHLBI, 2005). The study by Lloyd-Jones et al. (2003) sought to determine how cholesterol levels at various ages affect the lifetime risk of coronary heart disease. Analyses of the data report that lifetime risk of CHD increases sharply with higher TC for men and women at all ages. The results from this study support the vital role of cholesterol screening in younger patients, and they may help target high-risk patients for lifestyle modification or drug therapy (Lloyd-Jones et al. 2003).

HDL Cholesterol and Total Cholesterol Ratio

The ratio of HDL and total cholesterol (TC) is a preferred lipid fraction to predict cardiovascular disease. The ratio is found by taking total cholesterol divided by HDL cholesterol (von Mühlen, Langer, Barrett-Conner, 2003, pp. 1311-1315). The goal is to keep the ratio below 5:1; the optimum ratio is 3.5:1 (American Heart Association, 2005).

The study suggested that using the HDL/TC ratio is a better predictor in men than in women.

Cholesterol Summary

ATP III recommends therapeutic lifestyle changes in order to lower cholesterol levels. Therapeutic lifestyle changes are the most important cholesterol lowering modification including low saturated fat and low cholesterol diet, physical activity, and weight control (ATP III, 2004). A diet consisting of saturated fat and cholesterol will increase blood cholesterol level while reducing the fat and cholesterol in the diet can help lower total cholesterol levels. Physical activity helps increase HDL-C and decreases LDL-C in addition to helping subjects lose weight for weight management. Weight reduction decreases LDL cholesterol, triglycerides, and increases HDL levels (NHLBI, 2005).

However, a study performed by Watson et al. (1995, p.81) demonstrated that of 495 people suggested to have only dietary treatment, 342 (69%) were receiving no treatment. The same study also found that of 538 patients placed on drug supplementation coupled with dietary changes; only 102 (19%) patients were receiving no treatment. The conclusion of the study by Watson et al. (1995, p.81) suggests that, “U.S. primary physicians surveyed were not completely following the prevailing national guidelines for lipid screening and primary prevention of CHD.”

Impaired Fasting Glucose

A normal fasting glucose (overnight – eight hours) range is between 70 and 100 mg/dL. An impaired fasting glucose range is between 101 and 125 mg/dL is known as pre-diabetes (MayoClinic, 2005). Diabetes is defined as a fasting glucose 126 mg/dL or greater (NHLBI, 2005). Diabetes is an increasingly common chronic disease that can cause heart disease, kidney failure, leg and foot amputations, and blindness. These diseases can result in disability and death. An estimated 18 million Americans have diabetes while an additional 5 million of the people are unaware they have the disease. This estimation can be broken down to approximate that one in three Americans born in 2000 will develop diabetes in their lifetime (Centers for Disease Control, 2005). In 2002, the direct and indirect costs of diabetes totaled $132 billion dollars (Centers for Disease Control, 2005).

Type 2 diabetes increases the risk of coronary heart disease by two times and the prognosis of clinical CHD is worse in subjects with diabetes compared to those without it (Alexander et al. 2000). Subjects with diabetes have an increased chance of having elevated lipids, blood pressure, and mortality rate. Due to the increase chance of developing CHD, the glucose levels of subjects should be monitored and treated early to reduce the risk of morbidity and mortality (Alexander et al. 2000). Type 2 diabetes is linked to two modifiable risk factors: obesity and physical inactivity (Centers for Disease Control, 2005).

Family History

Epidemiologists recognize family history (first-degree relatives) as a significant risk factor for coronary heart disease (Hunt et al., 2001). In addition, the number of affected relatives and the younger the age of CHD onset is associated with an increase in cardiovascular risk (Kardia et al. 2003, NHLBI). Patients with a first-degree relative who has CHD can have between two and twelve times the risk of coronary heart disease compared with those with no family history of CHD. The Finnish Twin Cohort Study provided sound evidence that physical activity reduces cardiovascular mortality independent of genetic influences. The study took 444 twins who were at a healthy baseline; mortality was reduced by 34% in occasional exercisers and by 56% in the conditioning exercisers compared to the twin who was sedentary (Puffer, 2001, p. 3).

Framingham Heart Study

The Framingham Heart Study was one of the first studies developed to monitor the risk factors and establish the significance of risk factors for cardiovascular diseases (FHS NHLBI, 2005). The Framingham Heart Study is a coronary disease prediction algorithm for people between the ages of 20 to 79 years old. Framingham uses age, total cholesterol concentration, high-density lipoprotein cholesterol concentration, blood pressure, diabetes, and smoking status (Ford, Giles, Mokdad, 2004, p. 1794). Since established in 1948 there have been significant findings as a result of the study. The date and findings of this study are as follows:

“1956 Findings on progression of rheumatic heart disease

1959 Factors found that increase the likelihood of heart disease; some heart attacks discovered to be "silent" (causing no pain)

1960 Cigarette smoking found to increase the risk of heart disease

1961 Cholesterol level, blood pressure, and electrocardiogram abnormalities found to increase the risk of heart disease

1965 First Framingham Heart Study report on stroke

1967 Physical activity found to reduce the risk of heart disease and obesity to increase the risk of heart disease

1970 High blood pressure found to increase the risk of stroke

1971 Framingham Offspring Study begins; progression of congestive heart failure described

1974 Overview of diabetes and its complications

1976 Menopause found to increase the risk of heart disease

1977 Effects of triglycerides and LDL and HDL cholesterol described

1978 Psychosocial factors found to affect heart disease; atrial fibrillation found to increase the risk of stroke

1981 Filter cigarettes found to give no protection against coronary heart disease; major report issued on relationship of diet and heart disease

1983 Reports on mitral valve

1986 First report on dementia

1987 High blood cholesterol levels found to correlate directly with risk of death in young men; fibrinogen found to increase the risk of heart disease

1988 High levels of HDL cholesterol found to reduce risk of death; Type "A" behavior associated with heart disease; isolated systolic hypertension found to increase risk of heart disease; cigarette smoking found to increase risk of stroke

1990 Homocysteine found as possible risk factor for heart disease

1991 Heart disease risk prediction models produced

1993 Mild isolated systolic hypertension shown to increase risk of heart disease; major report predicts survival after diagnosis of heart failure

1994 Enlarged left ventricle (one of two lower chambers of the heart) shown to increase the risk of stroke; Lipoprotein (a) found as possible risk factor for heart disease; Risk factors for atrial fibrillation described; Apolipoprotein E found as possible risk factor for heart disease

1995 First Framingham report on diastolic heart failure

1996 Progression from hypertension to heart failure described

1997 Report on the cumulative effects of smoking and high cholesterol on the risk for atherosclerosis; investigation of the impact of an enlarged left ventricle and risk for heart failure in asymptomatic individuals"

(NHLBI, 2005)

The Framingham Heart Study is designed to estimate short-term risk for coronary heart disease in individuals. Subjects receiving a low to moderate risk score do not mean that risk is low throughout one's life. Vigilance in cardiac risk monitoring is important as those established risk factors may become more severe if left untreated. Those who employ the score should note that the Framingham Heart Study score might underestimate the CHD risk factor for younger subjects because hypertension, diabetes, and obesity often occur later in life.

"Framingham 10-year risk equations could reliably stratify lifetime risk for coronary heart disease in men and women free of CHD at selected ages" (Lloyd-Jones et al., 2004). The 10-year prediction of the Framingham Heart Study performed by Vasan et al., (2005) detailed an estimation of CHD events by sex and age. The study found that men and women who ere 55 years at the start of the study had a 56% and 70% chance, respectively, of a CHD event. Men and women who were 65 years of age at the baseline of the study had 29.5% and 39.6%, respectively, of CHD events over the 10-year period. For the younger male and female population between the ages of 35 and 44, 45 and 54 years of age, had a 17% and 9.7%, 26.7% and 20.5%, respectively, chance of having a CHD event (Vasan et al. 2005, p. 398). The same study found that starting CHD risk factors is used to predict the subjects' 10-year CHD risk score. Vasan et al. 2005, p. 398, reported that people with one or more risk factors made up 90% of CHD events while 8% of CHD events were people with borderline risk factors, none elevated. People with one elevated risk factor had 25% of the CHD events and more than two-thirds of the people with one or two risk factors had CHD events.

Health care facilities use predictor models to identify patients or members who have an increased risk of incurring high cost in order to plan health care delivery. This estimation helps the organization plan for future costs (Ford, Giles, Mokdad, 2004, p. 1794). Despite low 10-year risks for CHD in younger subjects, those subjects can still have a substantial lifetime risk for CHD. The Framingham Heart Study score, used to predict 10-year risk for CHD was very effective in women and men (Lloyd-Jones et al., 2004).

According the American Heart Association, the Framingham Heart Study contributed importantly to predicting coronary heart disease. The National Cholesterol Education Program, National High Blood Pressure Education Program, American Heart Association, Joint National Committee, and the National Heart, Lung, and Blood Institute endorse the use of the Framingham Heart Study score in estimating future risk of CHD (Grundy et al. 1998*)*.

The update of the 1991 Framingham coronary prediction algorithm provides estimates of total CHD risk (risk of developing one of the following: angina pectoris, myocardial infarction, or coronary disease death) over the course of 10 years. Separate score sheets are used for men and women and the factors used to estimate risk include age, blood cholesterol (or LDL cholesterol), HDL cholesterol, blood pressure, cigarette smoking, and diabetes mellitus. Relative risk for CHD is estimated by comparison to low risk Framingham participants. In addition to score sheets for men and women, a sample score sheet is provided to illustrate how they can be used. Users of this risk algorithm should be aware of several caveats:

1. The risk estimating score sheets are only for persons without known heart disease.
2. The Framingham Heart Study risk algorithm encompasses only coronary heart disease, not other heart and vascular diseases.
3. The Framingham Heart Study population is almost all Caucasian. The Framingham risk algorithm may not fit other populations quite as well.
4. For some of the sex-age groups in Framingham, the numbers of events are quite small. Therefore, the estimates of risk for those groups may lack precision.
5. Other organizations are considering how the information from the Framingham risk algorithm, as well as other assessments of risk, might best be incorporated into clinical practice. As new information and guidelines become available, they will be added.
6. The Framingham risk score estimates the risk of developing CHD within a 10-year time period. This risk score may not adequately reflect the long-term or lifetime CHD risk of young adults, which is one in two for men and one in three for women.

7. The presence of any CHD risk factor requires appropriate attention because a single risk factor may confer a high risk for CHD in the end, even if the 10-year risk does not appear to be high.
8. Since age is a prominent determinant of the CHD risk score, the 10-year hazards of CHD are, on average, high in older persons. This may over-identify candidates for aggressive interventions. Relative risk estimates (risk in comparison with low risk individuals) may be more useful than absolute risk estimates in the elderly.
9. The score derived from this algorithm should not be used in place of a medical examination. (Wilson et al. 1998)

See Appendix E for a copy of the male and female Framingham Heart Score.

Anthropometric Methods

Anthropometry comes from the Greek terms 'man' and measure,' literally meaning in English as "measurement of humans" (Wikipedia, 2005). Several anthropometric measurements are used during a research study for comparison of changes prior to the study and at the end. Studies that include an exercise regime often measure height, weight, body mass index, body composition, girth measurements, and flexibility.

Body Mass Index (BMI)

Body mass index (BMI) assesses weight relative to height in order to estimate obesity. BMI is calculated by taking the individual's body weight (kg) and dividing it by height (in meters) squared. Any BMI number above 25 $kg{\cdot}m^{-2}$ is associated with an increase risk of health problems. A BMI range between 25-29.9 $kg{\cdot}m^{-2}$ is considered overweight and ≥ 30 kg·m^{-2} is considered obesity. BMI does not distinguish between muscle mass and fat mass; therefore, other body compositions methods should be used to predict body fatness (ACSM, 2006, p.58).

Body Fat Percentage

Body fat percentage is expressed as the relative percentage of body mass that is fat and fat-free tissue (ACSM, 2006, p.57-63). Body fat is associated with risks for hypertension, type 2 diabetes, stroke, coronary heart disease, and hyperlipidemia. A variety of methods is available to determine body fat, but many are too expensive and complicated to use as a screening tool. A common tool for screening body fat is skinfold calipers. Skinfold calipers are small, inexpensive, and easy to use once an individual has been trained. In addition, there is a high correlation between skinfold caliper measurements and the more expensive body composition devices (hydrostatic weighing; BodPod©). There is an error rate of approximately + 3.5 % for an experienced technician using skinfold calipers to measure body fat. Skinfold calipers measure the subcutaneous fat in millimeters at various parts of the body. Because subcutaneous fat is proportional to whole body fat, when the values are used with an appropriate equation, total body fat is estimated (ACSM, 2006, p.59-63).

There are varieties of equations, which can be used to determine total body fat based upon gender, age, level of physical activity, or type of physical activity. Screening methods use a general population equation, which incorporates a three or seven-site measurement equation (ACSM, 2006, p.63). The ideal body fat percentage reflects the participant's sex and age. The standards for body composition are from the American College of Sports Medicine (2006, pp. 66-67) (See Appendix A, Table 20).

Girth Measurements

Girth measurements can be used to predict body composition and risk for coronary heart disease. People who have more fat in the abdominal region have android obesity. Increased abdominal adiposity is related to an increased cardiovascular disease and premature death (Smith et al., 2005, p. 370). Intra-abdominal obesity is associated with metabolic dysfunction, which may lead to insulin resistance syndrome, a possible link between central obesity and an increased risk of CHD (Smith et al., 2005, p. 370). Body weight distribution differs between men and women. Women tend to have gynoid obesity, where fat is distributed more in the lower body (hips and thighs), whereas men more often have android or central obesity. This trend is not exclusive between the sexes. Approximately 60% of doctors and only a minority of patients know that the bigger waist size raises the odds of heart attack. Girth measurements are within 2.5 – 4.0% of an individual's body composition (ACSM, 2006, p.58). However, girth measurements should not be the lone tool for body composition; it should be an association with other methods.

Waist to hip ratio (WHR) can be used to determine body fat distribution and/or heart disease risk. WHR may be the most widely used clinical estimate of central adiposity. WHR is calculated by dividing waist circumference by hip circumference. Health risks increases once WHR index exceeds 0.86 for women and 0.95 for men (ACSM, 2006, p.58). Studies have shown the association between a high WHR with cardiovascular disease risk (Smith et al., 2005, p. 370).

Flexibility

Flexibility is the ability to move a joint through its complete range of motion (ACSM, 2006, p. 85). Flexibility is an essential component of physical fitness and overall health, because adults lose joint mobility as a part of inactivity and aging. The loss of flexibility increases an individual's risk of injury due to lack of balance and stability (Fatourous et al. 2002). Witvrouw et al. (2004) determined that tendon compliance increased as an acute or chronic adaptation of stretching resulting in to the tendon's ability to absorb energy better.

The range of motion in a particular joint depends on the bone, muscle, and connective tissue arrangement. Between the ages of 30 and 70 years, there is a significant loss in joint flexibility in both genders; this loss is associated with muscle disuse (Fatourous et al. 2002). When the joint is unused, the muscle surrounding it shortens and it reduces the range of motion (Fatourous et al. 2002). In the study performed by Fatourous et al. 2004, a combination of strength and cardiovascular training is able to enhance flexibility of inactive adults. A common way to measure flexibility is with a sit-and-reach box (ACSM, 2006, p.86). Often used to assess low-back flexibility, it more accurately predicts the flexibility of hamstrings.

Exercise Tests

Pre-Exercise Evaluations

Prior to any exercise test, a complete medical history and physical examination should be performed in order to reduce any further risk of injury due to exercise. A licensed physician should do the medical evaluation and any limitations of the subject are noted. The medical history should include the following: medical diagnosis, previous complications, history of symptoms, recent illnesses or hospitalizations, medication use, exercise history, family history, and other habits (smoking, caffeine, drug use, etc.) (ACSM, 2006, p. 40). The physical examination includes measurement of body weight, resting heart rate, resting blood pressure, determination of any heart beat irregularities, inspection of the skin, determination of neurologic functions, and orthopedic conditions (ACSM, 2006, p.40). After the medical and physical examinations, the subject's coronary heart disease risk stratification is assessed.

Maximal Oxygen Consumption

Maximum oxygen uptake (VO_2) is related to the functional capacity of the heart. VO_2 max is determined by the maximum amount of blood the heart pumps per minute and the amount of oxygen utilized by the exercising muscles (ACSM, 2006, p.66; VO^2 = cardiac output x arteriovenous oxygen difference). Exercise training increases maximum ventilatory oxygen uptake by increasing both maximum cardiac output (the volume of blood ejected by the heart per minute, which determines the amount of blood delivered to the exercising muscles) and the ability of muscles to extract and use oxygen from blood (Fletcher et al. 1996).

It is important to perform a fitness test because it is a well established that poor exercise capacity is a predictor of coronary heart disease and mortality (Bertoli et al. 2003). There are two main types of test to determine VO_2 max – by testing the individual on an ergometer (treadmill, bicycle ergometer, etc.) while directly measuring oxygen uptake or by estimating maximal oxygen uptake after a submaximal exercise test. It is important to note that a maximal exercise test requires that subjects exercise to the point of volitional fatigue and medical supervision and/or emergency equipment must be available (ACSM, 2006, p. 67). The decision to use a maximal or submaximal exercise test depends on the reasons for the test and availability of appropriate equipment and personnel (ACSM, 2006, p.67). Submaximal tests are not as precise as a maximal oxygen uptake tests. However, submaximal tests can still provide reasonable estimation of fitness and/or exercise capacity. Submaximal VO_2 tests are used to determine how the heart rate responds to one or more submaximal work rates; these results are used to estimate max VO_2 (ACSM, 2006, p.66). When using a submaximal test to predict VO_2 estimates several assumptions are made from the heart rate responses:

> "1. A steady-state heart rate is obtained for each exercise work rate and is consistent each day.
>
> 2. A linear relationship exists between heart rate and work rate.
>
> 3. The maximal workload is indicative of the maximal VO_2.
>
> 4. The maximal heart rate for a given age is uniform.
>
> 5. Mechanical efficiency is the same for everyone.
>
> 6. The subject is not on medications that alter heart rate." (ACSM, 2006, p. 68)

Ebbeling Walk Test

The purpose of an exercise test in a non-medical setting is to assess aerobic power of healthy adults rather than diagnose CHD (Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991, p. 966). The protocol of the assigned submaximal fitness test should take into account the purpose of the study (ACSM, 2006, p.99). The Ebbeling Walk Test is a single-stage four-minute walk submaximal VO_2 test on a treadmill. A treadmill test is often preferred because it is easy to regulate speed and grade (Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991, p. 967). Walking is the modality and the speed of the test is individualized to the participant's ability. The Ebbeling Walk Test is practical for assessing functional capacity of participants who vary in age, gender, and fitness level (Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991, p. 970).

This test begins with a four-minute warm-up at a speed between 2 and 4.5 miles per hour at a 0% grade. The speed of the treadmill should bring the participants' heart rate rise between predicted age-related 50-70% maximum heart rate (Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991, p. 970). After the completion of the warm-up, the pace is increased so that it is challenging and brisk for the participant. Grade is increased from 0% to 5% for an additional four minutes. When the participant completes the four-minute walk test, there is a cool-down period of four minutes at 0% grade and warm-up speed. Conclusions from the research supporting this exercise test states that the equation used to estimate VO_2 max from this single stage test "provides a valid and time-efficient method for assessing aerobic power" (Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991, p. 972).

Flexibility: Sit-and-Reach Test

The sit-and-reach test is a popular way to measure hamstring flexibility (ACSM, 2006, p.85). Studies have shown that hamstring and low back flexibility could possibility prevent acute and chronic musculoskeletal injuries, low back problems, postural deviations, gait limitations, and the risk of falling (Baltaci et al., 2003). The sit –and-reach test is highly reliable and one measurement is sufficient to ensure accuracy after a warm-up and practice stretching session (Baltaci et al. 2003). See Appendix A, Table 19 for standards.

Hospital Employees

Stress has been linked to hypertension, cardiovascular disease, immune disorders, obesity, depression, musculoskeletal conditions, and all-cause mortality (McNeely, 2005, p.292). Level of stress is related to lack of control in the work place, such as with job security; and the lack of control at work predicts morbidity and mortality. The higher the position on the corporate ladder, the more control the person has and therefore, a lower risk of mortality (McNeely, 2005, p.292). Work stress often reflects after work behaviors such as reduced physical activity in leisure, increased substance abuse, and lowered civic participation.

Nurses' Personal Health Habits

Nurses have been shown to be at an increased risk of mortality for several diseases compared to other professionals (McNeely, 2005, p.293). The personal lifestyles of nurses or health professionals can reflect their work related stress, professional philosophies, and/or their commitment to health promotion. These lifestyle practices can include smoking and illicit drug usage (Hope and Kelleher, 1998, p. 439). A New York survey found that student nurses had a high smoking rate, lower use of seat belts, more irregular eating habits, and more frequent binge-drinking compared to other health professionals (Hope and Kelleher, 1998, p. 439). Nurses were more tolerant of smoking behaviors and more reluctant to enforce a ban on smoking at the hospital site than other professions (Hope and Kelleher, 1998, p. 439). Furthermore, nurses were more likely to be overweight compared to the general population (Hope and Kelleher, 1998, p. 439). In addition, Angard, Chez, and Young (1998, p.1292) reported a high prevalence of nurses not using personal screening health practices, such as regular physician visits.

The study by Bulaclac (1996, p.20) had nurses participate in an exercise program and surveyed during the post-program health screening. The participants of the study were asked to rate the program in relation to employee retention, hospital concern for its employees, and reasons for joining the wellness program. The study found that 73% of the participants saw the program as an indication of concern for the employees and 67% thought that the program positively influenced their decision to stay employed at the hospital (Bulaclac, 1996, p.20). Worksite programs have been shown to decrease employees' sick leave absences, health benefit costs, turnover rate of employees due to debilitating disease, and improved employees' quality of life and morale, and enhanced productivity (Angard, Chez, and Young, 1998, p.1292). Nevertheless, the hospital in the study by Angard, Chez, and Young (1998, p.1292) reported that hospitals tend to offer health community screenings, but do not offer the same opportunity for the employees.

Worksite Health Promotion

Promoting health programs in the worksite is important for educating employees and providing diagnostic and therapeutic interventions (Angard, Chez, and Young, 1998, p.1289). Nurses can define health education, but not all can define health promotion, and nurses often do not perceive themselves as health educators (Cantrell, 1998, p.89). Littlewood & Parker (1992, p. 89) reported that nurses felt that patients resented unsolicited advice such as losing weight and exercising. For example, 51 percent of the nurses said that patients get annoyed when asked if they smoked. The study also said that this attitude of resentment by the patients would most likely inhibit the nurses from encouraging a positive health promotion program (Littlewood & Parker 1992, p. 89). Littlewood & Parker (1992, p. 89) found that 95 percent of nurses believed that the government needed to take more responsibility in promoting health. Recent government documents regarding nurses' employment in the hospital and community settings have recommended that nurses be more involved in health promotion and facilitation at their worksite (Cantrell, 1998, p.89).

Exercise and Heart Disease

A large portion of the population is at risk for coronary heart disease because of a sedentary lifestyle; approximately 55% of the adult population is inadequately active. Including the population that is insufficiently active, an estimated 75% of the population could be at risk for CHD due to physical inactivity (Puffer, 2001, p.1). It is estimated that $24 billion dollars of United States health care system is spent as a direct result of lack of physical activity (Rastogi et al. 2004, p759.).

Physical exercise and coronary heart disease are inversely associated in Western populations (Rastogi et al. 2004, p759.). A large prospective study in the United States showed that women who exercised approximately ≥3 hours per week of brisk walking was associated with a 30-40% reduction in CHD risk and men had a 20% drop during an equivalent study (Rastogi et al., 2004, p765). Performing daily physical activity at the minimum recommendations can prevent or reduce obesity. In addition, regular activity is associated with reductions in blood pressure, LDL-cholesterol and triglyceride levels, and increased HDL-cholesterol (Sebregts, Falger, & Bär, 2000, p.431). An increase in HDL-cholesterol was observed over a one-month period of exercising at an intensity of 6.7 kcal/min. Those who exercised at a lower intensity did not show an improvement in HDL-C. A study by Lehtonen and Viikari, 1978, p.113, reported that larger amounts of weekly exercise increased HDL-C levels and decreased total cholesterol and triglycerides. The benefits of physical activity on the reduction and or prevention of coronary heart disease risk factors are independent of age, gender, or genetic influences (Puffer, 2001, p.6).

Summary

The American College of Sports Medicine recognizes family history, cigarette smoking, hypertension, high cholesterol, impaired fasting glucose, obesity, and sedentary lifestyle as the major factors for coronary heart disease (ACSM, 2006, p. 22). The risk stratifications are based on the presence or absence of CHD risk factors (ACSM, 2006, p. 27). “Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease” (Fletcher et al. 1996).

The Surgeon General reports that physical activity reduces risk of dying prematurely from heart disease, developing diabetes, high blood pressure, and controls weight; which in return can reduce the risk of CHD in individuals who engage in regular physical activity (Centers for Disease Control, 2005). Recent studies have shown that intensive multiple interventions such as smoking cessation, blood lipid reduction, weight control, and physical activity significantly decreased rate of progression and, in some cases, led to regression in the severity of atherosclerotic lesions in persons with coronary disease (Fletcher et al., 1996). It is recommended that an increase in physical activity with other lifestyle changes, such as smoking cessation, fat body-weight reduction, and a low fat diet, are suggested as initial treatment prior to beginning or adjacent to pharmacotherapy to combat CHD and its risk factors (Kokkinos and Fernhall, 1999, p. 308). In addition, physical activity can also have a reversing effect for individuals already diagnosed with CHD (Puffer, 2001, p.5). The study by Angard, Chez, and Young (1998, p.1292) showed that a worksite exercise program for the employees improved quality of life and morale, enhanced productivity, decreased employees' sick leave absences, health benefit costs, and turnover rate of employees due to debilitating disease.

III. METHODS

This chapter outlines the research design and the description of the study setting. The recruitment and criteria for the subjects are explained and the ethical considerations of the subjects that were followed. In addition, the instrumentation and procedures for data collection are described A plan for data analysis and chapter summary concludes this chapter.

Setting

Miami Valley Hospital was founded in 1890 and currently ranks in the top 100 hospitals in the nation (Miami Valley Hospital, 2005). It has more than 1,200 physicians for the 848 licensed beds. The physicians make up 50 of the primary medical and surgical specialties. In 2004, Miami Valley Hospital was recognized as the state's fifth hospital to be named a Magnet hospital for excellence in nursing care. U.S. News & World Report listed this hospital in the top 50 hospitals in multiple clinical areas from 2002 to 2004 (Miami Valley Hospital, 2005). Area residents have voted the hospital for eight consecutive years as the area's top hospital; the hospital also received 'as expected' or 'better than expected' in the quality scoreboard from the area's Greater Hospital Association on all measurements. In 2002, Miami Valley Hospital received a fifth consecutive excellent rating from the Joint Commission on Accreditation of Healthcare Organization putting the hospital in the top ten percent of all hospitals surveyed; no other hospital in the state has received this status (Miami Valley Hospital, 2005).

In 1994, Miami Valley Hospital created a Wellness Center to serve as an exercise and wellness facility to the employees. The Wellness Center is staffed with an exercise physiologist, registered dietitian, and a graduate assistant exercise physiologist. The Wellness Center is open to employees 24 hours a day - seven days a week. The office is staffed during normal business hours, from 8:00am - 5:00pm, unless otherwise scheduled. The Wellness Center offers free fitness assessments, educational handouts, and Lunch and Learn discussions. The staff provides fitness tracking for employees through incentive programs, and will conduct community health screenings when requested. The Wellness Center has seven goals:

1. To provide an organizational environment supportive of positive health and fitness practices
2. To provide adequate, purposeful education and fitness facilities to help employees reduce lifestyle risk factors and become better health care consumers
3. Continuously assess and improve health status of the employees
4. To evaluate the effectiveness of the Wellness Center's programs and their design, using appropriate analysis techniques
5. To conduct the planning process by allowing customer wants and needs to guide organizational programs
6. To maximize communications within the organization by founding a Wellness Council consisting of employees and physicians interested in the future of wellness at the hospital.

7. To reduce the cost of employees' health care and other insurance related costs over time.

Population

In this study, there was a recruiting goal of 40-60 subjects. The sample size was based upon the capacity availability of the Wellness Center and the number of people the researcher could efficiently handle. A Power Analysis was performed to determine the total subjects needed at an 80% power level (n=450). The only criterion to be a participant in this study was to have full-time employment status at Miami Valley Hospital (36+ hours a week or paid full-time hours). The participants of the study were a convenient sample solicited from all full-time employees at Miami Valley Hospital with and without history of physical activity. Subjects were stratified according to the American College of Sports Medicine Risk Stratification Classes - Low Risk, Moderate Risk, and High Risk. Those identified as Low Risk were encouraged to participate because the American Heart Association recommends that each individual receive a CHD risk evaluation every five years (Sheridan et al., 2003). Activity history, employment history at the study site, and other demographic data were collected (See Appendix F, Demographic Data).

Sampling Plan

Participation was voluntary. An announcement via email was sent to MVH Exchange Administration, which distributed the email to everyone's hospital account. This helped to publicize the study and through word of mouth, additional interest to participate in the study was observed. Individuals who expressed an interest in participating attended an introductory presentation at the hospital, where study procedures and subject expectations were explained. The presentation detailed the time commitment required each week the benefits the subjects would receive by participating, and why this study was so important in relation to coronary heart disease in hospital employees. The American Heart Association states that current exercise status (e.g., persons remaining physically active or having been sedentary and becoming physically active) revealed the greatest decline in coronary artery disease risk compared to sedentary individuals (Fletcher et al. 1996).

After the presentations was there more than one presentation?, interested employees were given a packet of material to read and sign, including an informed consent sheet, physician's approval to exercise, health history, demographic data, nutritional questionnaire, agreement and release of liability, and an informational handout regarding the basics of the study (See Appendix C, D, and F). The first 60 employees who turned in their completed packets, regardless of their current physical fitness level, were chosen as the participants in the study.

Human Subjects Consideration

Human rights required protection of subjects in research studies. These rights included the right to privacy, anonymity or confidentiality, fair treatment, and protection from discomfort and harm (Burns & Groves, 1997). In order to ensure that these rights were upheld and protected, the Institutional Review Board (IRB) at the study hospital and researcher's university approved the study before any data collection began (See Appendix C). The IRB assured that the study was ethical, that no discomfort or harm transpired during the research, and that each subject received fair treatment. Employees who participated in the study were informed of their rights, provided with a verbal explanation of the procedures, and signed an informed research consent form (See Appendix D).

Participation in this study was voluntary and the subjects were allowed to terminate their involvement at anytime with no repercussions. The subjects were encouraged to ask questions at any time throughout the study. The participants' health questionnaires and data were kept in a file cabinet in a locked office to ensure confidentiality. The only individuals who had access to the files were the primary researcher and a second exercise physiologist employee who helped throughout the study. At the end of the study, the information sheets were destroyed and only the group data results remained

Research Instruments

The research instruments in this study were located at Miami Valley Hospital's Wellness Center. The instruments were owned by the hospital or borrowed from Wright State University.

Cholestech L.D.X.

The Cholestech L.D.X. machine (Cholestech Corporation, Hayward, CA) was used to assess the subjects' total cholesterol, HDL level, and TC/HDL ratio. The cholesterol levels were calculated by using blood from a fingerprick. The blood was ejected from a collection tube into a cassette housed in the machine. Complete results were available in approximately seven minutes.

"The National Cholesterol Education Program through the Center for Disease Control and Prevention has established total error guidelines for lipid tests which can be used to determine whether the difference between the Cholestech LDX and another method is acceptable" (Cholestech Corporation, 2005). The percentage of error for Cholestech LDX is $\leq$ 8.9% for total cholesterol and $\leq$ 13% HDL cholesterol; these results reflect a 95% rate of results that meet the error guidelines set by the CDC (Cholestech Corporation, 2005). Factors that can affect the participants' (actual) cholesterol results include age, gender, seasonal variation, exercise, fasting, pregnancy, diet, alcohol, medication, posture, anticoagulants, trauma, and acute infection (Cholestech Corporation, 2005).

Measuring Tape

Abdominal and hip girths were measured using a standard tailor's 60 in. (150 cm.) measuring tape with a white background and black numbering. The tape was made of a smooth fiberglass with metal tips.

Body Composition

Skinfold Calipers

To measure body fat percentage the Lange skinfold calipers were used [Beta Technology, Cambridge, MD]. The calipers measured the subcutaneous tissue in the body, which is comparative to the subjects' body composition. The calipers were spring-loaded levers, which provided a constant standard pressure of 10 g/mm^2 over the operating range with an easy-to-read scale. The calipers had pivoted tips with rectangular faces and rounded corners; these tips adjusted for parallel measurements of the skinfold. The surface area of the faces was approximately 30 square millimeters. The scale read up to 60 millimeters with an accuracy of +/- 1 mm.

Bioimpedence

The second method of measurement for body fat percentage was the handheld Body Logic Body Fat Analyzer HBF-306BL [OMRON, Vernon Hills, IL]. This bioimpedence device had a digital screen with grip electrodes and had a percentage of error rate of +/-8%. The split digital screen displayed both the subjects' body fat composition and BMI in seven seconds.

Treadmill

A submaximal treadmill test was conducted on a True 500 HRC series [True Fitness Technology, O'Fallen, MO]. The control panel had five separate data readout windows that gave instant feedback regarding distance, grade, time, speed, pace, calories, and METS for the treadmill. The deck was made of phenolic laminate that was up to 20 times the industry standard. On the deck was a 4-ply belt that formed less friction due to a triple weave backing that allowed the belt to last longer. The belt running surface was 20″x54″. The belt moved along custom-built rollers with a laminate material that minimized slippage and tension, which resulted in a longer roller and belt life. A 3.0 HP continuous duty motor powered the belt for a smooth and balanced operation. The treadmill was under warranty and was regularly checked by trained technicians. Prior to each test, the technician verified the treadmill's calibration.

Sit-and-Reach Box

The Figure Finder Flex-Tester was used to measure low back flexibility (hamstring range of motion) [Novel Product, Inc., Rockton, IL]. The box had a maximum reach indicator, in addition to a built-in footplate to ensure foot placement consistency during testing.

Weight Scale

The subjects were weighed on a Detecto Physician scale [Detecto, Webb City, MO], which had a capacity of 350 pounds (160 kg). The scale was regularly monitored for accuracy and if needed, calibrated by a trained professional prior to any weight measurement. The standing platform was 10.5 in x 14.5 in. The optional height rod on this scale ranged from 30 in. to 78 in. (75-193 cm.).

Stethoscope and Sphygmonometer

The Litmann II Stethoscope [3M Health Care, St. Paul, MN] and the Tycos Welch Allyn 767 Series sphygmonometer [Welch-Allyn Medical, Skaneateles Falls, NY] were used in the assessment of blood pressure throughout the research study. The Littmann II Stethoscope had a bell shape chest piece that provided reliable and clear acoustics. The headset was anatomically angled to ensure proper fit in the ear canal.

The Tycos sphygmonometer was certified to be within one percent of scale ($\pm$3 mmHg). The face was 6.25 inches in diameter with laser-engraved dial for accuracy. It was located on a 360˚ manometer swivel for mobility and ease of reading. The attached Welch Allyn brand cuff had a four-foot coiled tubing for range and durability. The cuff was the standard adult size and bladder (Model 7670-03.)

Heart Rate Monitor

The Polar Heart Rate Monitor FS1 [Polar Electro, Oy, Finland] watch and chest transmitter was used to measure the subjects' heart rate throughout their workouts and pre- and post-assessments. It had a large watch face screen that allowed numbers to be read easily. The FS1 reported heart rate and exercise time. One button controlled the watch which made it easy to use.

The transmitter (Polar T31) was positioned on the subjects' chest and measured the heart rate per minute in real time. The T31 has a lifespan up to 2,500 hours of operation or five years of usage. It has a built-in lithium cell that cannot be replaced. The band which held the transmitter on the chest was nylon, polyester, and natural rubber and also included a small amount of latex.

Rate of Perceived Exertion (RPE)

The Borg's rate of perceived exertion was used to monitor the subjects' exercise tolerance. It is an ordinal scaled with values from 6 to 20. The greater the exertion felt by the subject, the higher the rating. The scale increases linearly with physiological measurement such as heart rate, oxygen uptake, and exercise intensity. The Borg's RPE scale allowed the participants to "subjectively rate their feelings during exercise, taking into account personal fitness level, environmental conditions, and general fatigue levels" (ACSM, 2006, p.77).

Framingham Heart Score

The Framingham Heart Score form accessed the subjects' 10-year coronary heart disease risk. The 1991-updated prediction algorithm was used during this study. There were two score sheets for the Framingham Heart Score, one for males and the second for females. Both forms included the following CHD risk factors to estimate 10-year risk: age, total cholesterol, HDL cholesterol, blood pressure, cigarette smoking, and diabetes mellitus (See Appendix E). The relative risk for CHD was estimated by comparison to low risk Framingham participants (National Heart, Lung, Heart, and Blood Institute, 2005).

Methods

The total duration of the study was fourteen weeks. The study was divided into three phases for assessment purposes. Week 0, pre-assessment; week 6, mid-assessment; and week 13, post-assessment; all testing was conducted at the Wellness Center. All participants performed their exercise program during Weeks 1-12. The recruitment phase of the research study lasted one week prior to the beginning of the assessments and/or the exercise program. On a Friday, a hospital-wide email was sent to spread the word regarding participation needed and to gain interest in the study. Included in the email was the purpose of the study, criteria to participate, benefits of participating, the dates of two informational meetings, and the primary researcher's name and position (See Appendix K). The first informational meeting was held the following Wednesday. At the informational meeting, the primary researcher described in detail the purpose of the study, the criteria for participation, benefits of participation, participant responsibilities, and the time commitment required for the 12 weeks of exercising.

After the initial email was sent, any employee who expressed interest both by stopping by the Wellness Center and at the informational meeting was given a participation packet to complete. The packet included a physician's approval to exercise form, research consent form, demographic data, health history form, agreement and release of liability, and a study informational handout (See Appendix D and F). Current members of the Wellness Center did not have to have a new physician's approval to exercise form because they were up-to-date. The interest employees expressed through email, phone, and stopping by the Wellness Center wanting to be part of the study exceeded the number of available spots. Therefore, the primary researcher told the employees who attended the first informational meeting that the first 50 employees to turn in their completed paperwork were included in the study. The primary researcher accepted 60 employees to take into account dropouts. Within three hours of the first meeting, all 60 spots were filled with full-time hospital employees. The primary researcher then sent a second hospital wide email to cancel the second meeting that was supposed to be held the next day and to make it known all spots were filled (See Appendix L). Other completed packets that were dropped off at the Wellness Center were retained so that if any spots became available the primary researcher would fill the spots according to the order they arrived. The primary researcher called the participants to schedule their pre-assessments during that week to begin the following Monday.

Professionals, including the primary researcher and full-time employees of the hospital's Wellness Center, performed the assessments. All individuals performing assessments were trained prior to data collection. Each of the subjects was assigned one of the exercise physiologists to conduct their pre-, mid-, and post- assessments. The subjects had the same tester perform each of their assessments throughout the entire research study for consistency of the results. The pre-, mid-, and post-assessments was scheduled at a time that was convenient for both the subject and the researcher. The pre- and post-assessments were schedule for one hour time slots.

The primary researcher reviewed the participants' paperwork prior to the pre-assessment in order to create an individualized exercise program for the employees. All of the participants' folders were created prior to the start of the workday so the assessments flowed smoothly and there was no confusion within the paperwork. The paperwork prepared for the subjects' pre-assessment included the recording form, which had any health-related conditions or injuries that might restrict exercise program written on the form, and the Framingham Heart Score form. Paperwork prepared and given to the participants included their individualized exercise program, schedule of events, cardiovascular recommendations, exercise intensity measurements, cardiovascular exercise, cardiovascular log, weight training recommendations, weight training log, recommended stretches, flexibility benefits, and healthy hydration (See Appendix I).

The researcher reviewed the employees' health history, demographic data, and discussed any issues that might affect their ability to participate in a regular exercise program. The subjects' activities three hours prior to testing, such as smoking, physical activity, or eating, were recorded (See Appendix F, Pre- and Post-Assessment Form). For consistency purposes, the tester advised the subjects to perform the same tasks prior to the mid- and post-assessments. The tester focused on the subjects' medication in relation to blood pressure and cholesterol; these medications included statins, blood thinners, and diuretics. The tester noted these medications in order to advise the subjects taking blood pressure medications to use the 'talk test' as a measurement of intensity instead of heart rate. In addition, the cholesterol medication might make the subjects bleed longer after the cholesterol test and the testers were prepared. After reviewing the paperwork, the researcher reviewed the procedures and measurements that were about to take place. The researcher answered any questions the subjects had before continuing the assessment.

At the pre- and post-assessments the following measurements were taken: HDL-C, total cholesterol, HDL/TC ratio, height, weight, body mass index, resting heart rate, resting blood pressure, body fat percentage, flexibility, and waist and hip circumferences. The primary researcher varied the order of the test depending on the availability of the assessment room; however, the submaximal treadmill test was always performed last. Prior to the start of the submaximal cardiovascular test, the researcher calculated the subject's estimated targeted heart rate percentage of 85%. The method that was used is shown here:

$$\text{Maximum Heart Rate } (HR_{max}) = 220 - \text{age of participants}$$

$$\text{Target Heart Rate} = HR_{max} \times 0.85$$

(ACSM, 2006, p. 145)

For consistency purposes, the pre- and post-assessments were completed at the same time of day for the participants. The researcher requested that the subjects perform the same habits prior to each of the assessments. These requests included wearing the same clothing, abstaining from any caffeine, eating the same foods, not exercising within 12 hours, and refraining from smoking within three hours. These habits were recorded at the pre-assessment and the researcher reminded the participants of their previous behaviors when setting up the post-assessment.

Height, Weight, and Body Mass Index

Before a subject arrived for an assessment, the researcher calibrated the scale by using a known 10-pound weight. The subjects were weighed in their workout attire (the subjects were told to wear the same clothes at each assessment) without shoes. At the pre-assessment, the height was recorded using the Vertec Stadiometer. The body mass index was calculated from the weight and height measurements or if used, the bioimpedence during body fat measurement.

Table 1 Body Mass Index (BMI)	
Classification	**BMI ($kg \cdot m^{-2}$)**
Underweight	< 18.5
Normal	18.5 - 24.9
Overweight	25.0 - 29.9
Obesity	> 30
	ACSM, 2006, p.58

Body Fat Percentage

Two instruments were used to calculate body fat percentage: skinfold calipers and bioimpedence. The skinfold calculation was recorded as the subjects' body composition. If the subjects' skinfolds were bigger than the calipers' width due to obesity, the bioimpedence data were used to measure body fat. The skinfold method was the first choice of measurement. To calibrate the skinfold calipers, , the researcher took a known distance of 5 centimeters and measured that distance with the calipers A recommended seven site skinfold equation was used to determine the body composition of the subject The skinfold sites measured for both men and women included the chest, midaxillary, triceps, subscapular, abdomen, suprailiac, and thigh (ACSM, 2006, p. 63).

The general procedures followed were according to ACSM recommendations (See Appendix B, Table 22). Each of the skinfolds was measured on the right side of the body while the subjects were standing upright. The tester placed the calipers directly on the skin surface, one centimeter away from the thumb and finger, perpendicular to the skinfold, and halfway between the crest and the base of the fold. The pinch was maintained while waiting one to two seconds before reading the calipers. Each of the sites was measured and recorded three separate times (ACSM, 2006, p. 62). The researcher performed all the measurements once, and then repeated the process two additional times.

Once all three skinfold measurements were recorded, the researcher used the equations to determine the body density (See Appendix B, Table 23). Body density was plugged into the appropriate gender-related equation and recorded as percent body fat If the subjects were too large to use skin fold calipers, the subjects were tested by the Body Logic Bioimpedience for their body fat percentage. The tester entered the subject information into the bioimpedence device before handing it to the subjects. The subjects stood with their feet shoulder width apart holding the bioimpedience grip electrodes with their arms parallel to the floor. Once the results were displayed on the digital screen, the tester recorded the body fat percentage and BMI. The results were then recorded.

Girth Measurements

The girth measurements were performed according to the ACSM guidelines (ACSM, 2006 p.60). A non-stretch cloth measuring tape was used for all assessments. The researcher measured the subjects' hip and waist according ACSM guidelines (Shown below); each site was measured twice to assure accuracy and recorded in centimeters. Waist-to-hip ratio (WHR) was calculated from the girth measurements (waist/hip). Table 2, shown below, shows the correct procedures for measuring the hip and waist circumference.

Table 2 Girth Measurements	
Circumference Sites	
SITE	**PROCEDURE**
Hips	With the subject standing erect and feet together, a horizontal measure is taken at the maximal circumference of buttocks. This measure is used for the hip measure in a waist/hip measure
Waist	With the subject standing, arms at the sides, feet together, and abdomen relaxed, a horizontal measure is taken at the narrowest part of the torso (above the umbilicus and below the xiphoid process).
	ACSM, 2006, page 60

Flexibility: Sit and Reach Box

The subjects' flexibility test was performed prior to the cardiovascular test. The researcher put the bar on the sit and reach box at zero prior to the start of the test. The subjects sat on the floor with their feet pressed firmly against the sit and reach box. Once seated, the subjects positioned their hands so their fingertips were overlapping. The subjects' knees remained on the ground so the legs were kept straight while the subjects slowly reached forward with both hands as far as possible without bouncing. The distance of the stretch was recorded. There were three trials of the stretch and the average of the three was the flexibility range for the assessment. The subjects waited approximately 10 seconds between each trial.

Cardiovascular Treadmill Test

The decision to use a submaximal versus a maximal exercise test was based on the purposes for performing the test. The exercise test protocol used reflected the purpose of the test, the specific outcomes desired, and the characteristics of the subjects being tested (ACSM, 2006, p. 68). The subjects in this study were deconditioned and were stratified into a moderate to high-risk category for coronary heart disease. A maximal exercise test requires subjects to exercise to the point of volitional fatigue. In addition, a maximal test requires physician approval and/or and required medical supervision. ACSM, 2006, p. 67). For this study, it was important to determine functional capacity of the subjects. Therefore, a walking submaximal test was deemed appropriate. The Ebbeling Minute Walk Test protocol was chosen because it is a valid way to estimate VO2 when test time must be short and there is a wide-range of physical conditions of the participants (Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991, p. 970).

The subjects performed the Ebbeling Minute Walk submaximal VO_2 test on the True® treadmill ergometer and wore a Polar Heart Rate Monitor. The tester placed a chair on the treadmill belt. While seated for five minutes, resting heart rate and blood pressure were recorded for each subject. The use of a submaximal test assumed several factors based on the estimates of VO_{2max} from the heart rate response:

1. A steady-state heart rate was obtained for each exercise work rate and was consistent each day.
2. A linear relationship existed between heart rate and work rate.
3. The maximal workload was indicative of the maximal $VO_{2.}$
4. The maximal heart rate for a given age was uniform.
5. Mechanical efficiency (i.e., VO_2 at a given work rate) was the same for everyone.
6. The subject was not on medications that alter heart rate. (ACSM, 2006, p. 68)

<u>Resting Heart Rate</u>

1. The subjects put on the Polar Heart Rate Monitor, the watch and chest band.

2. The subject remained seated for 5 minutes; back supported, and feet flat on the floor.
3. While the subjects were seated in the chair, the researcher calculated the subjects' maximum heart rate by taking the subjects' age and subtracting that from 220. (220 - age = HR_{max})
4. The researcher read the heart watch after five minutes and recorded the heart rate on the Subjects' Recording Form.
5. Once the researcher had the predicted maximum and resting heart rates, heart rate percentages were calculated.
6. The researcher calculated the subjects' 70% heart rate maximum percentage to determine an endpoint to the treadmill test:

$$\text{Target Heart Rate} = HR_{max} \times 0.70$$

(ACSM, 2006, p. 145)

Blood Pressure

1. Patients sat quietly for five minutes in a chair with their back supported and with their feet on the floor. Subjects' left arm was positioned at heart level. Patients were recommended to refrain from smoking cigarettes or ingesting caffeine during the 30 minutes preceding the measurement.
2. The cuff was aligned with the brachial artery and firmly wrapped around the arm. The appropriate cuff size was used to ensure accurate measurement. The bladder within the cuff encircled at least 80% of the upper arm.
3. The stethoscope bell was placed below the antecubital space over the brachial artery.

4. The cuff was inflated quickly to 20 mm Hg above last Korotkoff sound.
5. Cuff pressure was released at rate equal to 2 to 5 mm Hg per second.
6. Systolic BP was recorded as the point at which the first of two or more Korotkoff sounds were heard (Phase 1) and diastolic BP was recorded as the point right before the disappearance of Korotkoff sounds (Phase 5).
7. At least two measurements were made (minimum of 1 minute apart).
8. Subjects were provided BP measurements verbally and in writing. The researcher worked with those subjects who were concerned about their high blood pressure to develop appropriate goals. (ACSM, 2006, p. 43)

Once the heart rate and blood pressure were recorded, the subjects stood up on the treadmill belt and the tester removed the chair and placed it on the floor in front of the treadmill. The subjects walked at their normal gait with their hands free from holding on to any part of the treadmill. The researchers followed the Ebbeling protocol:

1. Put a chair on the treadmill (treadmill is OFF) for the subject to sit on.
2. Take resting heart rate and blood pressure according to ACSM guidelines. Once resting heart rate was recorded the researcher calculated the subjects' 85% maximum heart rate percent by the Karvonen Method.
3. Explain the Ebbeling Walk Test protocol to the subjects including any indications that indicate an immediate stop to the test due to subjects' request or ACSM Contraindications (See Appendix G and H).
4. The subjects stood-up, the chair was moved from the treadmill and put on the floor in front of the treadmill.

5. The subjects straddled the treadmill belt, the subject was warned when the belt began moving to comfortably step on; the treadmill was set to a speed between 2-4.5 miles per hour chosen by the subject at a zero percent grade.
6. Once the subjects began walking on the treadmill the test began. The subjects performed a two-minute warm-up before increasing the speed and grade to between 2.0-4.5 miles per hour at a 5% grade.
7. The researcher recorded the subjects' heart rate and RPE (described below) at the end of every minute and marked it on the recording form.
8. The researcher took the subjects' blood pressure at the end of the third minute and marked it on the recording form.
9. The researcher asked the subjects at the end of each minute how they felt and asked if they can continue with the test.
10. At the end of four minutes, the final heart rate reached was used in the equation.
11. After the subjects completed a three-minute cool-down period, the subjects were allowed to step off the treadmill.

The tester measured the subjects' blood pressure at the third minute. At the end of every minute the tester asked the subjects how they felt according to the Borg's 20-point RPE scale. The researcher calculated the subjects' estimated maximum VO_2 level after the completion of the assessments. The data gathered from the submaximal treadmill test was plugged into the walking metabolic equation to estimate maximal oxygen uptake (VO_2):

15.1 + (21.8 x _________mph) - (0.327 x __________bpm) - (0.263 x _______mph x _____age) + (0.00504 x _______ bpm x _________ age) + (5.98 x _________ [Gender: F=0; M=1])

(Ebbeling, Ward, Puleo, Widrick, and Rippe, 1991)

The tester followed ACSM guidelines for any contraindications that could have appeared during testing or guidelines for stopping the test (See Appendix G and H). The researcher had the right to stop the test at any time if he or she deemed necessary. In addition, the subjects had the right to stop the treadmill test at anytime at their discretion with no repercussions from the tester. The tester requested a re-test date when a test needed to be repeated.

RPE Scale

While doing physical activity, the subjects rated their perception of exertion. This feeling reflected how heavy and strenuous the exercise felt to them, combining all sensations and feelings of physical stress, effort, and fatigue. The subjects did not concern themselves with any one factor such as leg pain or shortness of breath, but focused on the total feeling of exertion.

The subjects looked at the rating scale (See Table 3 below) while participating in the submaximal exercise test; it ranged from 6 to 20, where 6 means "no exertion at all" and 20 means "maximal exertion." The subjects chose the number that best described their level of exertion. The subjects were told to appraise their feelings of exertion as honestly as possible, without thinking about what the actual physical load was. The subjects' feelings of effort and exertion were important, not how it compared to others. The subjects' looked at the scales and the facial expressions on the chart and then gave a number that correlated with their feelings (Center for Disease Control, 2005). “A high correlation exists between a person's perceived exertion rating times 10 and the actual heart rate during physical activity; so a person's exertion rating may provide a fairly good estimate of the actual heart rate during activity (Borg, 1998). For example, if a person's rating of perceived exertion (RPE) is 12, then 12 x 10 = 120; so the heart rate should be approximately 120 beats per minute.

The Borg Rating of Perceived Exertion is also the preferred method to assess intensity among those individuals who take medications that affect heart rate or pulse (Center for Disease Control, 2005). The Borg Rating of Perceived Exertion is shown in Table 3:

Table 3 RPE Scale

Borg's Rate of Perceived Exertion	
ACSM, 2006, p. 77	
6	No exertion at all
7	
7.5	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard, feels OK to continue
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

The number 9 corresponds to "very light" exercise. For healthy subjects, the number 9 was like walking slowly at their own pace for several minutes; 13 on the scale was "somewhat hard" exercise, but it still felt OK to continue; 17, "very hard" was very strenuous; 19 on the scale was an extremely strenuous exercise level,; for most subjects this was the most strenuous exercise they have ever experienced.

Cholesterol

The technician used the Cholestech L.D.X. machine to perform the cholesterol screenings. Prior to the start of the test, the researcher calibrated the Cholestech L.D.X. machine by using the Optick check cassette. The Cholestech read the Opticks check and displayed four numbers between 85 and 92. If the numbers were outside the range then the machine was not calibrated and an identical machine was checked for calibration. The researchers' hands were washed and latex gloves were worn throughout the cholesterol test as a precaution in case of fluid transmission. The finger was disinfected with an alcohol swab and a new sterile lancet was used to obtain blood. The finger prick was done over absorbent paper to eliminate transmission of fluids. The finger prick procedure was adapted directly from the Cholestech and Miami Valley Hospital protocol:

<u>Fingerstick Procedure</u>

Precautions:

**A warm hand and good blood flow from the puncture site are essential in order to draw a good capillary sample.

1. The patient sat quietly for five minutes before the blood sample was collected.
2. A capillary plunger was put into the end of a Cholestech capillary tube to the red mark.

3. The researcher chose a spot that was on the side of one of the center fingers of either hand. The fingers and hands were warm to the touch. If needed, to warm the hand, the researcher:
    a. Told the subjects to wash their hand with warm water, or…
    b. Applied a warm (not hot) compress to the hand for several minutes, or…
    c. Gently massaged the finger from the base to the tip several times to bring the blood to the fingertip.
4. The site was cleaned with an alcohol swab. The site was dried thoroughly before the finger was pricked.
5. Firmly pricked the selected site with a lancet.
6. The researcher squeezed the finger gently to obtain a large drop of blood. This first drop of blood was wiped away because it could have contained tissue fluid.
7. The researcher squeezed the finger gently again while holding it downward until a second large drop of blood forms.
8. The capillary tube was held horizontally by the end with the plunger. The tube touched the drop of blood without touching the skin. The tube was filled by capillary action up to the black mark. The researched did not collect air bubbles. If it was necessary to collect another drop of blood, the finger was wiped with gauze then massaged again from base to tip until a large drop of blood forms.

9. The researched wiped off any excess blood and had the patient apply pressure to the puncture until the bleeding stopped.

Band-aids were available for subjects. The blood was collected in a capillary tube. The researcher used the black capillary plunger in the capillary tube to press the blood into the cassette hole. Once the blood was fully discharged from the capillary tube, the cassette was pressed firmly into the Cholestech L.D.X. and analyzed. The lancet, capillary tube and plunger were discarded in a biohazard waste container. The Cholestech L.D.X. took approximately seven minutes to complete an analysis. Once the cassette in the machine opened, the total cholesterol (TC) and the high-density-lipoprotein (HDL) values were recorded on the subjects' data form. After these two numbers were recorded, the machine provided the TC/HDL ratio. The cassette and the gloves were discarded in the biohazard waste container. If the results from the cholesterol screening reported the participants' levels as too high for total cholesterol or too low levels for HDL-C, then the researcher recommended that the subject go to the doctor for further testing and diagnosis. The biohazard waste container and bag were properly disposed of according to hospital safety standards.

Mid-Assessments

Mid-assessments were performed at week six to measure weight, height, girth measurements, resting blood pressure, resting heart rate, and body mass index. The results were recorded on a second form (See Appendix F, Mid-Assessment Form). After the mid-assessments were completed, the tester re-evaluated the results and exercise logs to see if adjustments needed to be made to the subjects' exercise program to ensure continued progress. The technician explained the exercise program modifications if needed.

Final Assessments

The final assessments were performed at week thirteen to measure weight, height, body fat percentage, waist and hip circumference, total cholesterol, HDL-cholesterol, total and HDL-cholesterol ratio, estimated VO_2 max, resting blood pressure, resting heart rate, flexibility, and body mass index. The results were recorded on the pre- and post-assessment form (See Appendix F). After the participants left the post-assessment, the primary researcher calculated the results and created a final send-off packet for each of the participants. The packet included a letter from the primary researcher to the participants, the results comparing the pre-assessment results to the post-assessment results, future cardiovascular and weight training recommendations, overall physical fitness benefits, and tips for staying active (See Appendix M).

Exercise

The results of each pretest assessment were recorded and the researcher stratified the subjects into one of two exercise groups based upon Body Mass Index: BMI <30 kg/m^2 and BMI ≥ 30 kg/m^2:

Table 4 BMI Groups	
Groups	
BMI < 30 kg/m^2	1
BMI ≥ 30 kg/m^2	2

Pre-assessment results were entered into two coronary heart disease risk factor analyses: Framingham Heart Score and ACSM Risk Factor Analysis. Following the completion of the risk factor analysis, the researcher calculated the Framingham Heart Score to determine the subjects' coronary heart disease 10-year risk. The second coronary heart disease analysis used is from American College of Sports Medicine. The primary researcher used the ACSM Risk Factor Threshold is shown in Table 5:

Table 5 ACSM CHD Risk Factors

Coronary Artery Disease Risk Factor Thresholds for Use With ACSM Risk Stratification	
Positive Risk Factors	**Defining Criteria**
Family History	Myocardial infarction, coronary revascularization, or sudden death before 55 years of age or other male first-degree relative, or before 65 years of age in mother or other female first-degree relative
Cigarette Smoking	Current cigarette smoker or those who quit within the previous 6 months
Hypertension	Systolic blood pressure $\geq$140 mmHg or diastolic $\geq$90 mmHg, confirmed by measurements on at least two separate occasions, or on antihypertensive medication
Dyslipidemia	Low-density lipoprotein (LDL) cholesterol >130 mgdL^{-1} or high-density lipoprotein (HDL) cholesterol <40 mgdL^{-1} or on lipid-lowering medication. If total serum cholesterol is all that is available to use >200 mgdL^{-1} rather than low-density lipoprotein (LDL) >130mgdL-1
Impaired Fasting Glucose	Fasting blood glucose >100mgdL^{-1} confirmed by measurements on at least two separate occasion
Obesity	Body mass index >30 kg m^{-2} or waist girth >102 cm for men and >88 cm for women or waist/hip ratio: $\geq$0.95 for men and $\geq$0.86 for women
Sedentary Lifestyle	Persons not participating in a regular exercise program or not meeting the minimal physical activity recommendations from the U.S. Surgeon General's Report
Negative Risk Factor	**Defining Criteria**
HDL Cholesterol	>60 mgdL-1

ACSM, 2006, p. 22

Using the above guidelines, the subjects' were listed in one of three ACSM Categories: Low, Moderate, or High Risk (ACSM, 2006, p. 27):

Table 6 ACSM Risk Stratification	
ACSM Risk Stratification Categories	
Low Risk	Men $\leq$ 45 years of age and women $\leq$ 55 years of age who are asymptomatic and meet no more than one risk factor threshold from CHD risk factors
Moderate Risk	Men > 45 years of age and women > 55 years or those who meet the threshold for two or more CHD risk factors
High Risk	Individuals with one or more signs and symptoms or known cardiovascular, pulmonary, or metabolic disease

The researcher explained the assigned exercise program according to exercise guidelines and showed the subjects any weight exercises with which they were unfamiliar. The subjects were given an outline of their exercise program and exercise logs to record their workouts (See Appendix I, Cardiovascular Exercise Log). The subjects had an opportunity to ask any questions regarding the procedures of the study or what was expected of them throughout the duration of the exercise program.

Exercise Guidelines

The primary researcher thoroughly explained the 12-week exercise program to the subjects. All elements of the program were written in detail so they would be easy read and understood (See Appendix I). Exercise risk was minimized by 1) having the participants obtain a physician's approval to exercise, 2) by placing them in an ACSM risk stratification level, and 3) by educating them of the dangers to avoid during physical activity (Fletcher et al. 1996). The subjects were given an exercise program that best fit their needs and conditions. The programs were individualized to promote constant progress and adaptable to specific health problems or injuries. The individualized programs were designed to challenge each participant to reach a higher level of fitness and to encourage participants to try new modalities of exercise. Each program included cardiovascular, weight training, and flexibility exercises. The cardiovascular guidelines gave specific heart rate ranges for the subjects to follow (described below).

The exercise guidelines recommended each exercise session start with a warm-up and end with a cool-down and stretching (described below). The recommended amount of exercise time for the subjects did not include the warm-up or cool-down. The exercise programs were designed so that the subject could choose to perform the weight training and cardiovascular exercises on the same day or alternate days. In addition, the subjects could decide the order in which they performed their cardiovascular and weight training exercises. Each of the participants was shown the correct form to use when stretching and when performing the weight exercises in order to prevent injuries from occurring.

The subjects were free to exercise at anytime during the week assuming the designated workouts were completed each week. The subjects were given cardiovascular and weight training logs. Each of the subjects recorded their workouts on the designated exercise logs. Every four weeks, the subjects turned in their cardiovascular exercise workout logs to the primary researcher. After reviewing the exercise logs, the researcher talked with the subjects if changes needed to be made. Throughout the study, the subjects had the opportunity to ask questions and make comments to the researchers regarding their training and the study.

Heart Rate

The primary researcher stressed the importance of monitoring the heart rate during the exercise sessions. As the subjects started training, their heart rate increased rapidly in proportion to the intensity of their training. The researcher calculated the subjects' heart rate ranges for the cardiovascular exercise recommendations. The subjects were asked to maintain a pace so that their heart rate was between was 60-85% of their maximum heart rate. Individual heart rate percentages were calculated at 60, 65, 70, 75, 80, and 85% of HR max. The heart rate calculations was from ACSM, 2006, p. 145:

$$\text{Maximum Heart Rate } (HR_{max}) = 220 - \text{age of participant}$$

$$\text{Target Heart Rate Range} = HR_{max} \text{ x percent intensity}$$

The heart rate recommendation for each exercise session was written on their exercise program (See Appendix I, Overview Cardiovascular Exercise Guidelines). The recommendation of the heart rate percentage for the exercise program varied session to session, from a low intensity (60%) to a high intensity (85%). The subjects were recommended to wear a Polar Heart Rate monitor during all cardiovascular workouts to track their heart rate intensity. The heart rate monitors were located in the Wellness Center for subjects to borrow during their workouts.

The "talk test" was used if subjects were on hypertension medication and unable to use a heart rate to measure intensity. Singing or talking freely while exercising meant that the subject was not working hard enough. The inability to maintain a conversation indicated that the subject was working too hard and should reduce intensity. Exercising at the correct intensity allowed subjects to carry on a conversation with a slight degree of difficulty during a moderately intense exercise.

Warm-Up

The warm-up was the transition from rest to exercise. Warm-up is recommended before exercise in order to stretch postural muscles, increase metabolic rate (augment blood flow, elevate body temperature, dissociate more oxygen), reduce the susceptibility to musculoskeletal injury by increasing connective tissue extensibility, improve joint range of motion and function, and enhancing muscular performance (ACSM, 2006, p. 137). “Subjects performed a low intensity (45-55% HR_{max}) cardiovascular exercise for 5-10 minutes that gradually increased the heart rate to desired workout heart rate intensity (ACSM, 2006, p. 138). The mode of exercise for warm-up was the subjects’ choice. The warm-up time was not included in the total recommended workout time as seen on the exercise guidelines.

Cool-Down

The cool-down period allowed for a gradual decline in heart rate intensity of the exercise session (ACSM, 2006, p. 138). The cool-down period is important in order to decrease the exercise-induced circulatory responses and return heart rate and blood pressure to near resting values (ACSM, 2006, p. 138). The cool-down continued for a period of five minutes. The cool-down time was not included in the total recommended workout time

Modalities

The main focus of any cardiovascular exercise is to increase the heart rate for a sustained period of time using large muscle groups in activities that are rhythmic or dynamic in nature (ACSM, 2006, p. 139). Subjects could choose any of the recommended exercises which included running, walking, cycling, rowing, swimming, or the use of exercise machines, such as the elliptical and arc trainer. It was recommended that the subjects alternate modalities throughout the week to reduce boredom and plateaus.

Stretching

Stretching is the "systematic elongation of musculotendinous units to create a persistent length of the muscle and a decrease in passive tension. Musculotendinous units were considered the limiting structures preventing a greater range of motion about a joint" (ACSM, 2006, p. 159). The application of stretching can result in a longer length of the muscle at a lower tension, thereby improving flexibility (ACSM, 2006, p. 159). The stretches performed during the exercise sessions were static stretches. Static stretching requires a slow stretch of the muscle to the end of the range of motion or the point of tightness without invoking discomfort. The stretch should be held for an extended period of time, such as 15-30 seconds (ACSM, 2006, p. 159). All the subjects performed stretches after the completion of an exercise session. The subjects followed ACSM guidelines:

- Precede stretching with a warm-up to elevate muscle temperature.
- Do a static stretching routine that exercises that major muscle tendon units that focuses on muscle groups (joints) that have reduced range of motion.
- Perform a minimum of 2 to 3 days/week, ideally 5 to 7 days/week.
- Stretch to the end of the range of motion at a point of tightness, without inducing discomfort.
- Hold each stretch for 15 to 30 seconds.
- Two to four repetitions for each stretch. (ACSM, 2006, p. 159-160)

Research Design

This study used a pretest-posttest design. To analyze the data, a Hotelling Paired T^2 test was used to determine if there was a significant difference in the amount of change in the pre- and post- values of total cholesterol, HDL-C, blood pressure, and Framingham 10-Year Risk Score between two groups of BMI $\geq$ 30 kg/m^2 and < 30 kg/m^2.

The major weakness of the study was the subjects could exercise outside the Wellness Center, which meant that they were not monitored. The subjects were encouraged to exercise exclusively at the Wellness Center, but it was not a requirement of the study. Having the availability of the Wellness Center to all participants during the study allowed the subjects to have easy access to trained staff members who reassured the subjects that they followed the exercise program correctly. The major strength of this study was the personalized attention the subjects received during all phases of testing and exercise. Each exercise program accounted for individual physical fitness levels and health conditions of the subjects.

Accountability

The primary researcher was in contact with the subjects to help keep them motivated to continue with the exercise program. The researcher sent out emails to each participant every three weeks to check on their progress. Subjects were encouraged to ask questions regarding their exercise. The Every four weeks, subjects sent their cardiovascular and weight training exercise logs to the primary researcher.

Data Analysis Plan

This study was designed to demonstrate the effects of a 12-week exercise program on coronary heart disease risk factors and 10-year risk reduction of coronary heart disease and specific CHD risk factors in hospital employees. The data from each of the subjects' assessment results were complied in an Excel spreadsheet. An overall coronary heart disease 10-year risk CHD risk factors, total cholesterol, HDL-C, blood pressure, body mass index, were compiled and calculated from the pre- to post-assessment results and statistically analyzed. A Hotelling Paired T^2 test was used to determine if there were significant differences in the amount of change in the pre- and post-values of the outcomes between the two groups BMI < 30 and BMI $\geq$ 30 kg/m^2. Data from subjects on hypertension and/or cholesterol medication were excluded from statistical analysis

The Body weight, body composition, waist to hip circumference, resting heart rate, flexibility, and estimated maximum VO_2, were calculated and reported as an overall change from the pre- to post-assessment. These measurements were not statistically analyzed, but the changes from pre- to post-assessments were found.

Summary

This study was designed to demonstrate the effects of a 12-week exercise program on coronary heart disease risk factors and 10-year risk reduction of coronary heart disease and specific CHD risk factors in hospital employees. The basis for the exercise program was by the American College of Sports Medicine guidelines. Subjects were placed into one of two groups based upon body mass index values. Exercise programs were based upon a subject's current fitness/health level and designed so that the sessions challenging and fun. This study used a pretest-posttest design incorporating the Hotelling Paired T^2 test to determine significant differences in the amount of change in the pre- and post-values of total cholesterol, HDL-C, blood pressure, and Framingham 10-Year Risk Score between the two BMI groups.

IV. ANALYSIS OF DATA

The purpose of this study was to demonstrate the effects of a regular exercise program on coronary heart disease risk factors in full-time hospital employees. The risk factors assessed in this study included obesity, hypertension, body mass index, total cholesterol, and HDL-C levels. Risk factor measurements were applied to the Framingham Heart Score to determine the participants' 10-year risk of CHD. In addition, to demonstrate the benefits of exercise, the body weight, body fat percentage, estimated VO_2 max, waist to hip ratio, resting heart rate, and flexibility were measured

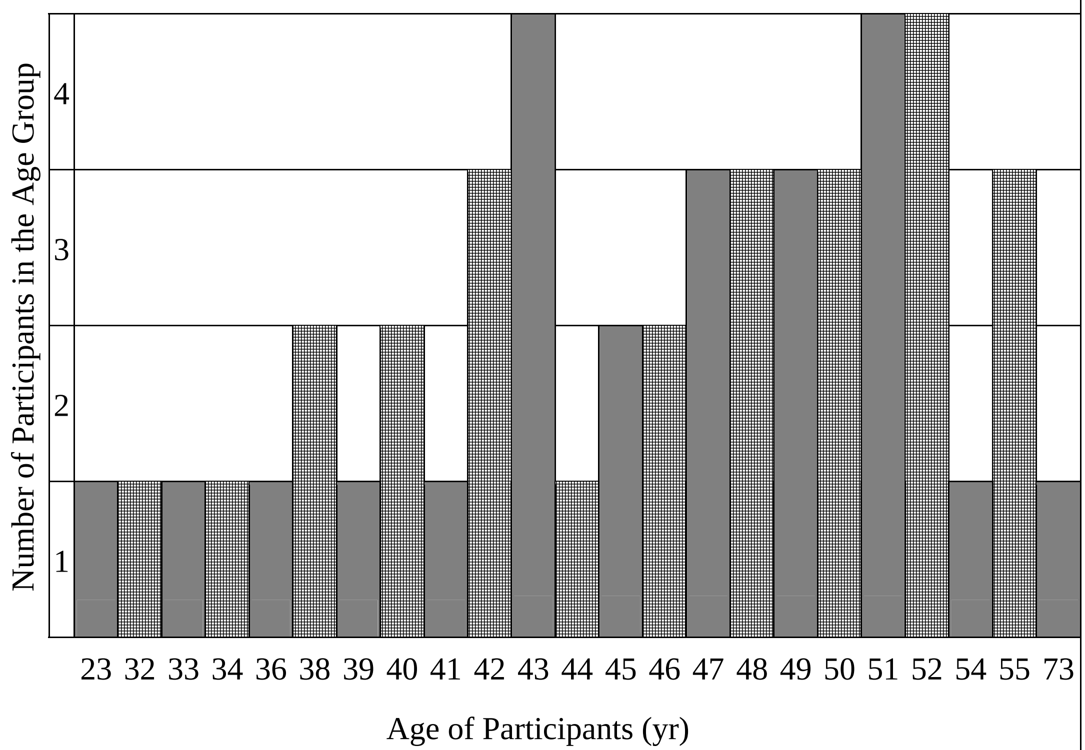
Data were analyzed using a multivariate version of the Student's t-Test called a Hotelling T^2 test. The Hotelling T^2 tested for significant differences between the pre- and post-assessment data simultaneously. The Wilks' Lambda statistic ultimately determined that there was no overall group effect (p-value = 0.9611).

Demographic Profile

Sixty participants began the study, but 12 individuals dropped out for various reasons. The final population for this study consisted of 48 full time hospital employees from 32 different departments at Miami Valley Hospital (MVH). The participants worked in departments including administration, coding, research, nursing, and a director. Subjects worked an average of 12.73 years (Range = 90 days to 33 years).

As shown below in Figure 1, the participants' ages ranged from 23 years of age to 73 years old. The average age of the participants was 48 years. In the BMI < 30 kg/m^2 group, the average age was 46.9 years and in the BMI $\geq$ 30 kg/m^2 group, the average age was 44.7 years old. The three most frequent ages of the participants were 43, 51, and 52 years.

Figure 1 Breakdown of Participants' Ages



Other demographic data recorded were gender, smoking status, current physical activity level, presence of diabetes, CHD risk for heart disease stratification, and whether the participants were on blood pressure medication, cholesterol medication, or both. Table 8 further describes the frequency and percentile data for each variable based upon the total population and both BMI groups. Table 7, shown below, further describes the demographic data.

Table 7 Demographic Data

Group		Total		BMI < 30		BMI ≥ 30	
Variable	**Level**	n_{total}	$\%_{Total}$	n_{group}	$\%_{group}$	n_{group}	$\%_{group}$
	BMI < 30	27	56.25				
	BMI ≥ 30	21	43.75				
Gender	Female	40	83.33	23	57.5	17	42.5
	Male	8	16.67	4	50.0	4	50.0
Smoker	Yes	2	4.17	1	50.0	1	50.0
	No	46	95.83	26	57.4	20	43.6
Exercise	≥ 2 days/wk	12	25.00	7	58.3	5	41.7
	< 2 days/wk	36	75.00	20	56.0	16	44.0
Diabetes	Yes	2	4.17	1	50.0	1	50.0
	No	46	95.83	26	57.4	20	43.6
CHD Risk	Low	17	35.42	15	88.2	2	11.8
	Moderate	31	63.58	12	38.7	19	61.3
Medications	None	38	79.17	23	60.5	15	39.5
	Hypertension	4	8.33	1	25.0	3	75.0
	Cholesterol	4	8.33	3	75.0	1	25.0
	Both	2	4.17	0	0.0	2	100.0

Based upon self-reported demographic data from Table 7, 75% of the participants, or 36 individuals, did not exercise at all or on a regular basis. The other 25% of the participants exercised two or more days a week at a moderate intensity. However, after evaluating the written exercise questions on the demographic handout given at the start of the study, none of the participants met the exercise recommendations given by ACSM's standards. From this finding, it was determined that the overall fitness levels of the participants were classified as sedentary to low/moderate. Despite the lack of exercise performed by the participants prior to the start of the study, the overall health of the participants was good based upon the demographic data received. This observation was noted because only 20.83% (n=10) of the participants were on hypertension medication, cholesterol medication, or both. In addition, 4.17% (n=2) of the participants were diabetic and 4.17% (n=2) were smokers.

Research Questions

To determine the effects of exercise on the risk factors for coronary heart disease, five hypotheses were developed. The results were based upon two separate measurements, a pre- and post-exercise program comparison. Tables 8 and 9 show the results for each BMI group.

Table 8 Hypotheses Results for BMI < 30 kg/m^2 Group

GROUP	BMI < 30 kg/m^2			
Variable	Mean $\pm$ SD		Range	
	Pre	Post	Pre	Post
Framingham Heart Score[a]	7.2 $\pm$ 5.5	7.6 $\pm$ 5.2	-4.0 to 19.0	-4.0 to 18.0
Total Cholesterol (mg/dL)	202.5 $\pm$ 49.6	191.5 $\pm$ 31.0	140.0 to 389.0	143.0 to 276.0
HDL Cholesterol (mg/dL)	60.3 $\pm$ 14.6	54.9 $\pm$ 13.2	26.0 to 87.0	21.00 to 83.0
Systolic Blood Pressure (mmHg)	120.8 $\pm$ 11.0	122.7 $\pm$ 10.9	98.0 to 142.0	102.0 to 150.0
Diastolic Blood Pressure (mmHg)	78.1 $\pm$ 9.4	76.4 $\pm$ 7.4	50.0 to 98.0	62.0 to 88.0
Body Mass Index (kg/m^2)	26.7 $\pm$ 2.6	26.4 $\pm$ 2.5	20.8 to 31.6	20.1 to 31.2

[a] Framingham Heart Score range = < 9 to > 25 points

Table 9 Hypotheses Results for BMI $\geq$ 30 kg/m^2

GROUP	**BMI $\geq$ 30 kg/m^2**			
Variable	**Mean $\pm$ SD**		**Range**	
	Pre	**Post**	**Pre**	**Post**
Framingham Heart Score[a]	7.0 $\pm$ 4.43	7.4 $\pm$ 5.3	-1.0 to 15.0	-3.0 to 16.0
Total Cholesterol (mg/dL)	202.4 $\pm$ 38.1	196.1 $\pm$ 38.4	144.0 to 305.0	143.0 to 310.0
HDL Cholesterol (mg/dL)	53.8 $\pm$ 11.8	49.2 $\pm$ 9.5	30.0 to 78.0	26.0 to 64.0
Systolic Blood Pressure (mmHg)	124.4 $\pm$ 8.2	128.5 $\pm$ 14.6	110.0 to 140.0	108.0 to 166.0
Diastolic Blood Pressure (mmHg)	82.5 $\pm$ 4.7	81.2 $\pm$ 5.8	72.0 to 90.0	70.0 to 90.0
Body Mass Index (kg/m^2)	35.9 $\pm$ 6.2	35.6 $\pm$ 6.3	30.0 to 56.4	29.9 to 57.1

[a] Framingham Heart Score range = < 9 to > 25 points

Null Hypothesis: The overall 10-year risk of coronary heart disease will not be lowered as demonstrated by the Framingham Heart Score The pre- and post-averages for the Framingham Heart Score for BMI < 30 and BMI $\geq$ 30 kg/m^2 were 7.2 and 7.6, 7.0 and 7.4 points respectively. There was no significant difference in the 10-year reduction of coronary heart disease in the participants in either BMI group; therefore, the null hypothesis cannot be rejected.

H_{01}: Incorporating a regular exercise program will not decrease the subjects' total cholesterol. The pre- and post-averages for the total cholesterol for BMI < 30 kg/m^2 and BMI $\geq$ 30 kg/m^2 groups were 202.50 and 191.50 mg/dL and 202.40 and 196.10 mg/dL, respectively. There were no significant differences in total cholesterol of the participants in either BMI group; therefore, the hypothesis cannot be rejected.

$\underline{H_{02}}$*: Incorporating a regular exercise program will not increase the subjects' individual high-density lipoprotein level.* The pre- and post-averages for the high-density lipoprotein cholesterol for BMI < 30 and BMI $\geq$ 30 kg/m^2 groups were 60.30 and 54.90 mg/dL, 53.80 and 49.20 mg/dL respectively. There was no significant difference in HDL-cholesterol of the participants in either BMI group; therefore, the hypothesis cannot be rejected.

$\underline{H_{03}}$*: Incorporating a regular exercise program will not affect the subjects' individual body mass index.* The pre- and post-averages for the body mass index for BMI < 30 and BMI $\geq$ 30 kg/m^2 groups were 26.70 and 26.40 kg/m^2, 35.90 and 35.60 kg/m^2 respectively. There was no significant difference in BMI of the participants in either group; therefore, the hypothesis cannot be rejected.

$\underline{H_{04}}$*: Incorporating a regular exercise program will not affect the subjects' individual blood pressure.* The pre- and post-averages for the blood pressure (systolic/diastolic) for BMI < 30 and BMI $\geq$ 30 kg/m^2 were 120.80/78.10 and 122.70/76.40, 124.40/82.50 and 128.50/81.20 mmHg respectively. There was no significant difference in blood pressure of the participants in either BMI group; therefore, the hypothesis cannot be rejected.

Observation Measurements

Other measurements were taken to show more benefits of exercise to the participants. These measurements include weight, body fat percentage, waist and hip circumference, resting heart rate, estimated VO_2 max, and flexibility. The results of the alternate measurements are described below in Tables 10 and 11.

Table 10 Observation Results for the BMI < 30 kg/m^2 Group

GROUP	BMI < 30 kg/m^2			
Variable	Mean + SD		Range	
	Pre	Post	Pre	Post
Weight (kg)	74.5 + 9.5	73.4 $\pm$ 9.0	55.7 to 101.6	56.4 to 100.0
Body Fat (%)	24.2 $\pm$ 4.1	23.5 $\pm$ 4.2	15.4 to 30.9	11.1 to 29.0
Waist to Hip Ratio (cm)	0.8 $\pm$ 0.1	0.8 $\pm$ 0.1	0.7 to 1.0	0.7 to 0.9
Resting Heart Rate (bpm)	72.7 $\pm$ 6.8	73.7 $\pm$ 8.6	62.0 to 88.0	57.0 to 96.0
Estimated VO_2 (ml/kg/min)	33.3 $\pm$ 6.3	37.6 $\pm$ 6.9	24.9 to 51.1	25.9 to 51.8
Flexibility (cm)	28.7 $\pm$ 14.0	31.7 $\pm$ 15.4	-7.6 to 50.8	-7.2 to 68.6

Table 11 Observation Results for the BMI $\geq$ 30 kg/m^2 Group

GROUP	BMI $\geq$ 30 kg/m^2			
Variable	Mean + SD		Range	
	Pre	Post	Pre	Post
Weight (kg)	101.3 $\pm$ 20.2	100.5 $\pm$ 20.4	72.3 to 158.5	72.5 to 160.5
Body Fat (%)	31.7 $\pm$ 6.6	30.7 $\pm$ 7.0	23.2 to 48.5	23.7 to 48.1
Waist to Hip Ratio (cm)	0.8 $\pm$ 0.1	0.8 $\pm$ 0.1	0.70 to 1.1	0.7 to 1.1
Resting Heart Rate (bpm)	78.8 $\pm$ 10.1	77.9 $\pm$ 12.9	62.0 to 100.0	63.0 to 119.0
Estimated VO_2 (ml/kg/min)	30.3 $\pm$ 6.6	34.4 $\pm$ 6.5	18.1 to 51.1	19.5 to 46.5
Flexibility (cm)	31.5 $\pm$ 9.3	32.5 $\pm$ 9.6	13.0 to 49.5	14.0 to 49.5

The results from the pre- to post-assessments observation for both BMI groups show that there were no significant differences between the pre- and post-assessment measurements. Therefore, it was determined that a 12-week exercise program did not change the weight, body fat percentage, waist to hip ratio, resting heart rate, estimated VO_2 max, and flexibility of the participants.

Exercisers versus Non-Exercisers

There was no significant difference in any tested measurements within the two BMI groups. Therefore, the results were looked at from those participants who were compliant to the exercise program and those participants who did not complete the minimum recommendations. In Table 12, shown below, show the pre- to post-assessments results for those participants who performed at least the minimum recommendations (exercised at least three days per week for 30 minutes or more) for the entire 12-week; these participants were categorized as 'Exercisers.'

Table 12 Average Exercisers Results

		# Subjects	**Pre**	**Post**
Exercisers	Weight (kg)	28	84.499	83.0113
	BMI (kg/m^2)		29.4768	28.9605
	Body Fat %		25.7484	24.3897
	WHR		0.82621	0.83524
	Blood Pressure (mmHg)		124/82	125/79
	Estimated VO_2 (ml/kg/min)		33.491	38.268
	Flexibility (cm)		33.5475	36.1549
	Total Cholesterol (mg/dL)		206.714	196.536
	HDL-Cholesterol (mg/dL)		58.8927	55.1786

Those participants who did not meet the exercise recommendations given to them were categorized as 'Non-Exercisers.' While the majority of the participants exercised more than they had prior to the start of the study, they did not meet the three days per week for 30 minutes recommendation. The results for the 'Non-Exercisers' are shown below in Table 13.

Table 13 Average Non-Exercisers Results

		# Subjects	Pre	Post
Non-Exercisers	Weight (kg)	20	88.55	88.4475
	BMI (kg/m^2)		32.4765	32.4526
	Body Fat %		29.8926	29.6932
	WHR		0.82667	0.82427
	Blood Pressure (mmHg)		120/77	124/77
	Estimated VO_2 (ml/kg/min)		28.3462	33.362
	Flexibility (cm)		24.8227	26.3053
	Total Cholesterol (mg/dL)		196.5	189.3
	HDL-Cholesterol (mg/dL)		55.45	48.45

There were no significant differences between the two exercise compliance groups.

Other Findings

A Multivariate Analysis of Variance (MANOVA) was run using total cholesterol, HDL-C, blood pressure, and Framingham Heart Score. The factors were BMI groups, < 30 kg/m^2 and $\geq$ 30 kgm^2, and level of exercise, $\leq$ 2 days per week and > 2 days per week. The MANOVA was a full factorial model that included the interaction between the two factors. This allowed the testing for an effect that may not be the same for both levels of the factors. Using the multivariate technique produced an overall p-value for the five outcomes and avoided inflation of the Type one error. The effects of the tested are shown in Table 14.

Table 14 MANOVA	
Effect	**p-values for Wilks' Lambda statistic**
BMI*Exercise (Interaction)	0.1328
BMI	0.7675
Exercise	0.7249

An α level of p = 0.05, no significant differences were observed for group and exercise. The four hypotheses of the study were statistically analyzed to see if there was a difference between a history of exercise and/or a sedentary lifestyle of the participants. As shown in Table 15, there was no significant different for any variable measured for either BMI group when analyzed for exercise behavior prior to the start of the study.

Table 15 Exerciser vs. Nonexercisers According to BMI Group				
	BMI < 30 kg/m^2		**BMI $\geq$ 30 kg/m^2**	
Outcome (Post-Pre)	**$\leq$ 2 days/wk**	**> 2 days/wk**	**$\leq$ 2 days/wk**	**> 2 days/wk**
Total Cholesterol	-13.75 (33.67)	-3.00 (18.43)	-5.19 (16.73)	-10.00 (20.43)
HDL-C	-6.50 (8.80)	-2.43 (8.04)	-2.63 (5.74)	-11.00 (4.74)
Systolic Pressure	1.40 (10.40)	3.14 (13.90)	3.50 (15.19)	6.00 (16.97)
Framingham Heart Score	0.35 (2.13)	0.57 (1.99)	0.63 (3.12)	-0.40 (1.67)

Summary

The Hotelling T^2 tested for significant differences between the pre- and post-assessment data simultaneously. Using the Wilks' Lambda statistic there was no overall group effect (p-value = 0.9611). Age, gender, smoking, regular exercise, and diabetes were used as covariates, however, due to the limited number of the participants, significant differences were not observed. From the results of the study, none of the hypotheses can be rejected.

V. DISCUSSION

In 2005, coronary heart disease was the number one killer in the United States (American Heart Association, 2005). Incorporating a weekly exercise program has been recognized as playing a vital role in the prevention and treatment of disorders such as coronary artery disease, hypertension, diabetes, colonic neoplasm, and coronary obstructive pulmonary disease. (DiLorenzo et al., 1999, p. 75). In addition, worksite exercise programs have been shown to decrease employees' sick leave absences, health benefit costs, turnover rate of employees due to debilitating disease, and improved employee quality of life and morale, and enhanced productivity (Angard, Chez, and Young, 1998, p.1292). Therefore, the purpose of this study was to demonstrate that exercise could reduce risk factors for CHD. The study was conducted in an employee worksite wellness center in a major metropolitan hospital.

Hypotheses

The changes in the coronary heart disease risk of full-time hospital employees were monitored in order to test five hypotheses.

Null Hypothesis: The overall 10-year risk of coronary heart disease will not be lowered as demonstrated by the Framingham Heart Score. As discussed in the Analysis of Results chapter, there were no significant differences in the study; therefore, the null hypothesis cannot be rejected. The factors that made up the Framingham Heart Score did not significantly change, including total cholesterol, HDL-cholesterol, and systolic blood pressure. Therefore, it cannot be concluded that exercise reduces the risk of heart disease based on these results. The results are in direct conflict with the conclusions of previous studies, which have shown that physical activity helps reduce risk factors for coronary heart disease (Puffer, 2001, p. 5).

$\underline{H_{01}}$*: Incorporating a regular exercise program will not decrease the subjects' total cholesterol.* Lifestyle changes, such as diet and exercise, have been promoted as the first line of treatment for high cholesterol (Lalonde et al. 2002, p.16). Durstine et al. (2001, p. 1034) reported that cross-sectional evidence suggests that lipids level were reduced further with additional increases in exercise training volume. Likewise, Rogers, Misner, Ockene, and Nicolosi (1993, p. 860) reported that there was a proportional relationship between reduced risks of CHD from the decrease in cholesterol.

As reported previously, there were no significant changes in total cholesterol values from pre- to posttest. On the surface, this would appear to be in direct contrast from the many studies reporting otherwise. Several reasons for the lack of change are proposed for consideration. The participants in the study did not exercise the same number of days per week, at the same duration, or intensity. This could explain the lack of significant change, specifically reduction, in total cholesterol over the twelve weeks of the study. The exercise portion of the study was not always monitored. Although, each study participant was given an individual prescription for exercise, the plan was not routinely followed. If all participants had exercised at the minimum recommendations given by the primary researcher there might have been a significant change in the overall total cholesterol.

Another possible reason the results did not show a significant difference was due to a malfunction of the Cholestech LDX device. Malfunctioning equipment can certainly be paramount in the lack of confidence in the recorded data. Total posttest cholesterol values were typically higher than pretest values. Participants with a very high posttest reading decided to get a full lipid profile done The results of the individual blood drawn lipid profile did not match the results given by the Cholestech LDX machine, confirming the suspicion of an error in posttest cholesterol reporting.

Further, one participant had his physician check his cholesterol prior to the start of the study and at the completion of the 12-week exercise program. His pretest total cholesterol value was 205 mg/dL and at the end, it was 178 mg/dL or a drop of 27 mg/dL (13%). The final cholesterol value for this subject was checked using the Cholestech LDX machine. The reading was 251 mg/dL, which was 73 mg/dL higher than his physician's assessment. Another participant's final reading from the Cholestech was 385 mg/dL for total cholesterol compared to the 254 mg/dL performed posttest by a personal physician. Clinically, for these individuals, exercise appeared to lower total cholesterol Although, one should draw no definitive conclusions based upon improvements in two or three individuals, at least for these participants, exercise was a positive factor in a reduction of total cholesterol.

The primary researcher discussed these results with a company representative hoping to learn what might have caused the error. The company could not determine the possible machine malfunction. Therefore, the pre- and/or posttest cholesterol values and any associated change were considered accurate. The manufacturer reports a percentage of error rates for the Cholestech LDX as $\leq$8.9% for total cholesterol (Cholestech

Corporation, 2005). A ±8.9% difference between the pre- to post-assessment measurements is quite large. In a small sample, changes will unlikely be significant.

$\underline{H_{02}}$: Incorporating a regular exercise program will not increase the subjects' individual high-density lipoprotein level. There were no significant changes observed for HDL-C. Low levels of HDL-C reflect a higher risk for CHD (ACSM, 2006). Kokkinos and Fernhall (1999, p. 308) reported that during a twelve-week exercise program, there was a significant improvement in HDL-C levels for participants who exercised at 75% of maximum heart rate. The current study was a twelve-week exercise program that recommended the participants exercised at an average of 75% heart rate max. However, results were not as expected and as demonstrated in the study by Kokkinos and Fernhall. Many participants did not exercise according to the guidelines recommended. These guidelines included a specified frequency, duration, and intensity to induce change over the twelve-weeks. As explained by Kokkinos and Fernhall (1999, p. 6), "It is most likely that exercise-induced changes in HDL-C metabolism are the result of the interaction between exercise intensity, frequency, duration of each exercise session, and length of the exercise training period." Participants who exercised minimally during the twelve-weeks did not perform enough physical activity to initiate any noticeable changes in the HDL-cholesterol (ACSM, 2006).

As reported above, the major suspected reason for a lack of change pre- to posttest was a result of malfunctioning equipment. The HDL-C percentage of error for the machine was ≤ 13% (Cholestech Corporation, 2005). Again, this is considered a relatively high error rate. A small sample size would unlikely demonstrate significant change over time.

Using the total population results, the pre-assessment reading for HDL-C was 57.46 mg/dL and the post-assessment decreased to 52.38mg/dL; this was a decrease of 8.84%. This percentage fell within the accepted percent error rate; therefore, the values were accepted as accurate. In this study, HDL-C decreased for several participants over the course of 12-weeks. A few examples of pre- to post-assessment levels of HDL-C for three participants included changes of 79 mg/dL to 49 mg/dL, 49 mg/dL to 38 mg/dL, and 72 mg/dL to 53 mg/dL, respectively. Exercise is a positive benefit for maintaining or increasing the "good" cholesterol. Again, final results for HDL-C are suspect.

Although this study did not confirm the results expected, the preventive aspects of exercise should encourage people to exercise despite the response shown in this study. Regular exercise should be performed regardless of the effects on HDL-C levels due to the numerous other health benefits derived from physical activity (Kokkinos and Fernhall, 1999, p. 6).

$\underline{H_{03}}$*: Incorporating a regular exercise program will not affect the subjects' individual body mass index.* There were no significant changes in BMI from the results of the study. Overall, the absence of weight loss in the study results affected the small or no change in body mass index; BMI is directly related to the weight of the participants. Despite the lack of change in the study, Miller, 2001, p.720, states, "Clinical trials show that exercise is critical to body weight loss maintenance." This study was supported by the two individual participants who showed a reduction in BMI based on their compliance to the exercise program. While two participants showed improvement it cannot be reflected onto the entire study population.

A possible reason for the lack of weight loss may be the unmonitored food intake in the participants. No nutritional analysis was performed for the participants. Many people are under the mistaken belief that exercise allows them to eat more. The caloric intake of the participants could have been greater than the calories they expended during exercise. It has already been reported that many individuals did not follow the exercise guidelines.

In contrast, individuals who followed the guidelines observed a decrease in overall body weight and BMI. For example, one participant started the program with a BMI of 29.10 kg/m^2 and ended at 27.08 kg/m^2 (5.45 kg weight reduction). Another participant started the program with a BMI of 31.15 kg/m^2 and finished the study at 29.89 kg/m^2. This 1.26 kg/m^2 drop in BMI moved the participant from the obese category to the overweight category. These two participants followed the researcher's recommendation and consciously maintained a healthy diet over the course of the study. Through conversations with the primary research and as reported in their exercise logs, the changes are believed to have occurred for the expected reasons, improvement in diet and exercise. In addition, it does not matter how much a person exercises, if the calorie intake is greater than output, the person will continue to gain weight (CDC, 2005).

A high BMI level has been found to have an increased risk of developing cardiovascular disease (Dalton et al. 2003, p. 556). Collectively, if the study had showed a reduction in total body weight, which would have been reflected in the BMI, the reduction in CHD risk factor would have been supported.

$\underline{H_{04}}$: *Incorporating a regular exercise program will not affect the subjects' individual blood pressure.* There were no significant changes in the participants' blood pressure, either diastolic or systolic. Previous studies, including reports from the Surgeon General, have shown that exercise reduces the resting blood pressure, both systolic and diastolic pressure. Resting blood pressure should be based on two separate measurements from two separate office visits, however, due to scheduling of post-assessments and the ability of the participants to come to the Wellness Center, this was not feasible. From the results of the twelve-week exercise study, the blood pressure of the participant remained unchanged. The results of my study showed that exercise did not affect blood pressure.

During the post-assessments, several participants expressed being stressed on that day due to work or other undisclosed reasons. Stress has been linked to hypertension (McNeely, 2005, p.292). The study by Steptoe (2000, p. 304) reported that blood pressure was shown to be higher during episodes of subjective stress or negative emotion over the day could explain the results shown in the study.

Exercise frequency and duration did vary from participant to participant and from week to week. The study by Wallace (2003, p.585) said that a frequency of three exercise sessions per week is considered the minimal frequency for blood pressure reduction. If the participants did not meet these recommendations then the improvement in their blood pressure would be minimal at best. Despite the results of the current study, exercise has shown to improve the blood pressure of exercisers. It is known that "Cardiovascular exercise training is the most effective mode of exercise in the prevention and treatment of hypertension (Wallace, 2003, p.585)."

Anthropometric and Exercise Measurements

In addition to determining risk factor benefits for CHD, anthropometric measurements were taken to show additional benefits of exercise The measurements taken were weight, body fat percentage, waist to hip ratio, estimated VO_2 max, flexibility, and resting heart rate. As describe in the Analysis of Data chapter, there were no significant differences in any anthropometric or exercise measurements.

Weight

There was no significant difference in the weight of the participants in the study. However, clinically, individual participants showed improvement. For example, at the midpoint assessment, two participants who had changed their lifestyle by exercising and eating better lost 4.55kg each. These participants demonstrated that the exercise did promote weight loss and was accelerated by a healthy diet. Participants can exercise the recommended amount; however, the energy expenditure must exceed the intake for weight loss to occur (Donnelly et al. 2004, p.1014).

The recommendation for weight loss is performing at least 30 minutes a day of moderate intensity aerobic exercise, however, a greater amount of exercise per week increases the magnitude of weight loss and maintenance (Donnelly et al. 2004, p.1010). A reason for the lack of significant weight loss could be the difference in exercise modality and intensities of the workouts by the participants. The difference in physical activity modality, both sports/exercise and daily routine contributed to the variability in weight over time (Sternfeld et al. 2004, p. 918). If the participants performed a higher intensity exercise with nutritional accountability, greater weight loss would be expected compared to an individual who worked out the same duration, but at a lower intensity.

Despite the lack of difference in the weight of the participants, individuals should exercise as an addition to any obesity intervention whether the outcome goal is body-weight-related or health-related (Miller, 2001, p.721). It is known that individuals who stop exercising, also stop receiving the benefits of exercise. Overweight individuals who dropped out of a regular exercise program will regain weight due to the cessation of exercise (Miller, 2001, p.720). Exercise has been shown as a voluntary control of weight and was reported as the best predictor of weight maintenance (Donnelly et al. 2004, p.1024).

Body Fat Percentage

There was no significant difference in the body fat percentage of the participants from the study. The possible reasons for the lack of reduction in body fat percentage reflected the amount of exercise the participants performed, the diet consumed, and the weight lifting regimen the participants followed. The explanations for the lack of change body fat percentage are the same as weight and body mass index described above.

Waist to Hip Ratio

There was no significant difference in the waist to hip ratio in the study. Waist circumference has been shown to be a simple measure of both intra-abdominal fat mass and total fat (Dalton et al. 2003, p. 556). The waist to hip ratio was measured because of the high correlation with heart disease. Dalton et al. (2003, p. 556) stated that adults have reported a stronger association between cardiovascular risk factors with abdominal adiposity than overall adiposity.

The WHR ratio remained at 0.83 from the pre- to post-assessment. This value is considered healthy for both men and women according to ACSM (2005, p.59). In relation to weight, BMI, and body fat index, waist to hip ratio remained minimally changed during the course of the twelve-week exercise program. As noted, no significant changes were observed for any anthropometric measurements; therefore, changes in WHR would not be expected. However, clinically, those participants who experienced weight loss of a few kilograms also experienced a reduction in girth measurements.

The unmonitored dietary intake and varying frequencies and intensities of the participants are certainly a concern for the lack of change reported in this study. Again, it has been reported that higher levels of sports/exercise workouts and more active daily routines are independently related to a lower weight and waist circumference (Sternfeld et al. 2004, p. 918).

Estimated VO_2 Max

The study did not result in a significant increase in the estimated VO_2 max. Maximum oxygen uptake (VO_2) is closely related to the functional capacity of the heart. VO_2 max is determined by the maximum amount of blood the heart pumps per minute and the amount of oxygen utilized by the exercising muscles (ACSM, 2006, p.66). "Exercise training resulted in an improvement in oxygen utilization from an increase in mitochondrial enzyme activity" (Woo, Derleth, Stratton, and Levy, 2006, p. 1056). An exercise program increases the body's efficiency to use oxgyen, despite the results of the study.

Individually, the participants who did not exercise regularly at the beginning of the program demonstrated a greater increase in estimated VO_2 max than those who were currently already involved in a program, assuming those participants exercised at least at the minimum recommendations. Examples of sizable (individual) increases in estimated VO_2 max from pre- to post-assessment include 24.27 to 35.09 ml/kg/min, 27.85 to 36.39 ml/kg/min, and 36.61 to 44.08 ml/kg/min.

Participants who did not exercise according to the recommendations also did not exercise at the correct intensities. Even participants who exercised several times a week, following the frequency and time recommendations did not all follow the intensity suggestions. Exercising at a vigorous intensity compared to moderate showed a greater increase in aerobic capacity (Swain and Franklin, 2006, p.145).

Flexibility

There was no significant difference in the flexibility of the participants. A possible reason for the lack of improvement in flexibility was the absence of stretching by the majority of the participants. If a joint has been relatively unused, the muscles that cross it shorten which reduced its range of motion (Fatorous et al. 2002, p. 117). Flexibility is often neglected in an exercise program and the majority of the participants in this study followed that trend. This is known because during the post-assessment, the majority of participants stated that they had not been stretching.

Another possible reason is the exercise performed by the participants. Katamoto (2002, p.45) reported that participants performing maximal walking speeds showed positive correlations with flexibility of trunk and hip joint. If the participants in this study had incorporated brisk walking as their mode of exercise, there might have been further improvement in the overall flexibility. Improved flexibility results in more economical walking in middle-aged people (Katamoto, 2002, p.45).

There was no significant statistical change in the overall flexibility, but clinically there were improvements. One participant focused on stretching every day and saw a significant improvement over the twelve-weeks. This participant started with a sit and reach score of 5.00 cm. Over the course of the study, flexibility had increased to 14.83

cm, an improvement of 9.83 cm (34%). Several other participants demonstrated minor improvements over the course of the twelve-weeks. These participants' flexibility from their pre- to post-assessments includes 27.31 to 33.02 cm, 39.37 to 45.72 cm, 38.74 to 43.82 cm, and 33.02 to 40.64 cm, respectively. These participants demonstrated that including flexibility in an exercise program improved the participant's range of motion and reduced of risk of injury.

The researcher described the importance of flexibility to the participants who commented that it was not part of their twelve-week program. Martin et al. described the importance of flexibility. Martin, Jackson, and Morrow (1998, p. 85) explained, "The development and maintenance of low back and hamstring flexibility is recognized as an important component of physical fitness and plays a substantial role, along with abdominal muscle strength and endurance, in protecting the spine from possible risk."

Resting Heart Rate

The results of the study showed no significant difference in the resting heart rate of the participants. The explanations for the lack of response are similar to that of blood pressure. Stress increases heart rate in addition to their blood pressure as described above. In addition, not all participants refrained from drinking coffee or caffeine prior to their assessments, which resulted in a false reading because caffeine increases the heart rate. Regular exercise reduced participants' resting heart rate. This has been proven in the study by Stein, Rottman, Kleiger, and Ehsari, 1996, 146A, whose participants' resting heart rate was reduced at night, when the participants were relaxed.

Summary

Worksite Health Promotions

The nurses in hospitals do not necessarily lead a positive (healthy lifestyle) example for the patients. For example, it has been reported that nurses tend to be more overweight, practice unhealthy habits such as smoking, and do not take advantage of the many personal screening health tools available to them, including regular physician visits (Hope and Kelleher, 1998, p. 439) (Angard, Chez, and Young, 1998, p.1292).

Studies have shown that nurses can define health education, but not all can define health promotion. Earlier studies have shown that nurses often do not perceive themselves at health educators (Cantrell, 1998, p.89). Littlewood & Parker (1992, p. 89) found that patients often resented the implication of weight loss, healthy diet, and smoking cessation when offered advice from nurses; this attitude by patients might inhibit the nurses from encouraging a positive health promotion program.

When a hospital worksite offered an exercise program for its employees, the majority of employees said that they would be more likely to stay at that hospital and felt that the hospital took interest in the health of the employees (Bulaclac, 1996, p.20). This study by Bulaclac showed that having an exercise program offered to its employees without a focus on results, that the employees have a more positive outlook for both their job and employer.

The current study created an exercise program for the employees that promoted a healthier lifestyle and offered smoking cessations help for those applicable. The employees who participated in this study, both nurses and administrative staff, expressed an appreciation for the Wellness Center’s location and enjoyed taking the steps towards a healthier lifestyle (See Psychological Benefits below). While there were no significant results, the program promoted the Wellness Center and brought more attention to the importance of exercise and the resources available at the site hospital.

Psychological Benefits

Substantial literature reports many benefits of regular exercise on physiological well-being. Aerobic fitness has beneficial short-term and long-term effects on psychological outcomes (DiLorenzo et al., 1999, p. 84). Observational studies have shown a positive relationship between physical activity and general well-being, a positive mood, self-perceived quality of life, lower levels of anxiety, stress, and depression (Lalonde et al. 2002, p.17). While psychological benefits were not measured in the current study, participants expressed a change in psychological aspects. Several participants stated that they experienced an improvement in self-image, feelings of confidence, greater sleep quality, mood, and energy level. This psychological improvement was enhanced by a visible change that participants saw in weight loss and clothes fitting differently, which improved body image (DiLorenzo et al., 1999, p. 83).

The changes mentioned are strictly anecdotal through conversations the participants had with the researcher.. No data were collected or analyzed. The current study did not measure psychological changes of the participants, but it is recommended that it is included in future studies.

Explanations

I tested six hypotheses regarding the ability of exercise to change the risk factors of coronary heart disease from a twelve-week exercise program. The null hypothesis was incorporated elements of several other hypotheses. The results of the study were affected by the minimal time exercise was performed, measurements taken (twelve-weeks), and the freedom of the participants to exercise at their own discretion based upon the recommendations from the primary researcher. There are several alternate explanations and recommendations based on the results of the study. Several questions were raised during the course of the study and include the limited 12-week period, the methods used to test the participants, exercise compliance of the subjects, and the body fat percentage discrepancies. These questions are explained below.

12-Week Exercise Period

The researcher, for several reasons, determined the study length of 12-weeks to be appropriate. The major factor in the 12-week time length was participant retention. As observed, twelve participants had dropped out of the study by the end, and that number may have increased with a longer study. Seven participants withdrew from the study due to work schedules and lack of interest. It was expected for a number of participants to drop out of the study, however, it would have been more beneficial if the dropout rate were less than ten.

The study took place from mid-January to mid-April. The study continued through spring break weeks of local high schools, which put a limit of the participants' ability to exercise during this time due to vacations. The exercise logs turned in by the participants reflected the diminished exercise time during vacation time of those participates who left town during the 12-week time period.

The study performed by Murtagh, Boreham, and Nevill (2005) consisted of a 12-week exercise program and the participants exercised for 20 minutes, walking, three times per week. The study found that 20 minutes of walking, three times a week for 12-

weeks was not sufficient to show improvements in cardiovascular risk in previously sedentary adults (Murtagh, Boreham, and Nevill, 2005, p. 94). No significant changes were found in total-cholesterol or HDL-C, possibly contributed to the low training volume and the unchanged body weight/fat (Murtagh, Boreham, and Nevill, 2005, p. 94). The current study recommended that the participants exercise more than the guidelines in the study by Murtagh, Boreham, and Nevill. The current guidelines included a higher intensity recommendation than the previous study.

A third reason why a 12-week time period was chosen for the study length was to see the changes in the risk factors over the short time period. It is well known that exercise reduces the risk factors for coronary heart disease, the researcher wanted to see how much change could occur over a shorter study length. However, no significant results were found during the 12-weeks. Taking the Murtagh, Boreham, and Nevill study into account, the researcher for the present study recommended an increase in exercise frequency and duration to monitor the changes over the same period, 12-weeks. However, matching Murtagh, Boreham, and Nevill there were no significant results.

Exercise Compliance

A limitation of the study was the inability to monitor all the subjects' exercise sessions. The subjects were to record their weekly workouts and turn their logs in every four weeks. The exercise logs turned in were assumed to be correct reflecting the actual exercise performed by the participants. Self-reporting of exercise was a source of error because personality traits could have affected the written log. The traits of 'social desirability' and 'social approval' might have influenced the participants exercise logs. (Adams et al., 2005, p. 389). After looking at the exercise logs turned in by the participants, 28 of the participants, or 58%, followed the exercise recommendations or surpassed expectations. The other 20 participants did not meet the minimum recommendations of three days per week for 30 minutes.

The researcher recommended certain intensities to follow during the twelve-weeks, from moderate to high intensity. The majority of the participants' workouts should have been in the moderately high category. Swain and Franklin (2006, p.145) reported that there were more cardiovascular benefits from vigorous intensity workouts than moderate. Swain and Franklin (2006, p.145) states that recent epidemiologic studies have shown to an 8% to 17% reduction in cardiovascular and all-cause mortality with each 1-MET increase in exercise capacity. Swain and Franklin's study also showed that high intensity exercises had lower incidences of CHD than moderate exercise, although regular moderate exercise was sufficient to provide some benefits. If the participants had exercised at a vigorous intensity, there might have been a significant difference in the results.

Exercisers versus Non-Exercisers

There were no significant differences between the two exercise compliance groups. While the majority of the participants exercised more than they had prior to the start of the study, 42% of the participants did not meet the three days per week for 30 minutes recommendation. A possible reason why 42% of the participants did not exercise at the minimum recommendations was due to the unmonitored exercise sessions. The subjects were held accountable by turning in their exercise logs; however, because there was no set exercise time for the participants, the subjects did not exercise as requested.

Screening versus Research Tools

The methods used to measure the risk factors and observational changes were both screening and research tools. The screening methods used included a finger-prick cholesterol check, body fat percentage by skinfold and bioimpedance, and a submaximal estimated VO_2 max test. The remaining measurements were research tools, including scale, sit-and-reach box, and waist circumference. The determination to use the methods of measurement was by the resources available at the Wellness Center; the center's location was on the main campus of the site hospital where the participants were employed.

For example, the decision to use a fingerpick cholesterol check was based upon the ease and quickness of blood collection. The Cholestech LDX took six minutes to calculate the total and HDL-cholesterol of the subjects. However, due to the complication of the machine readings, as explained in previous sections, a venous fasting blood draw is recommended for future studies.

A maximal VO_2 test was not feasible at the Wellness Center; the equipment needed to perform the test would have to have been conducted at an off-site location. Again, time constraints of the hospital employees made this type of assessment impossible. For future studies, it is recommended that all methods of measurements be conducted using research tools.

Inconsistent Body Fat Percentage Measurements

There were two methods of measuring body fat percentage of the participants, the skinfold calipers and the hand-held bioimpedance. The first choice of measurement was the skinfold calipers because of accuracy and consistency (ACSM, 2006, p.59-63).

However, skinfold calipers cannot be used if subjects have too much adipose tissue because the calipers are not large enough to fit the skinfold. Bioimpedance was used for overfat subjects. The handheld bioimpedance devices are not research tools and their accuracy is questionable. Ideally, the same method of body fat measurement would have been used for all participants. The most accurate method to ascertain body fat would have been obtained with the use of the BodPod. Again, this device was located at a local university and travel time would have interfered with employee schedules. The measurement takes approximately five minutes and has an error rate of 1-2%. This method of measurement would have been ideal for the study because subjects up to 500 lbs. can use the BodPod effectively (LMI, 2005). The 500 lbs. weight limit for the BodPod would have fit all the participants in this study.

It was unrealistic to expect the participants to travel to an off-site facility to use the BodPod due to their work and personal schedules. The demands of the employees and subjects of the study at the site hospital were high, which left limited time to perform the assessments during the required weeks. For future studies, the BodPod should be used to measure body fat percentage.

Implications

Equipment Bias

Equipment can introduce bias in a research study if altered in any way; therefore, the same equipment was used for all the assessment tests performed on the subjects during the course of the study. All equipment was calibrated identically prior to all assessments to eliminate as much bias as possible.

Limitations

This study had several limitations. These limitations were out of the control of the researcher, not controlled during the study, and/or limited by the Wellness Center resources. As discussed previously in the Summary section, limitations of the study were the short time period the measurements were assessed (12-weeks), using screening tools instead of research devices, and the lack of exercise compliance of the participants. One of the major limitations of the study was the limited number of subjects able to participate. Exercise equipment available for the participants to use in the wellness center was limited.

The researcher was not able to monitor each exercise session of the participants. Because the hospital employees exercised when their schedules permitted, continual observation was impossible. Therefore, many participants did not exercise according to the recommendations of the researcher. Ideally, continual observation and encouragement may have resulted in higher exercise compliance among the subjects. In addition, it is not known to what extent the participants were not completely truthful when filling out their exercise logs.

Another limitation was the participants' illnesses. The twelve-week exercise program started in January during which many illnesses occurred. The inability to control sick days and emergencies interfered with the participants' exercise program. Fletcher (I1997, p.356) reports that persons with the flu and other respiratory illnesses should be completely recovered before returning to their exercise routines. It is not known how many individuals in the present study lost the gains in exercise benefits by taking several days off.

The last major limitation to the study was the inability to control the participants' dietary changes and/or food intake. The program began at the start of 2006 when New Year's Resolutions were being made. The effects of the complete dietary changes are unknown, but could have affected the results. The results influenced by dietary changes were weight loss, body mass index, body composition, and circumference measures. The researcher was told by some of the participants that they were trying to eat a healthy diet, while other participants were not controlling for food intake because of the increase in energy expenditure. The participants' nutritional regime can affect the weight loss attempt if consumption is more than the energy balance output (Miller, 2001, p.720). The participants could have been following the researcher's recommendations, but consuming many more calories than needed. Dieticians recommend that nutritional changes be included when incorporating exercise into participants' lifestyle in order to lose weight (Zelasko, 1995, p. 414). A second method of controlling the participants' dietary intake is to give all participants the same nutritional counseling and identical meal plans to follow. Mougious et al. (2006, p.178) explained that the combination of dieting and exercise is effective and a good behavioral approach for weight loss. The maintenance of exercise may be one of the best predictors of long-term weight maintenance (Mougious et al., 2006). Controlling for food intake may have resulted in greater anthropometric changes among the participants.

Recommendations

Based upon the results, explanations, and limitations of this study, the primary researcher has made several recommendations for future studies. It is recommended that

1. The exercise program should be extended from twelve to twenty-six weeks;

2. The exercise program should be implemented during spring through fall months so the participants may workout outside; this provides additional options and times to exercise;
3. More subjects should be included to increase the chance for obtaining statistical significance and a higher confidence level in those results;
4. The exercise sessions should be monitored;
5. Exercise (fitness) level and/or health status should be a control factor when forming groups;
6. Diet should be assessed before and after the program. Lectures/workshops could be offered for those who may be interested;
7. Research, rather than field, tools and methods should be implemented;
8. Psychological evaluations could be implemented. This can be performed by a Quality of Life questionnaire such as the SF-12 (Ware, Retrieved 2006).

Conclusions

Exercise can be used as a preventive tool for heart disease. There has been substantial evidence that exercise reduces an individual's risk for developing many forms of cardiovascular disease (Durstine et al., 2001, p. 1034). Despite the lack of findings in this study, exercise has been shown to reduce weight (or obesity), blood pressure, total cholesterol, and HDL-cholesterol. Other reports note that participants who exercised were more likely to not smoke and eat a healthier diet than sedentary people (Dubbert, Rapparport, and Martin, 1987, p.337).

The lack of improvement and/or significant findings in the present study were possibly due to the short time period over which the measurements were taken, the inadequate volume/intensity levels of exercise performed by the participants, and the unmonitored dietary intake. Exercise and diet should be monitored for all the participants in future studies. Although this study did not show significant results for any tested measurement, there were individual clinical improvements. Physical inactivity has been established as an independent risk factor for the development of CHD because of the relationship between physical inactivity and cardiovascular mortality (Fletcher et al. 1996). The individuals who demonstrated a clinical decrease in risk factors also had a reduction in their overall coronary heart disease risk by the Framingham Heart Score.

Since 75% of the study population had not exercised regularly previously, this proved to be a good starting point for these employees. The small improvements in employees' results, whether it was a little weight loss, subjective observances of clothes fitting looser, or having more energy during the day, helped the participants to realize the benefits of exercise. Many of the study subject expressed interest in continuing their exercise program in the future.

APPENDIX A

Table 16 Blood Pressure		
Blood Pressure Guidelines American College of Sports Medicine, 2006, p. 44		
Classification	**Systolic BP (mmHg)**	**Diastolic BP (mmHg)**
Normal	< 120	< 80
Pre-hypertension	120 - 139	80 - 89
Stage 1 Hypertension	140 - 159	90 - 99
Stage 2 Hypertension	$\geq$ 160	$\geq$ 100

Table 17 Cholesterol Guidelines	
Classification of LDL, Total, and HDL Cholesterol (mg/dL) *ATP III Classification*	
Total Cholesterol	
< 200	Desirable
200 - 239	Borderline high
$\geq$ 240	High
HDL Cholesterol	
< 30	Low
$\geq$ 60	High
Ratio	
< 5 : 1	Goal number to keep below
< 3.5 : 1	Optimal

Table 18 Waist Circumference Guidelines		
Circumference American College of Sports Medicine, 2006, p. 61		
	Waist Circumference cm (in)	
Risk Category	**Females**	**Males**
Very low	< 70 cm (28.5 in)	< 90 cm (31.5 in)
Low	70 - 89 cm (28.5 - 35.0 in)	80 - 99 cm (31.5 - 39.0 in)
High	90 - 109 cm (35.5 - 43.0 in)	100 - 120 cm (39.5 - 47.0 in)
Very high	> 110 cm (43.5 in)	> 120 cm (47.0 in)

Table 19 Flexibility Guidelines										
Flexibility - Sit and Reach Box (cm) American College of Sports Medicine, 2006, p. 89										
	Age									
Category	**20 - 29**		**30 - 39**		**40- 49**		**50 - 59**		**60 +**	
Gender	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Excellent	40	41	30	38	41	35	38	39	33	35
Very Good	39	40	37	40	34	37	34	38	32	34
	34	37	33	36	39	34	38	33	25	31
Good	33	36	32	35	28	33	27	32	24	30
	30	33	28	32	24	30	24	30	20	27
Fair	29	32	27	31	23	29	23	29	18	26
	25	28	23	27	18	25	16	25	15	23
Needs Improvement	24	27	22	26	17	24	15	24	14	22

Table 20 Body Fat Guidelines					
Body Fat Percentage **Adult Men**					
	Under 30	**30-39**	**40-49**	**50-59**	**60+**
High	>28%	>29%	>30%	>31%	>32%
Moderately High	22-28%	23-29%	24-30%	25-31%	26-32%
Optimal	11-21%	12-22%	13-23%	14-24%	15-25%
Low	6-10%	7-11%	8-12%	9-13%	10-14%
Very Low	<6%	<7%	<8%	<9%	<10%
Adult Women					
	Under 30	**30-39**	**40-49**	**50-59**	**60+**
High	>32%	>33%	>34%	>35%	>36%
Moderately High	26-32%	27-33%	28-34%	29-35%	30-36%
Optimal	15-25%	16-26%	17-27%	18-28%	19-29%
Low	12-14%	13-15%	14-16%	15-17%	16-18%
Very Low	<12%	<13%	<14%	<15%	<16%

Table 21 VO_2 Guidelines

Maximal Aerobic Power Standards

American College of Sports Medicine, 2006, p. 79

MEN	**Age**				
Percentile	**20 - 29**	**30 - 39**	**40- 49**	**50 - 59**	**60 +**
90	55.1	52.1	50.6	49.0	33.2
80	52.1	50.6	49.0	44.2	41.0
70	49.0	47.4	45.8	41.0	37.8
60	47.4	44.2	44.2	39.4	36.2
50	44.2	42.6	41.0	37.8	34.6
40	42.6	41.0	39.4	36.2	33.0
30	41.0	39.4	36.2	36.4	31.4
20	37.8	36.2	34.6	31.4	28.3
10	34.6	33.0	31.4	29.9	26.7
WOMEN	**Age**				
Percentile	**20 - 29**	**30 - 39**	**40- 49**	**50 - 59**	**60 +**
90	49.0	45.8	42.6	37.8	34.6
80	44.2	41.0	39.4	34.6	33.0
70	41.0	39.4	36.2	33.0	31.4
60	39.4	36.2	34.6	31.4	29.9
50	37.8	34.6	33.0	29.9	28.3
40	36.2	33.0	31.4	28.3	26.7
30	33.0	31.4	29.9	26.7	25.1
20	31.4	29.9	28.3	25.1	21.9
10	28.3	26.7	25.1	21.9	20.3

APPENDIX B

Table 22 Body Fat Measurement	
Skinfold Sites and Procedures (ACSM, 2006, p. 62-63)	
SITE	**PROCEDURE**
Abdominal	Vertical fold; 2 cm to the right side of the umbilicus
Triceps	Vertical fold; on the posterior midline of the upper arm, halfway between the acromion and olecranon processes, with the arm held freely to the side of the body
Chest/Pectoral	Diagonal fold; one-half the distance between the anterior axillary line and the nipple (men), or one-third of the distance between the anterior axillary line and the nipple (women)
Midaxillary	Vertical fold; on the midaxillary line at the level of the xiphoid process of the sternum. An alternate method is a horizontal fold taken at the level of the xiphod/sternal border in the midaxillary line
Subscapular	Diagonal fold (at a 45-degree angle); 1 to 2 cm below the inferior angle of the scapula
Suprailiac	Diagonal fold; in line with the natural angle of the iliac crest take in the anterior axillary line immediately superior to the iliac crest
Thigh	Vertical fold; on the anterior midline of the thigh, midway between the proximal border of the patella and the inguinal crease (hip)

Skinfold Equations
Men: Seven-Site Formula (*Chest, midaxillary, triceps, subscapular, abdomen, suprailiac, thigh*) Body density = 1.112 - 0.00043499(sum of seven skinfolds) + 0.00000055 (sum of seven skinfolds)^2 - 0.00028826(age)
Women: Seven-Site Formula (*Chest, midaxillary, triceps, subscapular, abdomen, suprailiac, thigh*) Body density = 1.097 - 0.00046971(sum of seven skinfolds) + 0.00000056 (sum of seven skinfolds)^2 - 0.00012828(age)

Table 23 Body Density Formula

Body Density (Db) Conversion to Percent Body Fat			
Population (Race)	**Age**	**Gender**	**% Body Fat**
American Indian	18 - 60	Female	(4.81/Db) - 4.34
Black	18 - 32	Male	(4.37/Db) - 3.93
	24 - 79	Female	(4.85/Db) - 4.39
Hispanic	20 - 40	Female	(4.87/Db) - 4.41
Japanese Native	18 - 48	Male	(4.97/Db) - 4.52
		Female	(4.76/Db) - 4.28
	61 - 78	Male	(4.87/Db) - 4.41
		Female	(4.95/Db) - 4.50
White	7 - 12	Male	(5.30/Db) - 4.89
		Female	(5.35/Db) - 4.89
	13 - 16	Male	(5.07/Db) - 4.64
		Female	(5.10/Db) - 4.66
	17 - 19	Male	(4.99/Db) - 4.55
		Female	(5.05/Db) - 4.62
	20 - 80	Male	(4.95/Db) - 4.50
		Female	(5.01/Db) - 4.57

Percent is calculated by multiplying value from equation by 100

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APPENDIX C

MVH Miami Valley Hospital

One Wyoming Street
Dayton, Ohio 45409

Telephone: 937-208-8000

Clinical Research Center
Institutional Review Board
937-208-4169
Email: slklinger@mvh.org

January 6, 2006

Vicki Streng, BS
Miami Valley Hospital
Wellness Center
CHE 1822
Dayton, OH 45409

Dear Ms. Streng:

The Institutional Review Board (IRB) of Miami Valley Hospital has received the revision(s) requested for protocol 05-0144, ***Coronary Heart Disease Risk Stratification in Full-Time Miami Valley Hospital Employees*** ." All restrictions have been removed and your protocol has full approval. This approval will be approved through 11/15/2006.

This approval requires:

1. That the use of the Informed Consent for Participation in Research Approved by Miami Valley Hospital.
2. That any adverse effects of this procedure will be reported immediately to this Committee.
3. That this approval is for one year and if it extends beyond this period a request for an extension is required.
4. That a progress report must be submitted before an extension of the approved one-year period can be granted.
5. That any change in the protocol or informed consent form must be approved by the IRB; otherwise, approval is terminated.

Sincerely,

David E. Uddin, PhD

David E. Uddin, PhD, CIP
Vice Chair, Institutional Review Board

A member of **Premier Health Partners**

APPENDIX D

CONSENT FOR PARTICIPATION IN RESEARCH
APPROVED BY MIAMI VALLEY HOSPITAL

Study Title: Coronary Heart Disease Risk Stratification in Full-Time Miami Valley Hospital Employees

Patient Name:

Name and title of investigator who discussed this research with me: Vicki K. Streng, Exercise Physiologist, Graduate Assistant at Miami Valley Hospital's Wellness Center

This is a type of research study. Research studies only include individuals who choose to participate. Please take your time to make your decision. Discuss it with your friends and family. You are being asked to participate because you understand that coronary heart disease (CHD) is the number one killer in the United States and that physical activity is an important component for the reduction of CHD risk factors. This study will have individuals participate in a three-month guided exercise program with three assessment periods to track the progress of the subjects. The tests that will be performed during the assessments are height, weight, girth measurements, body fat percentage, body mass index, flexibility, cholesterol screening, resting heart rate and blood pressure, and aerobic endurance via a submaximal treadmill test. Once these tests are complete, the individuals will be stratified according to the American College of Sports Medicine for coronary heart disease risk factors and then the 10-year risk by the Framingham Heart Study form.

Why is this study being done?

The risk factors for coronary heart disease are on the rise every year resulting in an increase trend in CHD incidences; every 26 seconds a person suffers from a coronary event (American Heart Association, 2005). The Surgeon General shows that physical activity reduces risks of CHD such as dying prematurely from heart disease, developing diabetes, high blood pressure, high cholesterol, and control weight (Center for Disease Control, 2005). The purpose of this study is to show how physical activity can reduce the risk factors for coronary heart disease in full-time hospital employees.

How many people will take part in this study?

A goal of 40-50 subjects will be recruited to participate in this study.

Initial recruitment will start by sending an email to all employees giving a brief overview of the study. This email is planned to be sent out at the end of December or beginning of January. The email will include the primary researcher's name, purpose, criteria to participate, benefit of participating, time commitment, and location of the study. Listed on the email are two dates for two informational meetings to further discuss what will be involved in the study. The meetings will take place at two different times to accommodate different schedules: one during the lunch hour (12:00-12:45pm) and the second in the evening (5:00-5:15pm). Each meeting will have the same information presented. The primary researcher will discuss exactly what will be expected of the participants, how the study will be performed, what the participants should expect, and to answer any questions from prospective participants. Employees should expect to be in the meeting for approximately 45 minutes.

After the completion of the informational meeting, interested employees will take a packet of papers including an informational handout, consent to participate, physician's approval form, demographic data, nutritional questionnaire, and schedule of events. The primary researcher will sit in the cafeteria on two separate days, during the morning (7:30-9:00am) and lunch hour (11:30am-1:00pm), to collect the participants' paperwork. At this time the primary researcher will quickly review the paperwork to make sure everything paper is completely filled out and signed. If employees have all the paperwork completed, they will sign up for the pre-assessment.

Employees may also turn their paperwork directly into the Wellness Center (CHE 1822) as soon as the forms are completely filled out and signed. The employees will sign up for their pre-assessment when they turn in their paperwork to the Wellness Center. If needed, the primary researcher will contact employees if not available when the employees dropped off the paperwork.

If employees cannot attend either meeting but are still interested in participating, they will have to contact the primary researcher at Wellness Center, either via phone at extension 3899 or stop by in person at CHE 1822, to receive more information and the paperwork, if applicable. Employees who come to the informational meeting or inquire further about the study will not be required to join.

What is involved in the study?

The subjects will have three assessments during the course of the study. The assessments will take place at week zero, before the beginning of the exercise program, at week six for a mid-program review, and at week thirteen, after the exercise program, for a re-test to track changes. The participants should allow 60 minutes for the pre- and post-assessment and 20 minutes for the mid-assessment. The pre- and post-assessment tests and procedures will include:

- Height
- Weight – physician's scale
- Girth measurements – standard tailor's tape to measure hip and waist circumferences
- Body fat percentage - skinfold calipers for a seven-site measurement and bioimpedence
    - *Bioimpedence*: a hand held body fat percentage and body mass index analyzer by gripping electrodes and holding the electrodes for

approximately five seconds. The electrodes sends a very low frequency electrical current through the body, however, the frequency is minimal and cannot be felt nor is it noticeable to the subject.

- Body mass index – weight divided by height squared
- Flexibility – sit and reach box
- Cholesterol screening - a finger prick protocol will measure total, HDL-C, and TC/HDL ratio. All safety precautions will be taken according to MVH guidelines
- Resting heart rate and blood pressure
- Submaximal cardiovascular test – a walking treadmill test that will last between six and twelve minutes

The participants in the study will perform a regular exercise program for a 12-week period. The researcher will give the participants specific exercise guidelines to follow during the twelve weeks, including cardiovascular, weight, and flexibility training. The guidelines are specific to the heart rate ranges, days per week, length of time, and exact weight training exercises to follow. The guidelines leave room for the participants to choose what type(s) of exercise (example: running, walking, biking, swimming, etc.) to perform for their cardiovascular training. The exercise program is flexible to accommodate all schedules; the participants will exercise at a time and place that is convenient for them. The participants will be encouraged to join the Wellness Center, but it is not a requirement of the study. The exercise guidelines will be progressive to encourage constant improvement and challenges.

How long will I be in the study?

The total time the participants will be involved in the study will be fourteen weeks, referred to as week zero through week thirteen. Week zero and thirteen will be assessments only, which will take one hour during that week. The exercise portion of this study will last twelve weeks.

The subjects are free to end participation in the study at any time. The subjects will be asked to notify primary researcher when deciding to discontinue with the study. The primary researcher will not ask why the subjects are ending their participation in the study; their reasons will not be required nor requested. When the researcher is notified, the participants (who are not current members of the Wellness Center) will have their badges deactivated to both the cardiovascular and weight training room. If the subjects are members of the Wellness Center, their badges will remain activated.

What are the risks of the study?

There are potentially physical risks related with this study. The subjects will participate in a regular exercise program involving cardiovascular, weights, and flexibility training. Prior to the start of the study the subjects will be required to have a signed physician's approval to exercise form. The physician's approval form will notify the primary researcher that the subjects have a doctor's approval to begin an exercise program and physical risks are minimized. If the subjects are inactive prior to the start of the study the subjects are likely to be sore at the start of the study. The soreness might cause discomfort to the subjects at the start of the study. The subjects will also have two finger pricks during the study, at week zero and week thirteen to check total, HDL, cholesterol, and TC/HDL ratio. Bruising of the finger could occur. All safety precautions will be taken into consideration prior to the finger prick to minimize risks.

What are the benefits of the study?

The benefit in participating in this study will be the guided exercise program and the accountability of exercising. In addition, the participants will gain the benefits of performing a regular exercise program. The benefits can include: lowers total blood cholesterol, low-density lipoprotein, and triglycerides, increases high-density lipoproteins, lowers the risk of developing high blood pressure, helps reduce blood pressure in people who already have hypertension, lowers the risk of developing non-insulin-dependent (type 2) diabetes mellitus, reduces the risk of developing colon cancer, helps people achieve and maintain a healthy body weight, reduces feelings of depression and anxiety, promotes psychological well-being, reduces feelings of stress, helps build and maintain healthy bones, muscles, and joints, helps older adults become stronger and better able to move about without falling or becoming excessively fatigued, strengthens the cardiovascular and respiratory systems, and promotes better sleep.

The subjects will receive a packet of information regarding why each aspect of exercise, cardiovascular, flexibility, and strength training, is so important and beneficial to the body. The packet will also include and nutritional handout designed by a registered dietician. In addition to the packet of information, the participants will receive personal attention by exercise physiologists. The exercise physiologist, or the primary researcher, will be available throughout the entire study to answer any questions the participants have.

What are the costs of the study?

There will be no cost to participate in this study. The exercise guidelines, assessments, and meetings are free of charge to the participants. Participants will receive a temporary membership to the Wellness Center free of charge, if not currently a member. Participants who are not currently members will have their badge activated to both the cardiovascular and weight training room for twelve weeks in order to complete the exercise program. After the twelve weeks are completed, participants' badges will be deactivated. If the participants wish to continue using the Wellness Center after the twelve weeks, they must join the Wellness Center at regular cost, but this is not required.

If participants are currently members of the Wellness Center, they will receive a three month free membership. This will be completed by delaying their next renewal due date by three months. For example, if members are to renewal in April, they will not receive notice until July. After the three free months, the members must complete their renewal form to continue their membership.

In the case of injury or illness resulting from this study Miami Valley Hospital will provide reasonable and immediate medical treatment in the unlikely event of injury resulting from research procedures. Additional medical treatment will be provided in accordance with the hospital's determination of its responsibility to do so. Miami Valley Hospital does not, however, provide compensation to a person who is injured while participating as a patient in research if such injury occurred through no fault of the hospital.

What about confidentiality?

Any information that is obtained in connection with this research and that can be identified with me will remain confidential to the extent provided by federal, state, and local law. I understand, however, that an authorized representative of the investigator, the Miami Valley Hospital IRB, and the sponsoring agency may examine my records, and this will not be considered a breach of confidentiality**.** Once disclosed, it may not be protected by these rules.

Protected Health Information ((PHI) is any personal health information through which you can be identified. If you agree to participate in this research, you agree to the use of your health information for the following purposes explained: At the end of the study, the data from the pre-assessments will be compared to the post-assessments to see the change in risk stratification for coronary heart disease. An overall coronary heart disease risk from all the participants will be complied in the statistically analysis. The results will be based on a group total. The researchers will use your information until January 2, 2006 to April 10, 2006. The principal investigator will keep a list with your name, short identifier, and medical record number in a locked file that no one else has access to. When the study is complete, that list will be destroyed and all specific identifiers removed from electronic files and the investigator will remove the identifiers from your information, making it impossible to link you to the study. Your identity will not be revealed in any publication that may result from this study.

The decision whether or not to participate is voluntary. If you decide to participate, you understand that you are free to withdraw consent and to discontinue participation at any time. Such withdrawal will not adversely affect your care at this institution or cause a loss of benefits to which you might otherwise be entitled. If you decide to end your participation in the study or withdraw authorization for use of PHI, please send written notice to the investigator or ask them to send you a form letter for completion. Please send written withdraw to:

Miami Valley Hospital
1 Wyoming Street
Dayton, OH 45409
Wellness Center, CHE 1822
ATTN: Vicki K. Streng

Who do I contact if I have questions?

Please contact Vicki K. Streng at (937) 208-3899 to answer any questions regarding the study.

You can contact the hospital administration at the Department of Consumer Relations (937) 208-2666 if I have any questions concerning my rights with regards to the research or if I have a research-related injury.

I HAVE READ THE ABOVE MATERIALS AND UNDERSTAND THEM COMPLETELY. I HAVE HAD A CHANCE TO ASK QUESTIONS AND ANY ITEM THAT WAS UNCLEAR HAS BEEN FULLY EXPLAINED TO ME. MY SIGNATURE BELOW INDICATES THAT I HEREBY FREELY AND VOLUNTARILY CONSENT TO PARTICIPATE IN THIS RESEARCH.

______________________________	_______________
Signature of subject	Date
______________________________	_______________
Signature of investigator obtaining consent	Date
______________________________	_______________
Signature of Witness (Not connected with research)	Date

Copies to: Medical Record
Patient
Original Research Record

Report of Personal Physician

Dr. Doctor,

Your patient, ___________________________, is interested in joining an exercise program through the Miami Valley Hospital Employee Wellness Center. As part of the initial assessment process, he/she has the option of participating in a submaximal bicycle test on a stationary bike administered by a qualified medical professional. The exact program of exercise your patient will follow may include walking, jogging, stationary cycling, etc. and will be based upon the results of the evaluation. Please take this into consideration when checking the appropriate box for your response below.

- ❑ I know of no reason why he/she may not participate.
- ❑ I believe he/she could participate, but because of the following reason(s):

  ______ history of hypertension

  ______ history of chest pain

  ______ history of lightheadedness, dizziness, or fainting

  ______ history of history of orthopedic problems; please list: ________________________

  ______ history of lack of exercise

  ______ other (please explain) ____

  recommend the following restrictions: ____

  ____

If no recommendations are made, then we are obligated to follow the ACSM guidelines for program participation. *

- ❑ I recommend he/she have a graded exercise test before participating. *
- ❑ I recommend he/she not participate.

____
Physician's Signature

____
Date

Office Phone _________________________

*The American College of Sports Medicine (ACSM) Guidelines for Exercise Testing and Prescription (1991) state that any person over the age of 45 or any person over the age of 35 with one or more risk factors **should** have a graded exercise test before beginning an exercise program. If this is recommended, the test can either be schedule in your office, a cardiologist's office of your choice, or Miami Valley Hospital. Please send a copy of the test to the Wellness Center.

APPENDIX E

Men: Know Your Heart Disease Risk

The best defense again heart disease is knowing what puts you at risk. Risks related to age, gender race, and family medical history cannot be changed. Many other factors - including smoking, diet, blood pressure, diabetes, and inactivity - can be changed or controlled. Your doctor can help you take steps to keep your heart healthy.

A. INSTRUCTIONS

For each of the statements in the first column, circle the answer that best fits you

B. Next, fill in the blanks below, write the points, positive or negative - from each answer you circled in section A. Then, total the points.

C. In the Heart Disease Risk box, circle your point total from section B. The percentage next to the point total is your estimated CHD risk over the next 10 years.

1. My age is ….

Years	Risk Pts
20-34	-9
35-39	-4
40-44	0
45-49	3
50-54	6
55-59	8
60-64	10
65-69	11
70-74	12
75-79	13

2. My HDL Cholesterol level

mg/dL	Risk Pts
> 60	-1
50-59	0
40-49	1
< 40	2

3. My Total Cholesterol Level

	Risk Points by Age				
mg/dL	20-39	40-49	50-59	60-69	70-79
< 160	0	0	0	0	0
160-199	4	3	2	1	0
200-239	7	5	3	1	0
240-279	9	6	4	2	1
> 280	11	8	5	3	1

4. I'm a Smoker

	Risk Pts by Age				
	20-39	40-49	50-59	60-69	70-79
No	0	0	0	0	0
Yes	8	5	3	1	1

5. My Blood Pressure is…

Systolic BP mmHg	If Untreated	If Treated
< 120	0	0
120-129	0	1
130-139	1	2
140-159	1	2
> 160	2	3

Adding Up the Points

1. Age	___
2. HDL Cholesterol	___
3. Total Cholesterol	___
4. Smoker	___
5. Blood Pressure	___
6. Diabetes	___
Points Total	___

6. I'm Diabetic

	Risk Pts
No	0
Yes	2

Color Key:

Very Low	High
Low	Very High
Moderate	

Heart Disease Risk

Pts Total	10-Year CHD Risk
< 0	< 1%
0	1%
1	1%
2	1%
3	1%
4	1%
5	2%
6	2%
7	3%
8	4%
9	5%
10	6%
11	8%
12	10%
13	12%
14	16%
15	20%
16	25%
>17	> 30%

Typical Male Risk

Age	Avg 10-Year CHD Risk
20-34	3%
35-39	5%
40-44	7%
45-49	11%
50-54	14%
55-59	16%
60-64	21%
65-69	25%
70 +	30%

MVH Framingham Heart Study

Female Framingham

Men: Know Your Heart Disease Risk

The best defense again heart disease is knowing what puts you at risk. Risks related to age, gender race, and family medical history cannot be changed. Many other factors - including smoking, diet, blood pressure, diabetes, and inactivity - can be changed or controlled. Your doctor can help you take steps to keep your heart healthy.

A. INSTRUCTIONS

For each of the statements in the first column, circle the answer that best fits you

1. My age is ….

Years	Risk Pts
20-34	-7
35-39	-3
40-44	0
45-49	3
50-54	6
55-59	8
60-64	10
65-69	12
70-74	14
75-79	6

2. My HDL Cholesterol level

mg/dL	Risk Pts
≥ 60	-1
50-59	0
40-49	1
< 40	2

3. My Total Cholesterol Level

	Risk Points by Age				
mg/dL	20-39	40-49	50-59	60-69	70-79
< 160	0	0	0	0	0
160-199	4	3	2	1	0
200-239	8	6	4	2	1
240-279	11	8	5	3	2
≥ 280	13	10	7	4	2

4. I'm a Smoker

	Risk Pts by Age				
	20-39	40-49	50-59	60-69	70-79
No	0	0	0	0	0
Yes	9	7	4	2	1

5. My Blood Pressure is…

Systolic BP mmHg	If Untreated	If Treated
< 120	0	0
120-129	1	3
130-139	2	4
140-159	3	5
≥ 160	4	6

6. I'm Diabetic

	Risk Pts
No	0
Yes	4

B. Next, fill in the blanks below, write the points, positive or negative - from each answer you circled in section A. Then, total the points.

Adding Up the Points

1. Age __

2. HDL Cholesterol __

3. Total Cholesterol __

4. Smoker __

5. Blood Pressure __

6. Diabetes __

Points Total

C. In the Heart Disease Risk box, circle your point total from section B. The percentage next to the point total is your estimated CHD risk over the next 10 years.

Heart Disease Risk

Pts Total	10-Year CHD Risk
< 9	< 1%
9	1%
10	1%
11	1%
12	1%
13	2%
14	2%
15	3%
16	4%
17	5%
18	6%
19	8%
20	11%
21	14%
22	17%
23	22%
24	27%
>25	>30%
≥17	≥ 30%

Typical Male Risk

Age	Avg 10-Year CHD Risk
20-34	<1%
35-39	<1%
40-44	2%
45-49	5%
50-54	8%
55-59	12%
60-64	12%
65-69	13%
70 +	14%

Color Key:

Very Low	High
Low	Very High
Moderate	

MVH Framingham Heart Study

APPENDIX F

Demographic Data

Name: ________________________________ Date: __________________

History at Miami Valley Hospital

Total years MVH: _________________

Department: ______________________

Hours worked per week: ____________

Shift: ___________________________

Years at current department: _________

Previous departments: ____

What physical demands does your job require? ____________________________

____

History of Physical Activity or Current Physical Activity

Number of days currently exercising: ____________________________________

Exercises performed: ____

Time spent exercising each sessions: ____________________________________

What intensity do you workout at? 1 2 3 4 5 6 7 8 9 10

1 (very light) 5 (moderate) 10 (very hard)

Do you smoke? ______________________________________

If yes, how many cigarettes/cigars a day? _________________

How many years/months have you smoked? _______________

Do you have a family history of coronary heart disease? Yes No

Do you think you are at risk for Coronary Heart Disease? Yes No

Name:____ Date:____________

Have you seen a nutritionist before? ☐ Yes ☐ No

If so, who and when?____

Does your food feel out of control? ☐ Yes ☐ No

Are you taking any vitamin or nutritional supplements? ☐ Yes ☐ No

List:____

Do you have any family history of:

Diabetes ☐ Yes ☐ No

High cholesterol? ☐ Yes ☐ No

Do you drink alcoholic beverages? ☐ Yes ☐ No

Describe use:____

Are you currently on a special diet? (i.e., vegetarian, low-carb, gluten-free, etc) ☐ Yes ☐ No

Describe:____

Who recommended the diet? ____

If you have been on a special diet in the past, define it. _____________________

____

Describe changes, if any, that you have made to your eating habits. When did you implement these changes?

Where do you eat most often? ☐ Home ☐ Restaurant

Other:____

Do you eat at approximately the same time every day?

Do you skip meals? If so, when?

Do you usually eat between meals? What do you snack on most often?

Would you describe you appetite as hearty, moderate, or poor?

What barriers, if any, stand in the way of you achieving your nutritional goals?

Health History

The Wellness Center Health Profile

FOR OFFICE USE ONLY

Staff ________	Date ______
New Member ___	Previous ______
PWP ________	Year ______
Ht. ___ Wt ___	BF ________
RHR ________	RBP ___/___

The purpose of this form is to gather personal medical health information to enable you and your Wellness Professional to select appropriate health and fitness goals.

ALL INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL

Name ______________________ Dept. ______________ Phone ______________

Emergency Contact ______________________ Phone ______________ Relationship ______________

HEALTH HISTORY

___ Irregular heart rate or rhythm
___ Stroke
___ Hypertension
___ Chest pain / Angina
___ High cholestrol ____ mg/dl
___ Heart Attack
___ Coronary angioplasty/cardiac surgery
___ Other cardiac condition: ________
___ Smoking: ______ packs/day

___ Peripheral vascular disease
___ Diabetes
___ Kidney Disease
___ Thyroid Disease
___ Asthma
___ Pregnacy (current or within 6 months)

___ Emphysema
___ Chronic Obstructive Pulmonary Disease
___ Cancer: ______________
___ Other diagnosed disease/ disorder ______________
___ Major Surgery, physical limitations, or rehab within last 6 months
___ Stress:
___ *Occasional*
___ *Frequent/Mild*
___ *Constant/High*

ACTIVITY ASSESSMENT

1. As I become more active, my goals are:
   - ☐ Reduce body fat
   - ☐ Increase muscle mass
   - ☐ Improve cardiovascular fitness
   - ☐ Improve flexibility
   - ☐ Decrease stress
   - ☐ Disease management
   - ☐ Increase energy level
   - ☐ Train competitively
2. The minimum amount of time I can easily allot to exercise is:
   - ☐ 15 minutes
   - ☐ 30 minutes
   - ☐ 45 minutes
   - ☐ 60 minutes
3. The minimum number of days I can consistently allot to exercise is:
   - ☐ 1 Day
   - ☐ 2 Days
   - ☐ 3 Days
   - ☐ 4 or more days

MEDICATION

Please list all medications you are taking:

Medications	*Reasons*
1. ______________	______________
2. ______________	______________
3. ______________	______________
4. ______________	______________

Do you have a history of any of the following?

Orthopedic problems ______ yes ______ no
Please specify ______________________
Chronic back problems ______ yes ______ no
Arthritis ______ yes ______ no

Do you have any other medical situations or physical limitations which should be considere prior to your participation in an exercise program?
______ Yes ______ No Please explain: ________
____

I verify the above information is correct and accurately completed to the best of my knowledge. I understand it is my responsibility to inform the Wellness Staff of any changes in my health status which alter my physical ability to safely participate in a wellness/fitness program.

Signature ______________________ *Date* ______________

Pre- and Post-Assessment

Date: ____________ **Tester:** ____________________

CODE: ________________________ **Test:** Pre Post

D.O.B. ___________ **Weight:** _______ lbs / 2.2 = _________ kg **BMI = kg/m²**

Age: ______ **Height:** _______ in x 0.0254 = _______ m **BMI** _______

Clothes Description: ____

____

In the past three hours:

Smoked: ____

Ate: ____

Physical Activity: ____

Body Composition				*Avg.*
Abdominal				
Triceps				
Chest/Pectoral				
Midaxillary				
Subscapular				
Suprailiac				
Thigh				
Percent Body Fat: ______ %				

Flexibility (cm)

Avg.

TC: ________

HDL: ________

Ratio: ________

Male: 1.112 - 0.00043499(sosf) + 0.00000055(sosf)² - 0.00028826(age)
Female: 1.097 - 0.00046871(sosf) + 0.00000056(sosf)² - 0.00012828(age)

sosf = sum of skinfolds ***use Body Density equation after using the above equation***

Girth Measurements (cm)			*Avg.*	
Hips				
Waist				**Hip/Waist = Ratio**
Waist to Hip Ratio: ____________				/

Resting HR: ______________

Resting BP: ______________

Framingham Score: __________

Estimated Max VO2: ________

Comments: ____

Ebbeling Four Minute Submaximal Test		
Estimated 50-70% Max HR _________________ bpm		
Warm-Up Speed (2.0 - 4.5 mph) _____________ @ 0% grade		
Test Speed (2.0- 4.5 mph) __________________ @ 5% grade		
Minute 1: _______	RPE: ______	
Minute 2: _______	RPE: ______	
Minute 3: _______	RPE: ______	B/P: ______ / ______
Minute 4: _______	RPE: ______	
Estimated VO2 max = _________________ ml/kg/min		
15.1 + (21.8 x _________mph) - (0.327 x __________bpm) - (0.263 x _______mph x _____age) + (0.00504 x _______ bpm x _________ age) + (5.98 x _________ [Gender: F=0; M=1])		

Mid-Assessment

Date: ______________ **Tester: _________________________**

Code: ________________________ **Test:** Mid-Assessment

Weight: ________ lbs /2.2 __________ kg
Height: ________ in x .0254 _________ m

BMI: _______________

Girth Measurements (cm)			**Avg.**
Hips			
Waist			

Waist to Hip Ratio: ____________

Resting Blood Pressure: ________________ mm/Hg

Resting Heart Rate: ___________ bpm

Comments or changes to program:

APPENDIX G

General Indications for stopping an Exercise Test in Low-Risk Adults

ACSM, 2006, p. 78

- Onset of angina or angina-like symptoms
- Drop in systolic blood pressure of >10 mmHg from baseline blood pressure despite an increase in workload
- Excessive rise in blood pressure: systolic pressure >250 mmHg or diastolic pressure >115 mm Hg
- Shortness of breath, wheezing, leg cramps, or claudication
- Signs of poor perfusion: light-headedness, confusion, ataxia, pallor, cyanosis, nausea, or cold and clammy skin
- Failure of heart rate to increase with increased exercise intensity
- Noticeable change in heart rhythm
- Subject request to stop
- Physical or verbal manifestations of severe fatigue
- Failure of the testing equipment

APPENDIX H

Contraindications to Exercise Testing

ACSM, 2006, p. 50

Absolute

- A recent significant change in the resting ECG suggesting significant ischemia, recent myocardial infarction (within 2 days), or other acute cardiac event
- Unstable angina
- Uncontrolled cardiac dysrhythmias symptoms or hemodyanmic compromise
- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Suspected or known dissecting aneurysm
- Acute systemic infection, accompanied by fever, body aches, or swollen lymph glands

Relative

- Left main coronary stenosis
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities (e.g., hypokalemia, hypomagnesemia)
- Severe arterial hypertension (i.e., systolic BP of >200 mmHg and/or a diastolic BP of >110 mmHg) at rest
- Tachydysrhythmia or bradydysrhythmia
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Neuromuscular, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise
- High-degree atrioventricular block
- Ventricular aneurysm
- Uncontrolled metabolic disease (e.g., diabetes, thyrotoxicosis, or myxedema)
- Chronic infectious disease (e.g., mononucleosis, hepatitis, AIDS)
- Mental or physical impairment leading to inability to exercise adequately

APPENDIX I

Cardiovascular Exercise

American College of Sports Medicine: perform moderate intensity exercise most days of the week

- VARY your exercise routine – do not perform the same workout everyday
    - Your body will adapt to the stimuli (exercise) and will plateau
    - "*Keep your body guessing*"
    - Change modality
        - If you prefer one mode of exercise (ex. elliptical) perform that mode of exercise for the majority of your workouts, however, include 1-2 days of cross-training per week
    - Change length of time
        - If you only have 20 minutes to workout, workout those 20 minutes at a higher intensity (80-85%). On days where you can workout for an hour, keep intensity a bit lower (65-70%)
    - Change intensity
        - Changing intensities will help keep variety in your workout, adjust to different exercise modes (higher heart rate while running compared to elliptical)

According to your cardiovascular chart, exercise at the recommended intensities within the recommended time length. Record your workout on the cardiovascular logs. Turn in the exercise logs every 4 weeks.

Example of a workout week:

Exercised	**Modality**	**% Heart Rate**	**Time**
Monday	Upright Bicycling	75%	45 minutes
Tuesday	Elliptical	80%	45 minutes
Wednesday	OFF		
Thursday	Elliptical	75%	60 minutes
Friday	Walking on Treadmill (*hill program*)	85%	30 minutes
Saturday	Elliptical	65%	60 minutes
Sunday	OFF		

Overview Cardiovascular Exercise Guidelines #									
				Day and Heart Rate (avg)					
Week	**Days per week**	**Heart Rate Range**	**Exercise Time**	**1**	**2**	**3**	**4**	**5**	**Weight Training**
1	3	60-75%	30 minutes	65%	75%	70%	off	off	TB/2 times/week
2	3	60-75%	30 - 40 min	75%	70%	75%	off	off	TB/2 times/week
3	4	65-80%	30 - 40 min	65%	75%	80%	75%	off	TB/2 times/week
4	4	65-80%	30 - 45 min	75%	80%	65%	75%	off	TB/2 times/week
5	4	65-80%	30 - 45 min	70%	80%	70%	80%	off	TB/2 times/week
6	4-5	65-80%	30 - 45 min	70%	75%	80%	75%	80%	TB/2-3 times/week
7	4-5	65-80%	30 - 45 min	80%	80%	70%	75%	80%	TB/2-3 times/week
8	4-5	65-80%	30 - 60 min	75%	75%	80%	65%	80%	TB/2-3 times/week
9	4-5	65-85%	30 - 60 min	80%	75%	85%	70%	80%	TB/2-3 times/week
10	4-5	65-85%	30 - 60 min	80%	75%	80%	80%	70%	TB/2-3 times/week
11	4-6	65-85%	30 - 60 min	70%	80%	85%	80%	75%	TB/2-3 times/week
12	4-6	65-85%	30 - 60 min	70%	80%	80%	75%	80%	TB/2-3 times/week

Cardiovascular Exercise Log

Code # : ____________________________

WK		SUN	MON	TUES	WED	THURS	FRI	SAT
1	DATE							
	MODE							
	TIME							
	HR							
2	DATE							
	MODE							
	TIME							
	HR							
3	DATE							
	MODE							
	TIME							
	HR							
4	DATE							
	MODE							
	TIME							
	HR							
5	DATE							
	MODE							
	TIME							
	HR							
6	DATE							
	MODE							
	TIME							
	HR							

Cardiovascular Exercise Log

WK		SUN	MON	TUES	WED	THURS	FRI	SAT
7	DATE							
	MODE							
	TIME							
	HR							
8	DATE							
	MODE							
	TIME							
	HR							
9	DATE							
	MODE							
	TIME							
	HR							
10	DATE							
	MODE							
	TIME							
	HR							
11	DATE							
	MODE							
	TIME							
	HR							
12	DATE							
	MODE							
	TIME							
	HR							

Weight Training Recommendations
Upper / Lower Body Training Program

Number of days per week: between 3 – 6 days

- Can exercise as few as 3 days and up to 6 days

- Alternate Upper Body and Lower Body exercises
  - Can perform upper/lower sessions consecutive days
    - EX: Monday – Upper / Tuesday – Lower … etc

- *Never exercise the same muscle group two days in a row*
  - EX: Monday – Upper / Tuesday – Upper
  - Muscles need time to recover and rebuild

- ***The weight should be challenging!!***
  - By your last repetition, it should be tough to complete (*keeping your perfect posture*)
  - If you are at your last rep, and you could do 4 or more, do 5 more reps, and increase weight for the next set
  - If you are struggling to complete the assigned repetitions, stop immediately when you lose form, then decrease the weight for the next set to finish within the recommended repetitions
  - *Do not be afraid to increase the weight*

- **Always exhale on exertion!**
  - *Never hold your breath!!*

- You can perform you weight training exercises before or after your cardiovascular workout – it does not matter the order as long as they are both completed

Upper/Lower Body Weight Training Logs

CODE: ___________ REPS: __________ SETS: __________

**Exhale on exertion*
**Never hold your breath*
**Challenge yourself*

**Keep good posture - back straight, 'abs in'*
**Last rep should be tough*

**Don't be afraid to increase weight!*

DATE						
UPPER EXERCISES	**REPS**	**SETS**	**REPS**	**SETS**	**REPS**	**SETS**
Machine Chest Press						
Incline Chest Press						
Lat Pull Down						
Seated Row						
Machine Shoulder Press						
DB Bicep Curl						
DB Tricep Extension						
Back Extension						
Abdominals						

DATE						
LOWER EXERCISES	**REPS**	**SETS**	**REPS**	**SETS**	**REPS**	**SETS**
Leg Press						
Leg Extension						
Leg Curl						
Ball Squats						
Wide-Stance Ball Squats						
Back Extension						
Abdominals						

Comments ____

____

Weight Training Recommendations
Total Body Training Program

Number of days per week: 2 – 3 days

- Leave a day in-between workouts
    - *Never exercise the same muscle group two days in a row*
    - Muscles need time to recover and rebuild

- ***The weight should be challenging!!***
    - By your last repetition, it should be tough to complete (*keeping your perfect posture*)
    - If you are at your last rep, and you could do 4 or more, do 5 more reps, and increase weight for the next set
    - If you are struggling to complete the assigned repetitions, stop immediately when you lose form, then decrease the weight for the next set to finish within the recommended repetitions
    - *Do not be afraid to increase the weight*

- **Always exhale on exertion!**
    - *Never hold your breath!!*

- You can perform you weight training exercises before or after your cardiovascular workout – it does not matter the order as long as they are both completed

Total Body Weight Training Logs

CODE: ______________ REPS: ____________ SETS: _______________

DATE									
TOTAL EXERCISES	**WTS**	**REPS**	**SETS**	**WTS**	**REPS**	**SETS**	**WTS**	**REPS**	**SETS**
Machine Chest Press									
Lat Pull Down									
Machine Shoulder Press									
DB Bicep Curl									
Cable Tricep Extension									
Leg Press									
Leg Curl									
Low Back									
Abdominals									

DATE									
TOTAL EXERCISES	**WTS**	**REPS**	**SETS**	**WTS**	**REPS**	**SETS**	**WTS**	**REPS**	**SETS**
Machine Chest Press									
Lat Pull Down									
Machine Shoulder Press									
DB Bicep Curl									
Cable Tricep Extension									
Leg Press									
Leg Curl									
Low Back									
Abdominals									

*Exhale on exertion

*Never hold your breath

*Keep good posture - back straight, 'abs in'

*Don't be afraid to increase weight!

*Challenge yourself

*Last rep should be tough

RECOMMENDED STRETCHES

Flexibility Tips

- Always be warmed up!!! Do at least 5 minutes are cardio before stretching! Never stretch cold muscles. That is when injuries can occur.
- Start each stretch slowly, exhaling as you gently stretch the muscle
- Hold each stretch (each side) 15- 30 seconds
- Repeat 2-3 times

Things to Avoid While Stretching

- Do not bounce a stretch. Holding a stretch is more effective and there is less risk of injury
- Do not stretch a muscle that is not warmed up
- Do not strain or push a muscle too far. If a stretch hurts, ease up
- Do not hold your breath

 # 1 Hamstrings

- Lie on your back with your left leg straight out. While keeping your left leg extended, bend your right knee and pull it into your chest by clasping your right leg. Breathe deeply, hold for 15 seconds, and release. Then switch legs. Repeat.
- Stand arms at your side. Keeping your legs straight, bend forward and reach for your toes. Hold and repeat. Don't feel that you need to touch your toes. Whether or not you can do so may depend as much on the length of your legs vs. your torso than your flexibility.

 # 2 Calf

- To stretch your upper calf muscles, stand facing a wall or tree. Place your hands on the wall or tree and slide your left leg back 3 or 4 feet. Lean forward and shift your weight onto your right leg with the knee bent. Straighten your left leg and press your left heel into the ground. Make certain to point the toes of both feet forward, not out to the side.

 # 3 Triceps Stretch

- Stand up straight keeping a slight bend in your knees. Put your right arm over your head and bend your elbow behind your head. With your left arm, slight push your right elbow back until you feel a stretch on the backside of your arms, the triceps. Hold, repeat with other arm.

 # 4 Hip Flexor

- Keep your upper body in neutral position the entire time, back straight. Take a large step forward; bend the back knee towards the ground allowing the back heel to come off the ground. The front knee will be slightly bent, keeping your upper body straight. Lean back until you feel the stretch of your back leg’s hip flexor.

 # 5 Chest

- Clasp your hands behind your back and push gently away from your body.
- Stretch your arms out to the side, keeping them straight. Push your arms gently towards your backside, keeping them straight. You should feel the stretch through your chest. You can alter this stretch by keeping both thumbs facing upwards and holding, then facing the thumbs downward and holding.

 # 6 Outer Hips

- Sit up. Keep your right leg straight, bend the left knee and place the outer side of your right foot over your left thigh, just above your knee. Wrap your hands around your left knee or on top of the shin and draw it toward your chest. Keep your head relaxed and flat on the ground. Hold for five breaths and release. Switch sides and repeat three or four times on each side.

 # 7 Shoulders

- Place your right arm across the chest of your body. Using left arm, gently push the right forearm towards the body until a stretch is felt through the upper part of the right arm and right shoulder.

 # 8 Lower Back and Shoulders

- Stand with your feet 6 inches apart and about 3 feet away from a wall, fence, tree, or other supporting surface of about shoulder height. Place both your hands about shoulder-width apart on the supporting surface, and flex forward at your hips. Press down on the surface, flatten your back, and lower your head between your arms.

#9 Abdomen

- Lay flat on your stomach, stretched out. Prop your upper body up on your elbows. Pull your elbows towards your body until you reach a comfortable stretch.

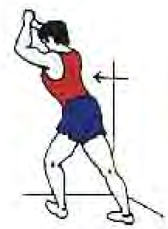
 # 10 Quadriceps

- You can also do the quadriceps stretch while standing. For balance, rest your right hand on a wall, tree, or fence. Grab your left foot with your left hand. While keeping the thigh muscles of your right leg tight, pull your left knee back and up toward your buttocks. Don't tilt forward. Repeat twice on each side

 # 11 Inner Thighs

- Sit on the ground with your feet in front of you. Bring the bottom of your feet together and bring your feet in towards your body as far as you can comfortably go. Keeping your back straight, lean forward until you feel the stretch in your inner thighs.

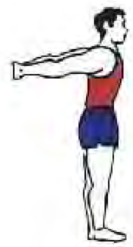
Hamstring
(back of thigh)



Calf

Tricep

Hip flexors
(groin)

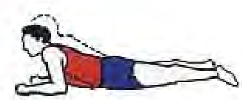


Chest

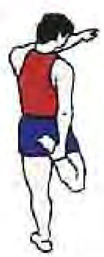
Abductor
(outer thigh)

Shoulder

Lower back



Abdom



Quadricep
(front of thigh)

Aductors
(inner thigh)

APPENDIX J

Exercise Intensity and How to Measure

An important part of exercising is making sure you are training at the correct intensity. The goal of physical activity is to increase the heart rate for a sustained period of time. Some people either work out too hard or not hard enough. The majority of your workouts should be in the heart rate range of 60-85% of your maximum heart rate (MHR.) This heart rate range trains the body aerobically, which involves or improves the heart and lung's ability to utilize oxygen in addition to promoting the loss of body fat.

It is always a good idea to vary your heart rate every few workouts. For example, if you are an avid runner or cyclist and your heart rate is ~85% or higher of your maximum heart rate, it is beneficial to cross-train (i.e. elliptical) at 70-75% of your heart rate. On the other hand, if you are an exercise for health benefits and normally train at low to moderate intensity, it is beneficial to have one day every week or every other week to train at 80-85% or higher.

Talk Test	The talk test method of measuring intensity is simple. A person who is active at a *light* intensity level should be able to <u>sing</u> while doing the activity. One who is active at a *moderate* intensity level should be able to <u>carry on a conversation comfortably</u> while engaging in the activity. The activity is considered *vigorous* if person becomes <u>winded or too out of breath to carry on a conversation</u>.
Borg Scale	The Borg Rating of Perceived Exertion (RPE) is a simple way to determine how intense the physical activity is. Perceived exertion is how hard you feel your body is working. It is based on the physical sensations a person experiences during physical activity, including increased heart rate, increased respiration or breathing rate, increased sweating, and muscle fatigue. A perceived exertion rating between 12 and 14 on the Borg Scale suggests that physical activity is at a moderate level of intensity. During activity, use the Borg Scale to assign numbers to how you feel (see instructions below). Self-monitoring how hard your body is working can help you adjust the intensity of the activity by speeding up or slowing down your movements.
Heart Rate	The heart rate varies with the different intensities of the activity. A good way to track your intensity is to monitor your heart rate – either using a heart rate monitor (recommended) or by taking your pulse. Using the heart rate, you can adjust the activity to stay within the target %MHR (max heart rate) goal range. Light intensity would be 60-65% of MHR; moderate intensity would be 75% MHR; vigorous intensity would be 80% or higher.

Heart Rate | HR = heart rate

220-(age) _____ = (MHR) ___________ | MHR = max HR

(MHR) x .60 = _________ (lower end of THR) | THR = target heart rate

(MHR) x .70 = _________ (mid - lower end of THR)

(MHR) x .75 = ________ (middle end of THR)

(MHR) x .80 = ________ (mid-upper end of THR)

(MHR) x .85 = ________ (mid-upper end of THR)

THR Range = _____________________ (beats per min)

Instructions for Borg Rating of Perceived Exertion (RPE) Scale

6 No exertion at all
7 Extremely light
8
9 Very light
10
11 Light
12
13 Somewhat hard
14
15 Hard (heavy)
16
17 Very hard
18
19 Extremely hard
20 Maximal exertion

9 corresponds to "very light" exercise. For a healthy person, it is like walking slowly at his or her own pace for some minutes

13 on the scale is "somewhat hard" exercise, but it still feels OK to continue.

17 "very hard" is very strenuous. A healthy person can still go on, but he or she really has to push him- or herself. It feels very heavy, and the person is very tired.

19 on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.

Flexible Benefits

American Council of Exercise

We take part in aerobic activity to improve our cardiovascular endurance and burn fat. We weight-train to maintain lean muscle tissue and build strength. Those are the two most important elements of a fitness program, right? Actually, there are three important elements. Often neglected is flexibility training. That neglect is regrettable, because flexibility training:

- Allows greater freedom of movement and improved posture
- Increases physical and mental relaxation
- Releases muscle tension and soreness
- Reduces risk of injury

Some people are naturally more flexible. Flexibility is primarily due to one's genetics, gender, age and level of physical activity. As we grow older, we tend to lose flexibility, usually as a result of inactivity rather than the aging process itself. The less active we are, the less flexible we are likely to be. As with cardiovascular endurance and muscle strength, flexibility will improve with regular training.

Stretch for success

Before stretching, take a few minutes to warm up as stretching cold muscles can cause injury. Begin with a simple, low-intensity warm-up, such as easy walking while swinging the arms in a wide circle. Spend at least 5 to 10 minutes warming up prior to stretching.

When performing any stretch:

- Start each stretch slowly, exhaling as you gently stretch the muscle.
- Try to hold each stretch for at least 10 to 30 seconds.

Avoid these stretching mistakes:

- Don't bounce a stretch. Holding a stretch is more effective and there is less risk of injury.
- Don't stretch a muscle that is not warmed up.
- Don't strain or push a muscle too far. If a stretch hurts, ease up.
- Don't hold your breath.

Fitting stretching into a compressed schedule

Time constraints keep many people from stretching. Some complain they just don't have time to stretch; others hurry out of their fitness classes before the cool-down exercises are completed. Ideally, at least 30 minutes, three times per week, should be spent on flexibility training. But even a mere five minutes of stretching at the end of an exercise session is better than nothing. And all aerobic activity should be followed by at least a few minutes of stretching.

Here are some tips for fitting stretching into an overstuffed schedule:

1. If you don't have time to sufficiently warm up before stretching, try doing a few stretches immediately after a shower or while soaking in a hot tub. The hot water elevates muscle temperature enough to make them more pliable and receptive to stretching.
2. Try a few simple stretches before getting out of bed in the morning. Wake yourself up with a few full-body stretches by pointing the toes and reaching the arms above your head. This can clear your mind and help jump-start your morning.
3. Take a stretching class such as yoga or Tai Chi. Scheduling a class will help you to stick with a regular stretching program.

Healthy Hydration

American Council of Exercise

Water basics

Water is one of the most essential components of the human body, yet many people do not understand the importance of a well-hydrated body nor how much water is lost during the day.

Water regulates the body's temperature, cushions and protects vital organs, and aids the digestive system. And, because water composes more than half of the human body, it is impossible to sustain life for more than a week without it.

Water loss

Necessary to the healthy function of all internal organs, water must be consumed to replace the amount lost each day during basic activities. Water not only composes 75 percent of all muscle tissue and 25 percent of fatty tissue, it also acts within each cell to transport nutrients and dispel waste.

Water also regulates the body's temperature, allowing heat to evaporate from the body in the form of sweat. In one hour of exercise, the body can lose more than a quart of water, depending on exercise intensity and air temperature.

If there is not enough water for the body to cool itself through perspiration, the body enters a state of dehydration.

Dehydration

In a dehydrated state the body is unable to cool itself, leading to heat exhaustion and possibly heat stroke. Without an adequate supply of water the body will lack energy and muscles may develop cramps.

For regular exercisers maintaining a constant supply of water in the body is essential to performance. Dehydration leads to muscle fatigue and loss of coordination.

Even small amounts of water loss may hinder athletic performance. To prevent dehydration, exercisers must drink before, during and after the workout.

Fluid balance and replenishment

It is important to drink even before signs of thirst appear. Thirst is a signal that your body is already on the way to dehydration.

It is important to drink more than thirst demands and to continue to drink throughout the day.
One way to check your hydration level is to check the color of your urine. The color should be light to clear unless you are taking supplements, which will darken the color for several hours after consumption.

Water is the best fluid replenisher for all individuals, although sports drinks may replace lost electrolytes after high-intensity exercise exceeding 45 to 90 minutes.

And remember - not all fluid has to come from pure water. Other choices include fruits, juices, soups and vegetables. It is easy to prevent dehydration with pure, healthy, refreshing water, so drink up!

Hydration hints

- Drink one to two cups of fluid at least one hour before the start of exercise.
- Drink eight ounces of fluid 20 to 30 minutes prior to exercising.
- Drink four to eight ounces of fluid every 10 to 15 minutes or so during exercise.
- Drink an additional eight ounces of fluid within 30 minutes after exercising.
- Drink two cups of fluid for every pound of body weight lost after exercise.
- Both caffeine and alcohol can have a diuretic effect, so be sure to compensate for this additional water loss.

APPENDIX K

Research Study: A Guided 12-Week Exercise Program - Monitoring the Reduction in the 10-Year Risk of Developing Coronary Heart Disease

The primary researcher in this study is: Vicki K. Streng, Exercise Physiologist

PUROSE OF THE STUDY: The purpose of this study is to demonstrate how a regular physical activity can reduce the risk factors for coronary heart disease (CHD) in full-time hospital employees. This study will focus on how physical exercise affects the following risk factors of coronary heart disease: total cholesterol, HDL-C, and hypertension, and 10-year coronary heart disease risk score. Other factors that will be measured to show the benefits of exercise include: weight, body mass index, body fat percentage, submaximal cardiovascular test, circumference, resting heart rate, and flexibility.

CRITERIA TO PARTICIPATE: To participate, you must be a full-time employee of Miami Valley Hospital, work 36 + hours per week, or be considered full-time by MVH. All participants must have a signed physician's approval form (form will be given to the participants). *You do not have to be a member of the Wellness Center to participate.*

BENEFITS: The benefits of participating in this study will include: a guided exercise program designed by an Exercise Physiologist and certified personal trainer, individual attention, three assessments to track progress, and the availability of trained professional to answer any question regarding the exercise program at any point during the study. The exercise program will have specific cardiovascular guidelines, including the number of days per week, exercise time, and intensity. The weight training guidelines will consist of exact exercises to perform with the repetitions and sets. The flexibility recommendations have stretches to perform with length of time to hold the stretch and repetitions. All the exercises guidelines are progressive to reduce boredom and constant improvement.

TIME COMMITMENTS: The total time of participation will be fourteen weeks (Referred to as week zero through thirteen.) Week zero and thirteen will be assessments only. During weeks one through twelve the participants will perform a regular (guided) exercise program. Participants should allow between three and ten hours a week for exercising.

LOCATION: Each of the three assessments will take place in the Wellness Center, CHE 1822. The participants will have access to the Wellness Center facilities to exercise for twelve weeks, if not already a member. The participants can exercise at a time and place convenient for to them, assuming the participants follow the written exercise guidelines.

INFORMATIONAL MEETINGS: To learn more information regarding this study, please attend the informational meeting on: **Wednesday, January 11th at 12:00-12:45pm in 6NW2**

If you cannot make either meeting, please contact Vicki Streng in the Wellness Center at extension 3899 or stop by CHE 1822 for more information. Coming to an informational meeting does not mean you are required to participate in the study.

APPENDIX L

There has been an overwhelming response to volunteer to participate in the 12-week exercise program. Good news and bad news, we have currently filled all the available. With this note, **the meeting for Thursday, January 12, 2006 from 5 to 6pm is CANCELLED.**

If you are still interested in beginning an exercise program or needing help with your workouts, the Wellness Center is staffed with Exercise physiologists and a dietician. Included in your membership are assessments, exercise guidance both weight training and cardiovascular, nutritional counseling, and the facility is open 24 hours a day, 7 days per week.

Thank you for expressing interest in participating.

Vicki K. Streng
Graduate Assistant
Wellness Center CHE 1822
208-3899

APPENDIX M

April 2006

Miami Valley Hospital
Wellness Center CHE 1822
937-208-3899

Dear Participants,

Thank you for participating in my Cardiovascular Exercise Study for the past four months and, more importantly, congratulations on completing the 12-week exercise program!!! Your time, commitment, cooperation, and dedication to my study is truly appreciated. Everyone did an amazing job following his or her recommended exercise routine and staying on track during the entire study. In the 12-weeks of my study, I have seen tremendous progress from week one to twelve!! Everyone should be very proud of themselves on your accomplishments!

I have included your results from the Pre-Assessment to the Post-Assessment with a brief explanation of what the tests mean. If you have any questions regarding the results, please feel free to come and ask. As soon as I received the finished complete study results [after working with the WSU Statistics Center], I will send you a copy of the results summary. The data I have received from the pre- and post-assessments look promising and will hopefully show significant results on how exercise benefits the reduction in total cholesterol, HDL-cholesterol, and blood pressure – not to mention the other benefits including estimated VO_2 max, body fat percentage, body mass index, weight, circumference measurements, resting heart rate, and flexibility. Also included in this packet are future exercise recommendations and final reading material.

Once again, thank you for your participation in my graduate thesis study. Everyone stepped up and met my exercise recommendations or even surpassed my expectations. I hope you have enjoyed being part of my study and feel like you have a better understanding on the importance of exercise, both physically and mentally. Making exercise part of your weekly routine is a lifestyle and lifelong commitment. If you have any questions regarding your future exercise routine please feel free to stop by and ask me at any time.

Best of luck in your future exercise endeavors.

Thank you,

Vicki K. Streng

Cardiovascular Exercise:
The Key to a Successful Program

You have now established a good baseline for fitness and have developed a regular exercise routine over the past 12 weeks. There are several key tips to keeping variety in your routine and ways to avoid plateaus and boredom.

To continue with your exercise routine, use the following tips as a guideline:

- **Try to maintain a <u>minimum</u> of 3 days per week of cardiovascular exercise for a <u>minimum</u> of 30 minutes**
    - *Ideally*, moderate exercise [70-80% maxHR] would be performed most days [5-6 days] of the week for 30 + minutes
    - *Try to set a goal of 4-6 days per week for 30-60 + minutes*

- **Monitor your heart rate to make sure you are working out at a desired heart rate and intensity**
    - You know how to monitor your heart rate and that is still very important to continue in the future.
    - Keeping an eye on your heart rate will ensure that you are working out at the correct intensity
    - Keep a variety in your heart rate:
        - Exercise at 65-70% maxHR once every other week or so
        - 85% is acceptable to include more often
            - If exercising at this intensity the majority of days, be sure to include workouts at 65-80% maxHR as well

- **ALWAYS challenge yourself!!**
    - Do not get comfortable performing the same exercise routines on a weekly basis
    - Push yourself to accomplish new cardio goals
        - Such as staying on the elliptical for a longer time period, keeping your heart rate at 80% for 45 minutes, finishing a century ride on your bike, running a 5K - then running a 5K with a time, carry your bags while golfing instead of taking a cart, etc.

- **Keep variety in your workouts!!**
    - Find new exercises to try like dance lessons, joining a sports league, find different places to exercise such as parks around your area [T*ake different walking/running trails, bike routes*]
    - Enjoy the outside during the spring/summer/fall months! Take advantage of vacations or trips by walking everywhere, running/walking along the sand, take different routes if you are walking/running/cycling outside etc.
    - If you perform the same exercises every week – you'll body will adapt – keeps your body guessing!!!

General Cardiovascular Recommendations
3– 6 Days

3 - 4 DAYS: 30-60+ Minutes of Moderate Intensity – HR between 70-80%
Talk Test: carry on a conversation with *some* degree of difficulty
Variety of exercises: bike, treadmill, elliptical, rower, swimming
*Should be challenging, but not strenuous

1 - 2 DAYS: 30-45+ Minutes of High Intensity – HR between 80-85%
Talk Test: should be a struggle to carry on a conversation [but still able to maintain it]
Variety of exercises: bike, treadmill, elliptical, rower, swimming
*Should be the hardest day(s) of cardio

1 - 2 DAYS: 45-60+ Minutes of Low Intensity – HR between 60-70%
Talk Test: carry on a conversation with only a *slight* of difficulty
Variety of exercises: bike, treadmill, elliptical, rower, swimming
*Should be the easiest day(s) of cardio

Different Cardio Ideas:

Intervals: 3 minutes slow – 2 minutes fast or 2 minutes slow – 2 minutes fast… *can vary*
Keep resistance challenging the entire time – change speed
Walk (3 minutes) / Run (2 minutes)

Split Machine Workout: 10 minutes elliptical, 10 minutes bicycle, 10 minutes treadmill
***Can vary machine order or equipment*

Vary speed, incline, or both during workouts

Choose different programs to follow on the machines [elliptical, treadmill, bicycle]

Remember…

- Warm-up and cool-down at each session
- **Stretch regularly!!**
- Monitor your heart rate during exercise
- Do not perform the same cardiovascular exercise at every session – *keep a variety in your routine!!* [This will help avoid plateaus and reduce boredom]
- Keep challenging yourself!!!!

Weight Training Recommendations

General Reminders:

- Abdominal and low back exercises should not be performed everyday
    - *Abs/low back are like any other muscle group and need a day of rest in-between lifting sessions*
- Keep perfect posture during all exercises - back straight/ "abs in"
- Exhale on exertion [the hardest part of the exercise] – NEVER HOLD YOUR BREATH!
- Know the difference between pain and soreness: sore is acceptable whereas pain *is not*
- Challenge yourself with the weights
- Do not work the same muscle groups two consecutive days – muscles need time to recover/ rebuild
- Warm-up and cool-down
- Stretch after you are complete

Designing a Program
Refer to the example exercises for each muscle group

Different ways to break down your lifting routine:

Design 1:	Design 2:	Design 3:
Day 1: Chest and Triceps, Abs	**Day 1:** Upper Body	**Day 1:** Total Body
Day 2: Back and Biceps, Low Back	**Day 2:** Lower Body	**Day 3:** Total Body
Day 3: Shoulders and Legs		

Number of days to follow the exercise design:

Design 1: 3-6 days/week
Design 2: 2-6 days/week
Design 3: 2-6 days/week

General Number of Days/Week to Weight Train:
Train each muscle group at least twice per week

It is a good idea the change your exercise routine [approximately] every 12 weeks

- This helps reduce boredom, promotes constant progression, and keeps your weight training program challenging

In the weight room:

- Can alternate between different muscle groups in-between sets
    - 1 set of chest exercise, immediately followed by 1 set of a back exercise, return to chest
    - This can also be done with: legs/shoulders, triceps/biceps, quadriceps/ hamstrings
    - This also helps reduce time in the weight room
- Perform the bigger muscle group exercises [chest/back] before smaller muscle groups [arms]

        - If you exhaust the smaller muscle groups, which are accessory muscles to the bigger groups, you will not be able to lift the weight needed to challenge the chest/back muscles
- Use a full range of motion with every exercise
- Slow and controlled movements
- If using heavy weights, make sure you have a spotter for your protection
- Have a well-balanced program
    - Work ALL muscle groups equally
        - If favor one muscle group more it could result in a muscle imbalance which can lead to injury

Examples of different exercises for various muscle groups:

Chest:	**Back:**	**Shoulders:**	**Triceps:**	**Biceps:**
DB Chest Press	Wide Grip Lat Pull Down	Shoulder Press*	Cable Pull Downs	Bicep Curl*
Bench Press	Close Grip Lat Pull Down	Lateral Raises*	DB Single Hand	Hammer Curl
Incline Press*	Row*	Front Raises*	DB Double Hand	
Decline Press*	Machine Row	Upright Row*	Close Grip Push-Ups	
Chest Fly*	Back Fly*	Internal/External Rotation	Dips	
Push-ups	Pull-Ups			
	Upright Row*			
Inner Thighs	**General Lower Body**	**Hamstring**	**Outer Thigh**	**Glutes**
Wide Toe Squats	Leg Press	Machine Curl	Adductor Lift*	Back Lifts*
Abductor Lift*	Squats	Flexi-Ball Curl	Side Lunges	
	Lunges	Straight Leg Deadlift		
	Leg Extension			
	Calf Raises			
Low Back		**Abdominal**	Reverse Curls	Side Bends
Plank Holds	Straight Leg Deadlifts	Machine	Bicycle Crunches	Med Ball Twist
Superman	Opposite Arm/Leg Lifts	Regular Crunches	Planks- Front/Side	Toe Touches
Flutter	Machine	Full Sit-Ups	Medicine Ball Crunch	Leg Lifts

**Means that this exercise can be performed with dumbbells, bands, or cables*

Be careful about previous injuries

- Some exercises might worsen the condition if performed
- Ask for assistance from a professional if an injury is present

Muscle Groups that work together:

Chest and Triceps
Back and Biceps
Do not work these muscles on consecutive day:
Example of what NOT to do: Chest on Monday then Triceps on Tuesday

Sets/Reps/Rest Time Between Sets

General Health & Toning	*Endurance*	*Strength*	*Size*
Sets: 2-3	**Sets:** 2-3	**Sets:** 3-5	**Sets:** 3-6
Reps: 10-12	**Reps:** $\geq$12	**Reps:** $\leq$6	**Reps:** 6-12
Rest: 30 seconds	**Rest:** $\leq$30 seconds	**Rest:** 2-5 minutes	**Rest:**30-90sec

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Circuit Training – *mixture of cardiovascular and weight training exercises*

- Example: 2 complete weight training exercises [alternating immediately between the two if possible] followed by 1-2 minutes of cardiovascular exercise
- Keeps heart rate elevated
- Be careful going from cardio to abdominal
    - Could get light headed since HR is elevated – save abs until after cool down when HR is lower
- Can include multi-task exercises
    - Squats with shoulder press/ lunges with bicep curl or side raises, etc…

Cardiovascular Ideas:

Grasshoppers/Mountain Climbers	Side-Side Shuffle	Star Jumps
Jumping Jacks	Any Cardio Machine	Jump Rope
Steps – toe touches, quick up/down		

Physical Activity Tips

Definitions:

- **Cardiorespiratory fitness -** the ability of the body's circulatory and respiratory systems to supply fuel and oxygen during sustained physical activity.
- **Exercise -** physical activity that is planned or structured. It involves repetitive bodily movement done to improve or maintain one or more of the components of physical fitness—cardiorespiratory endurance, muscular strength, muscular endurance, and flexibility
    - Examples: biking, running, swimming laps, weight training, elliptical, rower
- **Inactivity** not engaging in any regular pattern of physical activity beyond daily functioning.
- **Leisure-time physical activity** Leisure-time physical activity is exercise, sports, recreation, or hobbies that are not associated with activities as part of one's regular job duties, household, or transportation.
    - Examples: mall walking, playing sports [tag, football, softball, etc.], hiking
- **Physical activity** Physical activity is any bodily movement produced by skeletal muscles that result in an expenditure of energy.
    - *Regular physical activity*- pattern of physical activity is regular if activities are performed:
    - Most days of the week, preferably daily;
    - 5 or more days of the week if the exercise is at a moderate-intensity (in bouts of at least 10 minutes for a total of at least 30 minutes per day); or
    - 3 or more days of the week if the exercise is at a vigorous-intensity (for at least 20-60 minutes per session****

    Note: These are minimum recommendations; greater health outcomes can be achieved by doing additional types activities and/or increasing time spent doing activities.

Tips for Starting Safely

- Consult your physician
- *Ask for help* and advice from a trained professional to find a workout schedule that would best fit your needs
- Start slowly – 2-3 days per week for 20-30 minutes
- Progress slowly – *each week add a day or 5 minutes to your time*
- Invest in the appropriate shoes, clothing, and equipment
- Listen to your body – stop if you hurt or if you are overexerting yourself
- Give your body adequate rest between workouts

Overcoming Exercise Barriers

- *Make exercise a priority in your life!! It's your health!*
- Schedule your workouts ahead of time like any other meeting
    - Do not break this appointment!
- Create a balance lifestyle
    - Family, work, and exercise routine – make time for each
- Prepare for setbacks
    - Do not dwell, just jump right back into your exercise program

Staying Motivated

- *Find an activity you enjoy doing!!*
- Set short term and long term goals
  - *Short Term:* 3-6 months, set to help reach your long-term goal
  - *Long Term:* 1 year or longer
  - Goals should be <u>specific</u>!
  - Post your goals in a place that you will see as a daily reminder
- Reward yourself for achieving your goals
  - Ex: new clothes, shoes, vacation, etc
  - *Do not reward with food!*
- Get your family and friends support
- Have a workout buddy to hold each other accountable
- Replace bad thoughts with good ones.

Recommendations

- Exercise is a life-long commitment
- Ask the help of trained professionals if you are unsure of how to start an exercise program
- Always warm-up and cool-down
  - 5 minutes for both activities
  - *Warm-up* prepares the body to exercise – increases heart rate, breathing, and muscle activity
  - *Cool-down* brings the body down closer to pre-exercise conditions
- Ideally, exercise would be performed on most days of the week for a minimum of 30 minutes
- Include a healthy diet
  - Just because you exercise, you do not have the freedom to eat whatever you want

Cardiovascular

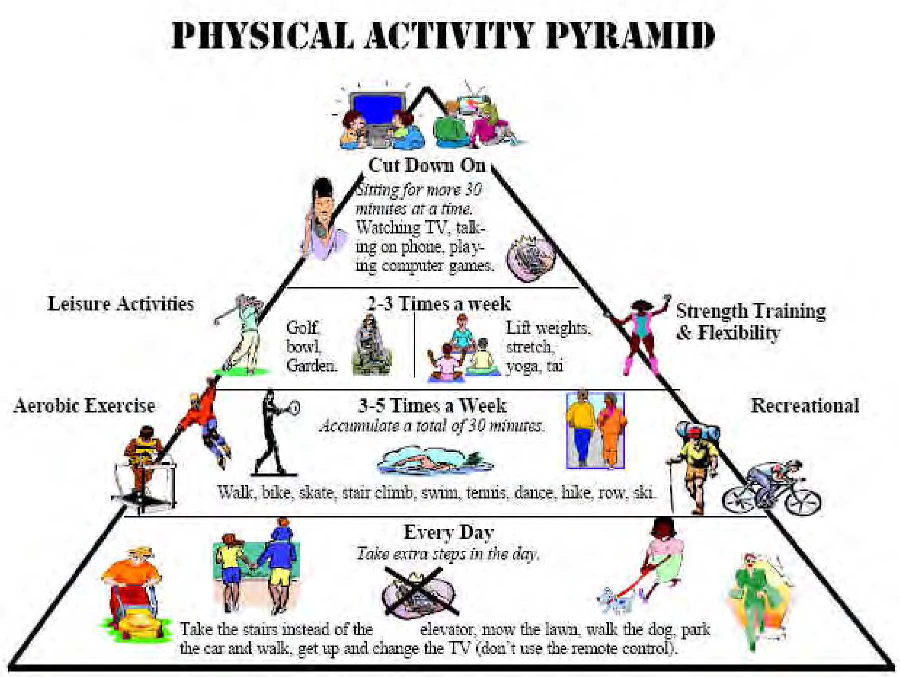
- **Days per week:** 3 -6
  - Minimum of 3 days
- **Time:** 30 minutes or longer
  - Minimum of 30 cumulative minutes per day
- **Type:** Any active movement that causes an increase in heart rate and breathing
  - Running, brisk walking, cycling, elliptical, swimming, dancing, etc.
  - Whatever you enjoy doing
- **Intensity:** moderate to vigorous

Flexibility

- Always be warmed up!!!
  - Do at least 5 minutes of cardio before stretching!
- Never stretch cold muscles.
  - That is when injuries can occur
- Hold each stretch (each side) 15-30 seconds
- Stretch muscle - <u>do not bounce</u>
- Repeat 2-3 times
- Stretch after each workout

Weight Training

- Perform 3-5 min cardio warm-up
- Train each muscle group minimum of two times per week
- Never work same muscle groups two consecutive days
- Work bigger muscle groups first
- *Challenge yourself with the weights!*
  - By your last rep it should be more difficult to complete
  - Don't be afraid to move up the weights! Weight needs to be increased for constant improvement
- Controlled movements (reduce all possible momentum)
- Full range of motion (never 'lock' elbow or knees on any exercise)
- Challenge yourself – keep variety in training to avoid plateaus
- BREATHE!! (*Exhale on exertion!!*)



Here are some tips to help you stay physically active:

1. Set your sights on short-term as well as long-term goals. For example, if your long-term goal is to walk 1 mile, then your short- term goal can be to walk the first quarter mile. Or if your long-term goal is to lose 10 pounds, then focus on the immediate goal of losing the first two or three pounds. With short-term goals you will be less likely to push yourself too hard or too long. Also, think back to where you started. When you compare it to where you are now, you will see the progress you've made.
2. Discuss your program and goals with your family or friends. *Their encouragement and understanding are important sources of support that can help you keep going*. Your friends and family might even join in.
3. What were your original reasons for starting an activity program? Do these reasons still apply or are others more important? If you are feeling bored or aren't enjoying a particular activity, consider trying another one.
4. Sticky Notes and More! Create motivational notes for yourself, conveniently placing them where you are sure to see them. Or maybe you are trying to get in shape so you can fit into your favorite outfit? As a motivation to keep going, hang up a picture of that outfit so you can be reminded of your goal. Use anything that encourages you to make your way to looking and feeling great.
5. Heads Up! Don't get discouraged if you miss a workout session. At times everyone does. *The important thing is not having a perfect record, but getting back on track again when you miss a workout*. Missing one session does not mean you can't make up for it. Double up the following week or stay a little longer the next time you work out. It is commitment, not perfection that is necessary.

How can I become more active throughout my day?

To become more physically active throughout your day, take advantage of any opportunity to get up and move around. Here are some examples:

- Use the stairs - up and down - instead of the elevator. Start with one flight of stairs and gradually build up to more
- Park a few blocks from the office or store and walk the rest of the way. Or if you ride on public transportation, get off a stop or two before and walk a few blocks
- Take an activity break - get up and stretch, walk around and give your muscles and mind a chance to relax
- Instead of eating that extra snack, take a brisk stroll around the neighborhood
- Do housework, such as vacuuming, at a more brisk pace
- Mow your own lawn
- Carry your own groceries
- Go dancing instead of seeing a movie
- Take a walk after dinner instead of watching TV

If you have a family, encourage them to take part in an exercise program and recreational activities they can either share with you or do on their own. It is best to build healthy habits when children are young. When parents are active, children are more likely to be active and stay active after they become adults. Whatever your age, moderate physical activity can become a good health habit with lifelong benefits.

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