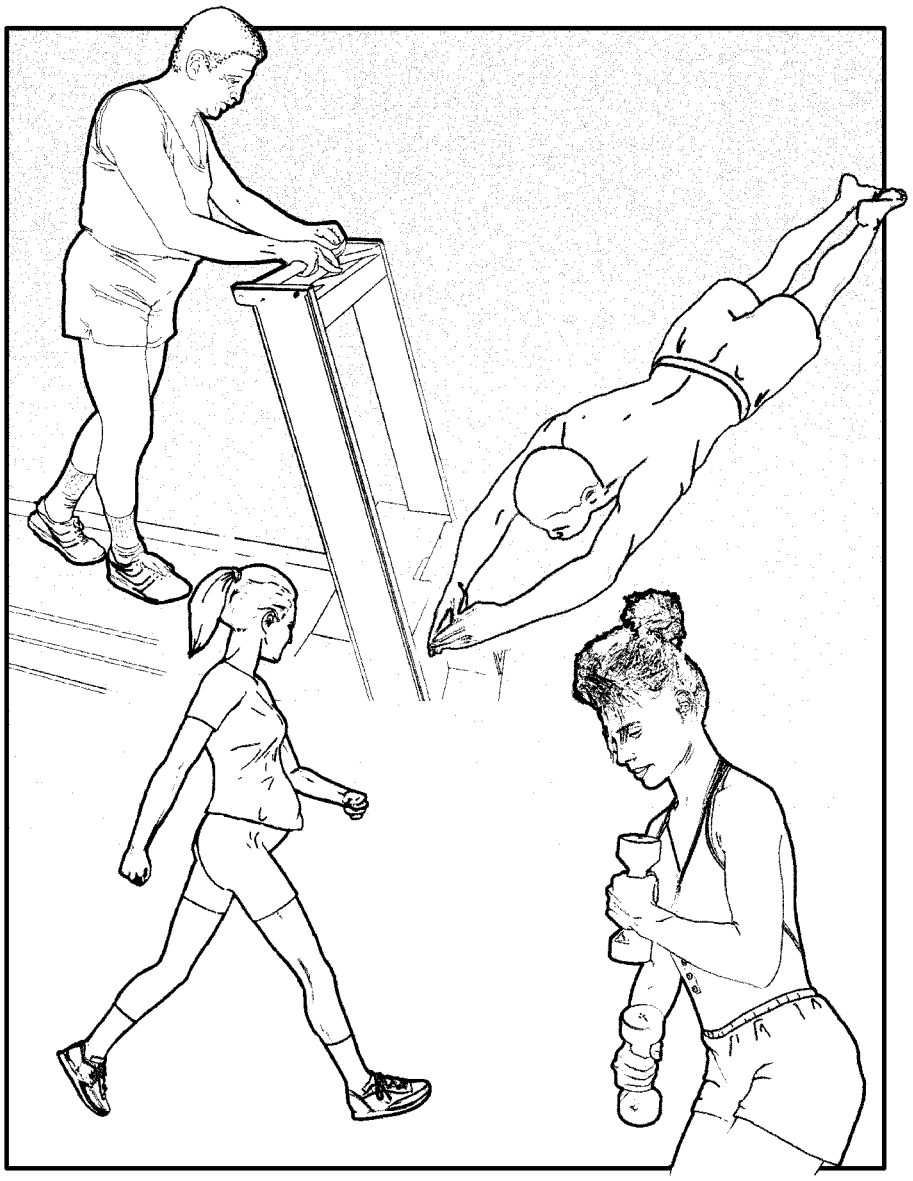
Tech Guide 269
Writing Exercise Prescriptions:
Technical Guidelines for Healthcare Providers
May 2001



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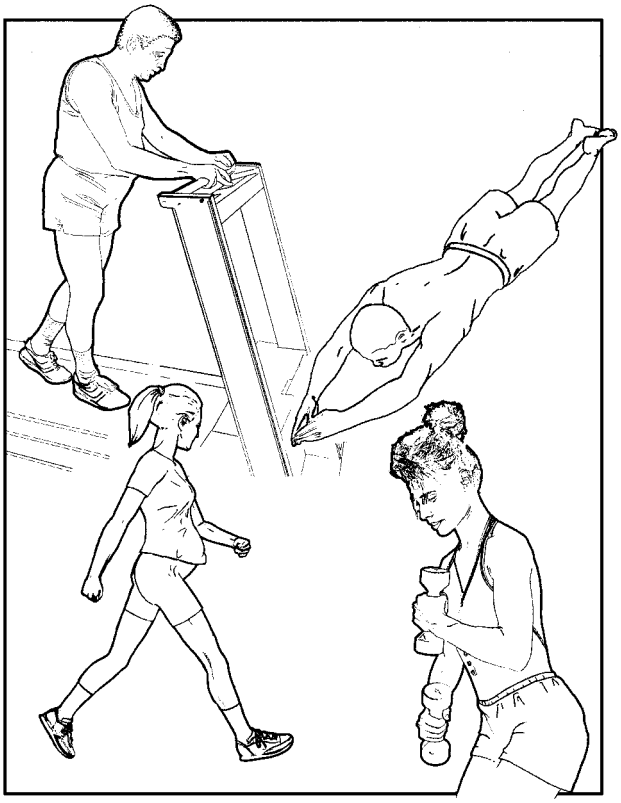

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INTRODUCTION

"All parts of the body if used in moderation and exercised in labors to which each is accustomed, become thereby healthy and well developed, and age slowly; but if unused and left idle, they become liable to disease, defective in growth, and age quickly."

Hippocrates

Regular physical activity has been regarded as an important component of a healthy lifestyle and has been proven to increase longevity and the overall quality of life.[1] Recently, this stand has been reinforced by scientific data linking physical activity to a wide array of physical and mental health benefits.[2,3] Despite this evidence and the apparent heightened public awareness, millions of Americans continue to practice sedentary lifestyles. In order to effect change, it is very important that health care providers (HCPs) include exercise counseling as a part of routine health maintenance. HCPs in this publication refers to physicians, physicians assistants, nurse practitioners and others directly involved in primary health care. HCPs need to emphasize the benefits of exercise and encourage all children and adults to engage in at least 20 to 60 minutes of formal physical activity at a minimum of 3 days per week. Most patients can begin a formal exercise prescription program after consultation with a HCP. Selected high-risk patients, specifically those with pre-existing coronary artery disease (CAD), may require further evaluation prior to initiation of exercise. Specific instruction should be given to the patient as to type, frequency, intensity and duration of exercise. This is most readily achieved through a written exercise prescription program. The products of an effective exercise program are disease prevention, healthy living and a general sense of well being.

This monograph is designed to assist HCPs in appropriately prescribing exercise to their patients. This document will review specific benefits of exercise, risks associated with exercise, current recommendations on exercise, cardiovascular risk assessments, assessing an individual's desire to become physical fit, and guidelines for writing an exercise prescription. Information is provided on exercise precautions for individuals with specific health issues such as heart disease, diabetes mellitus, lung disease and pregnancy. Included are convenient references that are available to patients in the form of handouts.** The intent of this paper is to instill confidence in prescribing exercise to a broad patient population, thus mastering the "art of exercise prescription."

**These handouts are available courtesy of the Parlay International company, located on the web at http://www.parlay.com. This site has several brochures available to assist in exercise preparation and readiness.

EPIDEMIOLOGY OF INACTIVITY

The 1991 National Health Interview Survey-Health Promotion/Disease Prevention reported that 22% of adults engage in light to moderate physical activity for at least 30 minutes per day, 54% are somewhat active, but do not meet the current recommendations, while 24% are completely sedentary (reporting no physical activity over the past month).[4]

Patterns of physical activity vary with demographic characteristics (Table 1). Women reported higher amounts of inactivity than did men. Variations in race/ethnicity were significant as well, demonstrating that African Americans and other ethnic minority populations are less active than white Americans.[5] The prevalence of inactivity, in general, increases with age. There does, however, appear to be a slight increase in physical activity in adults over 65 years of age, but overall, physical activity declines with advancing age.[6] Individuals with a college education are almost twice as likely to be active compared to individuals with a high school level education.

As with education, socioeconomic patterns are similar. Individuals with an annual income of less than $15,000 per year are twice as likely to be sedentary compared to adults who makes in excess of $50,000 per year. Differences in education and socioeconomic status account for most, if not all of the differences in leisure-time physical activity associated with race and ethnicity.[7] Among youths, 60% of males and 47% of females reported participating in vigorous activity of three or more times per week.[8]

Assessing population attributable risk is one way to demonstrate the impact of inactivity on society. Based on 1992 estimates, 35% of the deaths from CAD are attributed to physical inactivity. Accordingly, an estimated 168,000 of the 480,000 CAD deaths would not have occurred if everyone were optimally active.[9] Based on Healthy People 2000 objectives, if 30% of the population were to engage in regular exercise, defined as 30 minutes of light to moderate exercise, preferably daily, approximately 24,000 deaths from CAD per year would be averted.[9]

Table 1

Proportion of Adults Reporting No Leisure-Time Activity Within The Last Month, 1991 Behavioral Risk Factor Surveillance System

Demographic Group	Sedentary, % (95% CI)
Sex	
Male	27.89 (27.18-28.60)
Female	31.48 (30.85-32.11)
Race	
White	27.75 (27.24-28.26)
Nonwhite	37.52 (36.27-38.77)
Age, years	
18-34	23.77 (23.01-24.53)
35-54	29.50 (28.70-30.30)
≥55	38.00 (37.10-38.90)
Annual income, $	
≤14,999	40.14 (39.06-41.22)
15,000-24,999	32.00 (30.90-33.10)
25,000-50,000	25.43 (24.63-26.23)
>50,000	18.64 (17.60-19.68)
Education	
Some high school	48.06 (46.75-49.37)
High school/tech school graduate	33.57 (32.79-34.35)
Some college/college graduate	20.16 (19.55-20.77)

A population-based random-digit-dial-telephone survey with 87,433 respondents aged 18 years and older from 47 states and the District of Columbia. Data are weighted, and point estimates and confidence intervals (CI's) are calculated using the SESUDAAN procedure to adjust for the complex sampling frame.[7]

Additionally, it has been estimated that 250,000 deaths per year in the United States, approximately 12% of the total mortality, are associated with a sedentary lifestyle.[4] The benefit of exercise has been demonstrated in both primary (no evidence of disease) and secondary (diagnosed disease) prevention strategies. Children, young adults and otherwise healthy individuals that engage in regular exercise can see their risk of acquired disease decline. Those with existing health conditions may see improvement in their disease process. Physical activity, whether it be primary or secondary prevention, has the potential to benefit all Americans.

REASONS FOR INACTIVITY

Regular exercise is regarded as an important component of disease prevention and health enhancement. A large and growing body of clinical, scientific and epidemiologic evidence supports the concept of "exercise and longevity."[10] Despite this overwhelming evidence, literally millions of US adults and children remain sedentary. The pattern is such that only 25 percent of American adults and children engage in sustained physical activity. In order to promote physical activity, it becomes important to understand why people are sedentary.

There are numerous behavioral, physiological and psychological variables related to initiating and maintaining physical activity.[11-13] A lack of time appears to be the most common reason cited as a barrier to exercise while injury is a common reason for stopping regular activity.[14] As HCPs it is our responsibility to tactfully approach a patient and encourage initiating/maintaining an appropriate exercise program. Table 2 lists other barriers and motivators of physical activity.

Table 2

Barriers and Motivators Associated with Physical Activity

Motivators	Barriers
Feeling better/more energy	No time/too busy
Promote health	Exercise will not help me
Prevent heart attacks	Lack of confidence
Lower Blood Pressure	Facilities not convenient
Look better	Too costly
Lose weight	Exercise not interesting/painful
Personal accomplishment	Embarrassed of appearance
Contact with friends	Poor environment
Increase strength	Increased fatigue
Sleep better	Does not make me feel better

Adapted from Will PM, Demko TM, George DL. Prescribing exercise for Health: A Simple Framework for Primary Care. Am Fam Physician 1996; 53: 579-585.

HCPs should practice physical activity recommendations not only to benefit their own health, but to make more credible their own endorsement of an active lifestyle. If HCPs are to effect change in patient behavior, they must set the example and adhere to the advice given to patients.

ROLE OF THE HEALTH CARE PROVIDER

Most HCPs are aware of the benefits of exercise, however, few within their practice recommend exercise during patient office visits. In one study, only 47% of primary care physicians surveyed included a careful exercise history as part of their initial examination. The same study noted that just 13% of patients reported that their physician give them advice concerning benefits of exercise.[15] Some constraints cited are: *lack of time*, *a belief that intervention will not be successful*, *lack of reward*, *inadequate reimbursement* and most significantly *a lack of adequate training in physical activity counseling*.[4]

HCPs should routinely counsel patients concerning physical activity. HCPs can be effective proponents of physical activity because patients respect their advice and as a result are more likely to change their own behaviors.[16] With the large number of HCPs and the frequency of office visits, if providers are modestly effective in exercise counseling, it would result in a substantial increase in public awareness. A national health objective for the year 2000 is to increase to at least 50% the number of HCPs who appropriately assess and counsel their patients concerning exercise.[17] Achievement of this goal has the potential to considerably improve the national morbidity and mortality.

HCPs are more likely to counsel patients about exercise if three conditions are met: (1*) low-level screening technology to judge the appropriateness of intervention*, (2) *recommendations can be delivered easily within the context of a patient's visit*, and (3) *they can easily monitor the patient's adherence to prescribed recommendations*.[18] This paper demonstrates a user friendly and efficient algorithm that meet the above conditions.

Likewise, HCPs who have received minimal training in exercise prescription or are unfamiliar in exercise standards are less likely to recommend exercise programs to their patients. This paper is designed to improve counseling skills, define the current exercise guidelines and provide a template of the exercise prescription. The objective is to encourage HCPs to confidently write appropriate exercise programs for their patient population.

Role of the Health Care Provider

There are several studies attempting to improve the physical activity counseling skills of HCPs. The results suggest small but positive effects on patients, with 7% to 10% of sedentary persons starting to be physically active.[19] Two such studies are the PACE (Physician-based Assessment and Counseling for Exercise) and INSURE (Industrywide Network for Social, Urban, and Rural Efforts) projects. The PACE project was developed by the Centers for Disease Control and Prevention (CDC) and was designed to provide specific counseling protocols matched to the patient's level of activity and readiness to change.[20] Evidence suggests that the PACE program is practical and effective in increasing physical activity among patients counseled in the primary care setting.[21] Likewise, the INSURE project proved that medical education seminars combined with reimbursement for prevention counseling heightened physician awareness and increased the percentage of patients who subsequently started exercising.

Several professional health organizations such as the American Heart Association (AHA), the Academy of Pediatrics, the American Medical Association (AMA), the President's Council on Physical Fitness and Sports (PCPFS), and the U.S. Preventive Services Task Force (USPSTF) all recommend including physical activity counseling as part of routine clinical preventive services for adults and young people.

BENEFITS OF EXERCISE

Healthy individuals and patients with existing medical conditions can improve their exercise performance with training, thereby decreasing morbidity and improving overall quality of life. In recent years, significant information has been obtained concerning the risk of a sedentary lifestyle and the benefits of regular exercise.

I. All-Cause Mortality

Attributable risk estimates for all-cause mortality indicate that low physical fitness is an important risk factor in men and women. Higher levels of physical fitness appear to delay all-cause mortality primarily due to lowered rates of cardiovascular disease and cancer.[22]

II. Atherosclerotic Vascular Disease

Cardiovascular disease mortality rates are significantly lower among active than inactive individuals. It has been estimated that as many as 250,000 deaths per year in the United States are attributable to the lack of physical activity.[4,23] These statistics are true in all age groups, and are independent of other risk factors such as smoking, hypertension, obesity, family history of heart disease, or hyperlipidemia. Inactive individuals are two times more likely to develop coronary artery disease than active individuals.[24] Postulated protective mechanisms appear to be multifactorial, but include enhanced lipid profile, decreased blood pressure, weight reduction, increased insulin sensitivity and increased fibrinolytic activity.

Exercise in early adulthood confers protection from cerebrovascular events in later life. Decreasing atherogenesis by altering dependent risk factors such as lipids and blood pressure appear to be the most important mechanisms. Of those who have suffered a stroke, physical activity hastens recovery of neurological deficits.

III. Cancer

Cancer is the second leading cause of death, after heart disease, in the United States. The two most avoidable causes of cancer are tobacco use and alcohol consumption. Physical inactivity appears to be the other significant modifiable risk factor. Moderate exercise enhances the function of the monocyte-macrophage system and natural killer cells, therefore it is plausible for exercise in moderate amounts to reduce cancer risk (Table 3).[25]

Table 3

Physical Activity and the Reduced Risk of Specific Cancers

Cancer Type	Potential Mechanism	Potential Risk Decrease
Most cancer types	Enhanced immune system	Unknown
Colon cancer	Shortened intestinal transit time Decreased body fat	1.2 - 2.0
Breast cancer	Hormone level changes Decreased body fat	2.4(Study of women <45)
Prostate cancer	Hormone level changes	Unknown

Adapted from President's Council on Physical Fitness and Sports. Physical Activity and Cancer. Series 2, No 2, June 1995. Washington DC: US Department of Health and Human Services.

Epidemiological data suggest that exercise decreases the risk of certain types of cancer, particularly colon and breast cancer.[26] It is known that physical activity alters levels of reproductive hormones and investigators have hypothesized that active individuals should experience decreased incidence of hormonal dependent cancers such as prostate, cervical, ovarian and uterine, however current data do not consistently support this hypothesis.[27]

IV. Diabetes Mellitus

Diabetes Mellitus is categorized as either type 1 (formerly referred to insulin dependant diabetes mellitus) or type 2 (formerly referred to non-insulin dependant diabetes mellitus). Type 2 diabetes mellitus is the most common form accounting for 90% to 95% of all diabetes patients. Of those with type 2 diabetes, 60% to 90% of individuals were obese at the time of diagnosis. Physical activity has been shown to decrease the risk of developing type 2 diabetes mellitus.[28] Mechanisms responsible for this are weight reduction, increased insulin sensitivity, and improved

glucose metabolism. Exercise also prevents or delays the complications of diabetes, specifically, peripheral and coronary atherosclerotic vascular disease.

Most type 2 diabetics have hyperinsulinism and the most recent literature suggests that elevated insulin levels are associated in the pathogenesis of atherosclerotic vascular disease. Diabetics who engage in an exercise program can lead healthier lives and alter potential complications.

V. Hypertension

Recent data indicate that over 50 million people in the United States have hypertension. Physical activity is a non-pharmacological treatment that has been shown over time to have a positive effect. Two large studies indicated that physically active individuals had 40% to 60% lower mortality rates than did otherwise comparable unfit and sedentary hypertensives.[29] Cohort studies suggest that inactive individuals have a 35% to 53% greater risk of developing hypertension than those who exercise. This effect seems to be independent of other risk factors for hypertension.[3,30] The average reduction in systolic blood pressure was 10.5 mm Hg from an initial systolic blood pressure of 154 mm Hg and 8.6 mm Hg reduction in diastolic pressure from an initial value of 98 mm Hg.[29] Proposed mechanisms include a reduction in cardiac output, peripheral vascular resistance and sympathetic nervous system activity.

VI. Osteoporosis

Osteoporosis affects over 20 million postmenopausal American women and an unspecified number of men over 80.[10] The result of this process is musculoskeletal weakness, disability, height loss and most significantly, bone fractures of the hip and spine. Two hundred fifty thousand hip fractures occur annually costing over 10 billion dollars in medical expenditures.[31]

The development of osteoporosis is related to three factors: (1) *a deficient level of peak bone mass at physical maturity*, (2) *failure* to maintain *this peak bone mass during the third and fourth decades of life*, and (3) *the bone loss that begins during the fourth and fifth decade of life*. Physical activity may positively affect all three of these factors. In postmenopausal women, greater gain in bone density accrues when physical activity and estrogen replacement therapy occur simultaneously.[32] A proper exercise regimen that includes weight bearing will slow the progression of bone loss and provide improved muscle strength and balance, thereby reducing the overall risk of osteoporosis and its complications.[33,34]

VII. Dyslipidemia

Physical activity positively enhances the lipid levels in the serum. Those who exercise regularly have been found to have 20% to 30% higher high density lipoprotein (HDL) levels than those of their sedentary counterparts.[35] HDL is a lipid scavenger that protects against atherosclerosis by removing cholesterol from the serum. Exercise also reduces levels of triglycerides and very-low-density lipoproteins.[35] There appears to be less consistency comparing the effects of low density lipoproteins and exercise.

VIII. Obesity

It is commonly believed that physically active people are less likely to gain weight over the course of their lives and are thus more likely to have a lower prevalence of obesity than inactive individuals. Obesity plays a central role in the development of diabetes mellitus, and confers an increased risk for hypertension, osteoarthritis, certain cancers, coronary artery disease and all-cause mortality.[36-40] Daily life long exercise with dietary management has been shown to be the best predictor of long-term success in achieving and maintaining optimal weight.

IX. Mental Health

Exercise appears to be "medicine" in the area of mental health. Depression is the most common mental disorder affecting over 10 million Americans. The estimated lifetime prevalence of major depression is about 5% for men and 10% for women.[41] Psychiatrists have observed that physical activity in patients with depression has both psychological and physiological benefits.[42-43] Several studies conducted among college students demonstrated that regular exercise can reduce anxiety and depression.[44-47] The mechanism by which these positive effects are achieved are unknown, but the most likely mechanism involves improvement in the function of biogenic amine neurotransmitters.[48] Exercise in patients with depression is most beneficial when combined with psychotherapy and/or medication.

X. Economic Benefits

The most widely used measure of the economic benefit of physical activity programs is the benefit/cost ratio. The benefit is expressed as the amount of dollars saved from lower medical costs, less absenteeism and reduced disability expense. The cost in the equation represents the dollar amount required to operate physical activity programs. The literature reports benefit/cost ratio ranging from 0.76 to 3.43 with the majority reporting a positive benefit/cost ratio.[49] Some of these studies were conducted on comprehensive health promotion programs which included physical activity, weight control, nutritional education and stress management.[50] The conclusions of these studies indicates that physical activity is economically beneficial to communities, corporations and public health.

RISKS OF PHYSICAL ACTIVITY

I. Exercise Related Sudden Death

The most significant risk associated with regular exercise is a sudden death event. Among children and young adults, cardiac deaths are caused by abnormalities such as hypertrophic cardiomyopathy, Marfan's syndrome, myocarditis and anomalous coronary artery anatomy. Among healthy older adults over 35 years of age, acquired atherosclerotic coronary artery disease is the most common cause of exercise- related sudden death (ERSD).[51]

Data from numerous studies show that 80% of sudden death among competitive athletes 35 years and older were associated with coronary artery disease.[52] The annual incidence of ERSD among previously healthy middle-aged men is only 6 to7 per 100,000 exercisers.[53] A study of male runners between 30 and 64 years of age in Rhode Island reported approximately 1 death per 396,000 hours, or 1 per 7,620 joggers per year.[51,54] Sudden death among marathon runners who undergo vigorous training and competition is extremely low accounting for 1 to 2 annual deaths in a population of 18,000 to 25,000 runners.[55] The risk of myocardial infarction is transiently increased 2 to 6 fold during exercise, however, **regular exercise** is associated with an overall **decrease** in **all-cause mortality**.[30] Figures for exercise-related deaths among women are not available, but research suggests that women are relatively protected from sudden cardiac deaths.

As one can see, the risk of ERSD is extremely small. Physicians need to reassure their patients concerning the risk of sudden death and physical activity. As stated previously, the physiologic and psychological benefits of exercise vastly outweigh the risks.[56]

The rarity of cardiovascular complications during exercise limits the utility of any strategy designed to reduce the incidence of such events. When comparing etiology of ERSD among different age groups, it is important to define "What, if any, is the best screening tool" in

identifying at risk-patients. For individuals below the age of 35, congenital heart disease is the most common pathology for sudden death. In those who are 35 years and older, CAD is the most common cause of sudden death.

The most common cause of ERSD among young athletes is hypertrophic cardiomyopathy accounting for 24% to 48% of all cases.[52,57] The most accurate test to screen for this disease is with two-dimensional and M-mode echocardiography. The use of echocardiography as a screening tool is limited by the low prevalence of hypertrophic cardiomyopathy and cost of the test. In an attempt to investigate screening strategies for the prevention of ERSD in young athletes, Epstein and Maron concluded 200,000 asymptomatic athletes would need to be screened to identify one athlete who would die as a result of athletic participation.[58] The current consensus in the literature and the sports medicine community is that routine echocardiograms are not recommended. Screening for ERSD is best accomplished inquiring about a family history, obtaining a targeted history that identifies exercise-related symptoms and a thorough physical paying particular attention to the cardiovascular system.[59]

The cardiac exam should include the following: precordial auscultations in both supine and standing positions to identify heart murmurs consistent with dynamic left ventricular outflow obstruction; assessment of femoral arteries to exclude coarctation of the aorta; recognition of the physical stigmata of Marfan's syndrome; and brachial blood pressure measurements in the seated position. Any abnormalities with the above exam should warrant further investigation prior to exercise clearance.

The risk of CAD increases with age such that by age 35 it is the primary cause of sudden death. Exercise stress testing is the primary screening tool that provides a controlled environment for observing the effects of increased myocardial demand for oxygen. It is widely used as a first-choice diagnostic modality, a role in which it functions as a gatekeeper to more expensive and invasive procedures. It serves as the cornerstone on which the exercise prescription is based and is the primary method of assessing training efficacy. Exercise testing is generally a safe procedure which can be performed by primary care physician in an office setting. The risk of

myocardial infarction and death have been reported to occur at a rate of 1 per 2,500 tests.[61] The goal of screening is to identify individuals who have subclinical CAD. Identifying this population prior to exercise clearance may prevent a catastrophic myocardial event during periods of increased cardiac stress.[60]

Sound clinical judgment should be utilized in deciding which patients require exercise testing prior to engaging in a regular exercise program. The most predictive parameters of CAD are description of chest pain, gender, age, and concurrent medical conditions. Table 4 summarizes the pretest probability of CAD based on these parameters. This information is helpful for determining the potential utility of exercise testing for a given patient. Diagnostic testing is most valuable in patients with an intermediate pretest probability or higher.

Table 4

Pretest Probability of Coronary Artery Disease by Age, Gender, and Symptoms*

Age	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain	Asymptomatic
30 – 39	Men	Intermediate	Intermediate	Low	Very low
	Women	Intermediate	Very low	Very low	Very low
40 –49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very low	Very low
50 – 59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very low
60 – 69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

High indicates >90%; intermediate, 10 – 90%; low, <10%; and very low <5%.
*No data exists for patients <30 or >69 years of age, but it can be assumed that prevalence of coronary artery disease increases with age. In a few cases, patients with ages at the extremes of the decades listed may have probabilities slightly outside the high or low range.
Reproduced from ACC/AHA Guidelines for Exercise Testing. Circulation 1997; 96: 345-354.

Another factor that must be considered in diagnostic exercise testing is the range of specificity's and sensitivity's observed. In a meta-analysis of 58 consecutively published reports involving 11,691 patients, it was shown that mean sensitivity and specificity rates were 67% and 72%, respectively.[61] This translates into a small, but significant number of false-positive and negative results. False negative results are most disturbing as it gives false assurance of cardiac function to both the HCP and patient.

Risks of Physical Activity

Particularly difficult to detect is the evidence of fixed stenoses with collateral blood flow and low-grade stenoses. These abnormalities may not produce sufficient impairment of blood flow to affect the electrocardiogram. Some studies indicate that low-grade stenoses are unstable and are a source of spontaneous thrombosis leading to myocardial infarction and sudden death. These lesions do not have the benefit of collateral blood flow. As a result exercise stress testing would not be beneficial in detecting these types of lesions (false-negative result).

False-positive results in exercise stress testing, although initially alarming, are generally not as critical. Patients must undergo further invasive testing to verify absence of CAD. These patients usually suffer undue anxiety with the potential of adverse consequences related to work and insurance coverage. Other causes for false-positive results include resting repolarization abnormalities, nonischemic cardiomyopathy, coronary spasms, electrolyte abnormalities, medications and middle-aged female gender.

As one can see, there are limitations and pretest considerations for exercise stress testing. Both the American College of Sports Medicine (ACSM) and American College of Cardiology (ACC) do not recommend screening in healthy, asymptomatic individuals unless they are at moderate risk for suffering a cardiac event. Moderate risk is defined as: evidence of cardiac risk factors, men over 40 engaging in vigorous intensity exercise and women over 50 engaging in vigorous intensity exercise.

The most important key to prevent sudden death among exercisers in this age group is to educate patients of specific warning signs. Symptoms may manifest as angina, nausea, abdominal discomfort, dizziness or fatigue. In a case review of 28 marathon runners who died suddenly or had a myocardial infarction, 20 experienced premonitory symptoms.[56] Despite some limitations in screening for ERSD, education and exercise stress testing in certain populations is the most effective way to prevent sudden death related to exercise.

II. Musculoskeletal

The most common problems associated with physical activity are musculoskeletal injuries, which can occur from excessive amounts of activity or suddenly beginning an activity for which the body is not conditioned. These may present as muscle fatigue, joint/ligament damage or overuse injuries. The most common site of injury is the lower extremity involving the knee, ankle and foot.

Studies of injuries during exercise show that the two most important factors in determining the risk of injuries are age, and the impact nature of activity.[62] Additionally, the incidence of injury increases as the duration and frequency of exercise intensifies. The incidence of orthopedic injuries more than doubles when comparing 45 minute exercise sessions versus 30 minute sessions, yet improvement in VO_2max is minimal.[63] Table 5 lists several popular forms of activity classified by musculoskeletal impact. With appropriate conditioning and gradual increase in duration and intensity, most injuries can be avoided. Injuries, when they do occur, are short-term and gradual return to exercise is the rule.[64]

Table 5

Categories of Activity by Musculoskeletal Impact

High Impact	Low Impact
Jogging/running	Walking/hiking
Basketball	Cycling
Volleyball	Stationary cycling
Hopping/jumping	Swimming
Rope skipping	Rowing
Aerobic dancing	Cross-country skiing
Downhill skiing	

Derived from Pollock ML, Wilmore JH, eds. Exercise in Health and disease: Evaluation and Prescription for Prevention and Rehabilitation. 2nd Ed. Philadelphia, PA: WB Saunders Co. 1990.

III. Miscellaneous Risks

Other adverse effects of physical activity include metabolic and hematologic disorders. Metabolic disorders are rare, but include hyperthermia in warmer weather, hypoglycemia in diabetics, electrolyte imbalances, and dehydration. Hematologic manifestations, likewise rare, include hemoglobinuria, hematuria and rhabdomyolysis. Generally, these occur in athletes engaged in vigorous activity. Lastly, cyclist, runners and walkers often face risks when traveling on roadways such as motor vehicle collisions, falls on uneven surfaces, and attacks by animals.

CURRENT RECOMMENDATIONS

I. Evolution of Physical Activity Recommendations

Recommendations for physical activity based on clinical and scientific data did not surface until the 1960's. Expert panels and committees operating under health and fitness organizations began to recommend specific physical activity programs to promote physical health such as the President's Council on Physical Fitness of 1965; American Heart Association (AHA) in 1972, 1975; and American College of Sports Medicine (ACSM) in 1975. In 1978 the ACSM published a position statement titled "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults." This statement outlined the exercise that healthy adults would need to develop and maintain cardiorespiratory fitness and healthy body composition.

Between 1978 and 1990, most exercise recommendations made to the general public were based on this 1978 position statement. In large, these recommendations addressed only cardiorespiratory fitness and body composition. Over time, interest developed in health benefits of moderate exercise and alternative physical activity regimens.

In 1990, the ACSM updated its position statement by adding muscular strength and development as a major objective. The 1990 recommendations also recognized that activities of moderate intensity may have health benefits independent of improving cardiorespiratory fitness.[65] An important distinction was made between physical activity as it relates to health versus fitness. The quantity and quality of exercise needed to attain health-related benefits differed from what was recommended for cardiorespiratory fitness. Lower levels of physical activity were needed to attain health benefits, yet these levels were insufficient to improve VO_2 max, thus no significant improvement in cardiorespiratory fitness.[66,67] As a result of these findings, the CDC and ACSM jointly published guidelines to reflect the health benefits of lower intensity exercise.

In 1998, the ACSM published updated guidelines. These guidelines detail health benefits at lower intensity exercises, however, the focus still remains on improving cardiorespiratory fitness.

Listed below are current recommendations by various organizations beginning with the most recognized authority in physical activity, the ACSM. The recommendations issued in this report are derived from the ACSM guidelines.

II. Current Recommendations

A. The American College of Sports Medicine Position Stand[68] (1998)

In 1998, the ACSM published their newest guidelines for the recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness and flexibility in healthy adults. This report is divided into cardiorespiratory endurance and body composition, which contains the frequency of training, intensity of training, duration of training, and mode of activity. The muscular strength and endurance, body composition, and flexibility section addresses resistance training and flexibility training. Each of these components will be discussed separately.

1. Frequency of training - the recommendation is 3 to 5 days per week. The VO_2max has been shown to increase with frequency of training and tends to plateau when frequency exceeds 3 times per week. The additional improvement in VO_2max which occurs with training more than 5 days per week is minimal and the incidence of injury increases disproportionately

2. Intensity/Duration - intensity recommendations are defined as 65% to 90% of maximum heart rate or 50% to 85% of maximum oxygen uptake or maximum heart rate reserve. Duration should be 20 to 60 minutes of continuous aerobic activity. Intensity and duration are closely related with the total amount of work performed. Improvement in fitness will be similar for activities performed at a lower intensity-longer duration compared to higher intensity-shorter duration if the total energy expenditure is equal. A realistic goal should be to expend 700 to 2,000 kilocalories per week.

3. Mode of activity - any activity that utilizes large muscle groups in a continuous and rhythmic nature such as walking, running, cycling, swimming, skating and various endurance game activities.

4. Resistance training - training of moderate intensity sufficient to develop and maintain fat-free weight (FFW). One set of 8 to 12 exercises that condition the major muscle groups 2 to 3 days of the week. Persons under 50 years of age should complete 8 to 12 repetitions of each exercise and persons over 50 years and older, 10 to 15 repetitions or until volitional fatigue, whichever occurs first.

5. Flexibility training - major muscle/tendon groups should be developed using static, ballistic, or modified proprioceptive neuromuscular fasciculation (PNF) techniques. Static stretches should be held for 10 to 30 seconds whereas PNF techniques should include a 6 second contraction followed by 10 to 30 seconds assisted stretch. At least 4 repetitions per muscle group should be completed 2 to 3 times per week.

B. Recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine (1995)[4]

The recommendation is to participate in 30 minutes or more of moderate-intensity physical activity on most, preferably all days of the week. This recommendation emphasizes the benefits of moderate-intensity physical activity that can be accumulated in relatively short bouts. Adults who engage in moderate-intensity physical activity, that expends a minimum of 200 calories can expect many of the known health benefits. Table 6 provides several examples of common physical activities and their respective intensities. Accumulation of physical activity in intermittent, short bouts is considered an appropriate approach in achieving the activity goal. Evidence suggests that the amount of activity is more important than the specific manner in which the activity is performed.[69,70] The frequency of activity should be most days, if not all days of the week. Additionally, this

recommendation also emphasizes muscular strength and flexibility as a means to improve balance, strength and coordination, which in turn may prevent injuries and falls.

Table 6

Examples of Common Physical Activities for Healthy US Adults by Intensity of Effort Required

Light	Moderate	Heavy/Vigorous
Walking, slowly	Walking, briskly	Walking, briskly uphill
Cycling, stationary	Cycling, pleasure	Cycling, fast
Swimming, slow treading	Swimming, moderate	Swimming, fast treading
Calisthenics, stretching	Calisthenics, general	Calisthenics, aerobic dance
	Racket sports (leisure)	Racket sports (competitive)
Golf, power cart	Golf, pulling/carrying clubs	
Bowling		
Fishing, sitting	Fishing, standing/casting	Fishing in stream
Boating, power	Canoeing, leisure	Canoeing, rapid (> 4 mph)
Home care, sweeping/vacuuming	Home care, general cleaning	Moving furniture
Mowing lawn, riding mower	Mowing, power mower	Mowing, hand mower
Home repair, carpentry	Home repair, painting	

*Data from Ainsworth et al, Leon, and McArdle.[71-73]

C. The American Heart Association/Scientific Statement (1996)[19]

The recommended frequency of training is 3 to 4 times per week. Intensity should be greater than 50% of VO_2max. Duration is recommended between 30 to 60 minutes. Mode of activity is designed for endurance training. Resistance training was not addressed in this report.

D. American Medical Association Guidelines for Adolescent Preventive Services (1994)[19]

The recommendations were specifically designed to address physical inactivity in the pediatric population. These recommendations are similar to the ACSM. Frequency should be greater than 3 times per week. Intensity should be moderate with 20 to 30 minutes of endurance type activity. Resistance training was not addressed in this report.

E. Department of Health and Human Service (DHHS)-Healthy People 2,000 (1995)[8]

The risk reduction objective is to have at least 30% of the population age six and older to engage in regular, preferably daily, light to moderate physical activity of 30 minutes in duration. Resistance training was not addressed.

F. United States Preventive Services Task Force (1996)[19]

The objective of this recommendation was for primary prevention in clinical practice. Endurance, strength and flexibility is encouraged at moderate intensity for 30 minutes preferably most days of the week.

G. Several other organizations such as the President's Council on Physical Fitness; National Heart, Lung, and Blood Institute; United States Department of Health and Human Services; American Association for Cardiovascular and Pulmonary Rehabilitation and Young Men's Christian Association (YMCA) recommendations are largely based on the CDC/ACSM guidelines.

III. Summary of Recent Physical Activity Recommendations

The traditional, structured approach originally described by the ACSM and other organizations involved specific recommendations regarding type, frequency, intensity and duration of activity such as fast walking, running, cycling, swimming or aerobic activity. As a way to bridge the gap for sedentary individuals, physical activity recommendations have adopted a lifestyle approach to increasing activity.[4]

This method involves common activities such as brisk walking, climbing stairs, yard work and engaging in active recreational pursuits. Either approach can be beneficial for sedentary individuals. Individual interests and goals should be used to determine which is more appropriate. The most recent recommendations cited agree on several points:[19]

Current Recommendations

A. All people over the age of 2 years should engage in at least 20 to 60 minutes of endurance-type physical activity of moderate intensity on most-preferable all-days of the week. Intermittent bouts of physical activity, as short as 8 to 10 minutes, totaling 20 to 60 minutes a day will provide beneficial health and fitness effects.

B. Additional health and functional benefits of physical activity can be achieved by adding more time in moderate-intensity activity, or by substituting more vigorous activity.

C. Persons with symptomatic CAD, diabetes, or other chronic health problems who would like to increase their physical activity should be evaluated by a HCP and provided an exercise program appropriate for their clinical status.

D. Previously inactive men over age 40, women over age 50, and people at high risk for CAD should first consult a physician before embarking on a program of moderate physical activity to which they are unaccustomed.

E. Strength-developing activities (resistance training) should be performed at a minimum of two times per week. At least 8 to 10 strength-developing exercises that use the major muscle groups of the arm, legs, trunk and shoulders should be performed at each session, with one or two sets of 8 to 12 repetitions of each exercise or until volitional fatigue occurs.

EXERCISE PRESCRIPTION

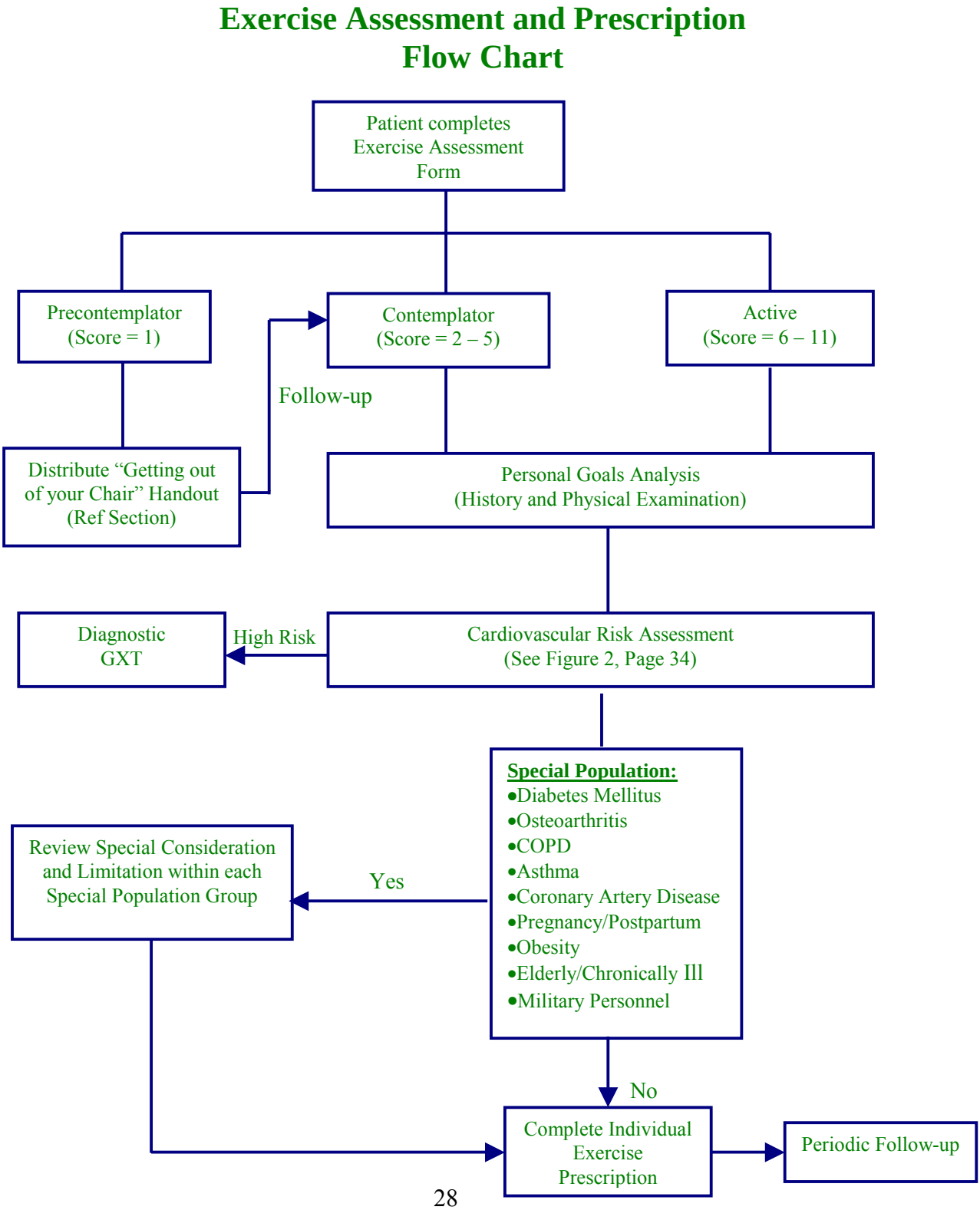
I. Approach to Recommending Exercise

One of the most challenging aspects of medicine is how HCPs approach a sedentary patient and attempt to recommend and prescribe an exercise program. Clearly, not all patients are willing to accept a provider's advice to start exercising. Others may desire to exercise, yet lack the knowledge or motivation. In an attempt to take a non-threatening, unbiased approach to this subject, this paper has designed a useful algorithm that demonstrates the approach to exercise assessment and exercise prescription (Figure 1). This algorithm represents a modification of the assessment utilized by the PACE Program. Additional information concerning the PACE project can be obtained at their website (http://www.PACEproject.org).

Utilizing a single counseling session to implement an exercise prescription is difficult. We recommend two separate office visits or two consecutive appointment slots. Prior to the initial assessment, patients are asked to complete the Exercise Assessment form located in Appendix A. This form serves several purposes. First, it identifies an individual's physical activity status. Secondly, this form will assess cardiovascular risk and potential necessity for pre-exercise testing. Thirdly, the form will determine the patient's performance goals. The first counseling session should entail a review of the assessment form, a focused history and physical examination, and a discussion of the individual's performance goals. The second session is utilized to review the individualized exercise prescription.

The exercise assessment form identifies three levels of physical activity: **precontemplator**, **contemplator** and **active** individuals. The *precontemplator* does not exercise nor intends to start in the near future. The *contemplator* either has considered starting an exercise program or is doing so infrequently and the *active* individual is near or achieves physical activity standards. Although PACE scores will vary with practices, approximately 10% (1 out of 10 patient visits) are *precontemplators*, 50% (5 out of 10 patient visits) are *contemplators* and 40% (4 out of 10 patient visits) are *actives* (desirable levels). The reporting bias by patients (tendency of patients to report doing more intense or frequent activity than they are actually doing) can influence the actual numbers when assessing levels of physical activity.

Figure 1


Exercise Assessment and Prescription
Flow Chart
Patient completes Exercise Assessment Form
Precontemplator (Score = 1)
Contemplator (Score = 2 – 5)
Active (Score = 6 – 11)
Follow-up
Distribute "Getting out of your Chair" Handout (Ref Section)
Personal Goals Analysis (History and Physical Examination)
Diagnostic GXT
High Risk
Cardiovascular Risk Assessment (See Figure 2, Page 34)
Special Population:
•Diabetes Mellitus
•Osteoarthritis
•COPD
•Asthma
•Coronary Artery Disease
•Pregnancy/Postpartum
•Obesity
•Elderly/Chronically Ill
•Military Personnel
Review Special Consideration and Limitation within each Special Population Group
Yes
No
Complete Individual Exercise Prescription
Periodic Follow-up

Exercise Prescription

Counseling strategies will differ based on the patient's stage of readiness. *Precontemplators* have no desire to exercise, therefore, counseling should be aimed at identifying potential personal benefits of an active lifestyle. This patient may present roadblocks to justify their inactivity. Below are some common roadblocks encountered by HCPs (Table 7). The goal is to encourage the individual into the contemplator category. When confronted by a precontemplator, distribute the "Getting Out of Your Chair" handout, located in the Resources/Reference section (Ref-15) and schedule a follow-up appointment.

Table 7

How to Approach Roadblocks

Roadblock:	How to get past it:
I do not have time.	We're only talking about three 30 minute sessions each week. Can you do without three television shows a week?
I am usually too tired to exercise.	Regular activity will improve your energy level. Try and see for yourself.
The weather is too bad.	There are many activities you can do in your home, in any weather.
Exercise is boring.	Listening to music during your activity keeps your mind occupied. Walking, biking, or running can take you past lots of interesting scenery.
I do not enjoy exercise.	Do not "exercise." Start a hobby or an enjoyable activity that gets you moving.
I get sore when I exercise.	Slight muscle soreness after physical activity is common when you are just starting. It should go away in 2 to 3 days. You can avoid this by building up gradually and stretching after each activity.

Reproduced from Patrick K, Sallis JF, Long B, Calfas KJ, et al. A new tool for encouraging activity: Project PACE. Phys Sportmed 1994; 22: 45-55.

Contemplators are patients who do little or no regular physical activity, yet are interested in becoming more active. These individuals are ready for change, but may require additional knowledge, skill, or encouragement. Counseling goals should be directed at reinforcing benefits of exercise, addressing barriers and changing patient behavior. Contracting and setting realistic goals is an effective counseling method designed to increase activity in this group.

Exercise Prescription

Actives are patients already participating in physical activity at various levels of intensity. This group should be praised for their self-motivation and encouraged to continue an active lifestyle. Benefits of exercise, pitfalls in their current exercise program, and short-term goals should be reviewed and established.

When an individual has decided to incorporate physical activity within their lifestyle, a personal goals analysis should briefly be performed. HCPs will be more successful in recommending physical activity if they know the patient's desires. Recommendations for activity will depend on the specific health, fitness and performance goals of the individual. A recommended model is outlined below (Table 8):

Table 8

Model for Physical Activity Recommendations

Individual's goals based on current level of fitness	Recommendations
1. Sedentary Individual	
Flexibility	Initiate conditioning exercises/stretching
Health benefits	Initiate low to moderate intensity leisure exercise (Table 6)
Physical fitness	Initiate moderate intensity exercise (aerobic fitness)
2. Moderately Active Individual	
Flexibility	Continue conditioning exercises/stretching
Health benefits	Continue low to moderate intensity exercise
Physical fitness	Continue moderate intensity exercise (aerobic fitness)
Muscle strength and endurance	Initiate/continue weight training program
3. Vigorously Active Individual	
Flexibility	Continue conditioning exercises/stretching
Health benefits	Goal already achieved
Physical fitness	Continue vigorous intensity exercise (aerobic fitness)
Muscle strength and endurance	Continue weight training program
Elite performance	Competitive organized sports league

II. Pre-exercise Evaluation

The initial evaluation should be incorporated into the routine history and physical examination. Specific issues that should be addressed are listed in Table 9. The physical examination should include, but not be limited to, cardiovascular, pulmonary, musculoskeletal and peripheral vascular assessment. Laboratory screening generally is not indicated, however, if someone appears to be at risk for CAD it is not unreasonable to obtain a lipid profile. The National Cholesterol Education Program (NCEP) Expert Panel guidelines for treatment of hyperlipidemia is located in Appendix B. Remaining laboratory analysis should be dictated by clinical judgment.

Table 9

Pre-exercise Evaluation History
Current and past exercise habits (mode, frequency, intensity, duration)
Current motivation and barriers to exercise
Preferred forms of physical activity
Beliefs about benefits and risks of exercise
Risk factors for heart disease (hypertension, diabetes mellitus, hyperlipidemia, smoking, family history of heart disease before 55 years of age)
Physical limitations precluding certain activities
Exercise-induced symptoms
Concurrent disease (cardiac, pulmonary, musculoskeletal, vascular, psychiatric, etc)
Social support for exercise participation
Time and scheduling considerations
Medication profile

Reproduced from Jones TF, Eaton CB. Exercise Prescription. Am Fam Physician 1995; 52: 543-550.

A medication history (prescribed and over-the-counter) is very important and should likewise be obtained. Certain medications interfere with heart rate, blood pressure and exercise capacity and may potentially cause cardiovascular or respiratory insult. Appendix C lists some common medications and their specific effects.

There is a small subset of patients in which the risk of exercise will exceed the benefit. Table 10 lists the absolute and relative contraindications to exercise. HCPs should carefully review the contraindications and discuss viable options with the patient. In these circumstances, it is advisable to have a cardiologist and/or exercise physiologist involved in the decision-making process.

Table 10

Contraindications to Exercise

Absolute Contraindications

Recent acute myocardial infarction
Unstable angina
Ventricular tachycardia and other dangerous dysrhythmias
Dissecting aortic aneurysm
Acute congestive heart failure
Severe aortic stenosis
Active or suspected myocarditis or pericarditis
Thrombophlebitis or intracardiac thrombi
Recent systemic or pulmonary embolus
Acute infection with fever

Relative Contraindications

Untreated or uncontrolled severe hypertension
Moderate aortic stenosis
Severe subaortic stenosis
Supraventricular dysrhythmias
Ventricular aneurysm
Frequent or complex ventricular ectopy
Cardiomyopathy
Uncontrolled metabolic disease (diabetes, thyroid disease, etc) or electrolyte abnormality
Chronic or recurrent infectious disease (malaria, hepatitis, etc)
Neuromuscular, musculoskeletal or rheumatoid diseases that are exacerbated by exercise
Complicated pregnancy

Adapted from British Columbia Ministry of Health and the Department of National Health and Welfare. PAR-Q validation report. In: Canadian standardized test of fitness (CSTF) operations manual. 3rd ed. Ottawa, Ontario: Fitness Canada, Fitness and Amateur Sport Canada, 1986 and American College of Sports Medicine. Guidelines for exercise testing and prescription. 4th ed. Philadelphia: Lea & Fegiger, 1991; 59.

III. Graded Exercise Testing (GXT)

The American College of Cardiology (ACC) and the American Heart Association (AHA) Task Force in July 1997 updated the latest practice guidelines for exercise testing.[61] The report stated that prior to initiating a fitness program, those who would benefit from a GXT for risk stratification are those with a history of cardiac disease, patients on antihypertensives, and sedentary middle-aged men older than 40 to 50 years. In asymptomatic individuals without known cardiac disease, the risk of suffering a major cardiac event during activity is small and there is no data to justify or criticize exercise testing.[74] Table 11 lists indications for exercise stress testing. Contraindications to exercise stress testing are similar to those for exercise as listed in Table 10. The ACSM and ACC/AHA guidelines are similar each discouraging screening in asymptomatic adults unless they are at increased risk.

Table 11

Indications for Exercise Stress Testing

1. **Evaluation of patients with suspected coronary artery disease**
   Typical angina pectoris
   Atypical angina pectoris

2. **Evaluation of patients with known coronary artery disease**
   After myocardial infarction
   After intervention

3. **Screening of healthy, asymptomatic patients**
   Persons in high-risk occupations (e.g., pilots, firefighters, law enforcement officers, mass transit operators)
   Men over age 40 and women over age 50 who are sedentary and plan to start vigorous exercise
   Persons with multiple cardiac risk factors or concurrent chronic diseases

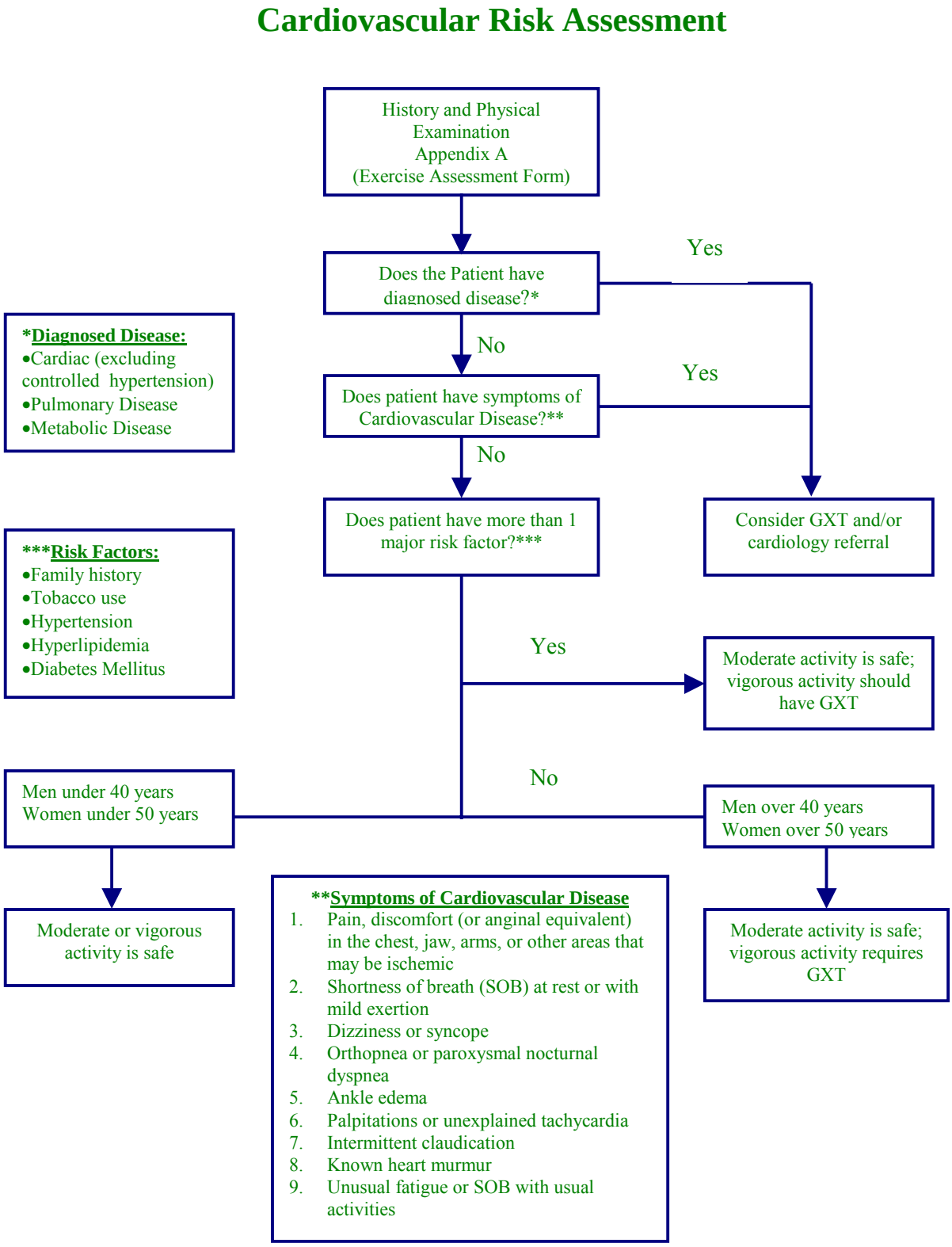
4. **Evaluation of exercise capacity in patients with valvular heart disease (except severe aortic stenosis)**

5. **Patients with cardiac rhythm disorders**
   Evaluation of exercise-induced arrhythmia and response to treatment
   Evaluation of rate-adaptive pacemaker setting

Adapted from Gibbons RJ, Balady GJ, Beasley JW, et al. ACC/AHA Guidelines for Exercise Testing. A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 1997; 30: 260-311.

In summary, certain situations may require clinical judgment, however, the parameters for pre-exercise stress testing for the most part are straightforward. Figure 2 demonstrates an useful algorithm for evaluating the need for GXT before a patient begins a formal exercise program.

Figure 2


Cardiovascular Risk Assessment
History and Physical Examination Appendix A (Exercise Assessment Form)
Does the Patient have diagnosed disease?*
Yes
No
Does patient have symptoms of Cardiovascular Disease?**
Yes
No
Does patient have more than 1 major risk factor?***
Consider GXT and/or cardiology referral
Yes
Moderate activity is safe; vigorous activity should have GXT
No
Men under 40 years
Women under 50 years
Men over 40 years
Women over 50 years
Moderate or vigorous activity is safe
Moderate activity is safe; vigorous activity requires GXT
*Diagnosed Disease:
•Cardiac (excluding controlled hypertension)
•Pulmonary Disease
•Metabolic Disease
***Risk Factors:
•Family history
•Tobacco use
•Hypertension
•Hyperlipidemia
•Diabetes Mellitus
**Symptoms of Cardiovascular Disease
1. Pain, discomfort (or anginal equivalent) in the chest, jaw, arms, or other areas that may be ischemic
2. Shortness of breath (SOB) at rest or with mild exertion
3. Dizziness or syncope
4. Orthopnea or paroxysmal nocturnal dyspnea
5. Ankle edema
6. Palpitations or unexplained tachycardia
7. Intermittent claudication
8. Known heart murmur
9. Unusual fatigue or SOB with usual activities

IV. Writing the Exercise Prescription

It has been shown that if HCPs take the time to write an exercise prescription, patients are more likely to comply with the "doctor's orders." A pharmacological prescription has the drug, dose, route and frequency, likewise an exercise prescription provides the patient instructions regarding exercise goals. The following sections present important components of the exercise prescription and is summarized in Table 12. The cardiovascular exercise prescription form is located in Appendix D. A patient handout on general guidelines for cardiovascular exercise may be found in the resource and reference section at the back of the book.

Table 12

Components of an Exercise Prescription
Activity Selection
Duration
Frequency
Intensity
Progression
Resistance Training
Flexibility Training

A. Activity Selection

The choice of physical activity should be based on the individual's fitness level and interest. The most effective exercises for aerobic training employ large-muscle groups that are maintained in continuous and rhythmic motion. Examples include walking, jogging, running, cycling, swimming, rope skipping, rowing and stair climbing. The most popular activity is walking. This activity requires no specialized equipment or facility. Activity selection will also depend on availability of specialized facilities such as gymnasiums, pools and fitness centers. Table 13 lists several activities with their respective benefits. Most of these activities, if done at or below moderate intensity, will provide health benefits, but not necessarily cardiorespiratory benefit. For example, while leisure walking will promote health benefits, the lower intensity, may not increase cardiorespiratory fitness.

Table 13

Activity Selection Guide

Purpose	Muscular Strength	Muscular Endurance	Cardiorespiratory Endurance	Flexibility	Body Composition	Speed/ Agility	Coordination
Aerobics		X	X	X	X		X
Bicycling		X	X			X	
Calisthenics		X		X	X	X	X
Golf							X
Skiing	X	X	X	X	X		X
Jogging/Running		X	X		X		
Racquet Sports			X	X	X	X	X
Stair Climbing		X	X				
Stretching				X			
Swimming		X	X	X	X		X
Walking (Fast)			X				
Weight Training	X	X				X	X

Cardiovascular goals can be established by modifying frequency, duration and intensity. Other training options, which can be used for conditioning of sedentary adults, include calisthenics, arm exercises and weight training. The latter is particularly important, since traditional aerobic conditioning regimens often fail to accommodate participants who have an interest in improving muscular strength and endurance. The levels of energy expenditures for activities vary and are listed in Table 14.[61,75,76]

Table 14

Energy Expenditures for Various Activities

Activity	METs*	Kilocalories per hour**
Aerobic dancing	6 to 9	440 to 660
Bowling	2 to 4	150 to 300
Calisthenics	3 to 8	220 to 600
Canoeing (leisure)	3 to 6	220 to 440
Cycling (< 10 mph)	3 to 6	220 to 440
Cycling (> 10 mph)	6 to 8	440 to 600
Dancing	3 to 7	220 to 510
Desk Work	1.5 to 2.5	110 to 180
Fishing (sitting)	1.5 to 3	110 to 220
Fishing (standing/casting)	3 to 6	220 to 440
Football (touch)	6 to 10	440 to 740
Golf (walking)	2 to 3	150 to 220
Handball	8 to 12	600 to 880
Hiking (cross-country)	3 to 7	220 to 510
Lawn mowing	3 to 8	220 to 600
Running at 5 mph	8.7	640
Running at 6 mph	10.2	750
Running at 10 mph	16.3	1,200
Sexual intercourse	2 to 5	150 to 370
Shoveling	4 to 7	300 to 510
Shuffleboard	2 to 3	150 to 220
Skating (ice/roller)	5 to 8	370 to 600
Skiing (cross-country)	6 to 12	440 to 880
Skiing (downhill)	5 to 8	370 to 600
Soccer	5 to 12	370 to 880
Softball	3 to 6	220 to 440
Stair climbing	4 to 8	300 to 600
Swimming (moderate)	4 to 6	300 to 440
Swimming (fast treading)	6 to 8	440 to 600
Tennis	4 to 9	300 to 660
Volleyball	3 to 6	220 to 440
Walking at 2 mph	2	150
Walking at 4 mph	4.5	330
Walking (4 mph and uphill)	6	440

mph = miles per hour

* - 1 MET = resting metabolic rate, 3.5 mL of O2 per kg per minute

** - The kilocalories expended during a particular activity are based on a person weighing 70 kg (154 lb). One kilocalorie = approximately 200 mL of O_2 consumed.[24,61,75,76]

Another consideration when selecting activities is to assess the patient's pre-existing medical conditions. It would be impractical to recommend jogging to a patient with severe osteoarthritis. For obese, elderly or arthritic individuals, it may be more practical to offer

low-impact exercises designed to decrease injuries and increase compliance. Examples of low-impact activities are cycling, golfing, walking and swimming. Each exercise prescription should give specific guidance as to what activity will benefit the patient most.

B. Frequency

The optimal training frequency appears to be 3 to 4 sessions per week. The amount of improvement in VO_2max tends to plateau when frequency of training is greater than three times per week, whereas the incidence of overall injuries increases significantly.[77]

Although improvement in cardiorespiratory fitness can occur in deconditioned individuals exercising only 1 to 2 times per week, such regimens evoke little weight loss, stamina or endurance. For conditioned individuals, training less than 2 days per week will result in minimal improvement in cardiorespiratory fitness.

C. Duration

The duration of exercise required for cardiorespiratory fitness and improvement in VO_2max varies inversely with the intensity. The greater the intensity, the shorter the duration of exercise necessary to achieve improvement in cardiorespiratory fitness. Exercise programs of low intensity but long duration can yield results similar to those of higher intensity and shorter duration. Current recommendations are to engage in 20 to 60 minutes of aerobic exercise excluding warm-up and cool-down. As with frequency, duration of exercise in excess of 45 minutes is associated with increasing incidence of orthopedic injury. To avoid acute injury, gradually increase frequency, duration, and intensity of activity over a period of several weeks to months.

D. Intensity

The final and most difficult aspect of the exercise prescription to write is intensity. The intensity should be specifically tailored to the patient's performance goals. The optimal intensity for aerobic exercise training occurs between 50% to 85% of the functional aerobic capacity (VO_2max). Deconditioned patients should start at 20% to 40% of their VO_2max.[78] VO_2max represents the amount of oxygen transported and used in cellular metabolism during maximal exercise.

Exercise intensity can be prescribed by several methods, the most popular of which are utilization of the target heart rate; calculated VO_2max; or category-ratio scales for rating of perceived exertion.[79] In most cases it is not feasible to directly measure oxygen uptake in patients. Studies show that heart rate and oxygen uptake are linearly related during peak exercise.[63] Thus heart rate monitoring has become widely accepted as an indicator of exercise intensity.

The recommended target heart rate (THR) should be 65% to 90% of maximum heart rate (MHR). This heart rate range is for improvement/maintenance of VO_2max. Health-related benefits may be seen at lower heart rate ranges. This method of calculating THR has come under some scrutiny because the variability of age-predicted heart rate maximums. Furthermore, recent data suggest the use of the "220 minus the patients age" formula significantly underestimates the MHR, especially in the elderly population.[80]

The alternate method to calculate THR employs the use of heart rate reserve (HRR) - the Karvonen equation. First, calculate the MHR. Women subtract their age from 220 and men subtract one-half their age from 205. The second step is to determine the resting heart rate (RHR). Third, calculate the HRR. The HRR is MHR minus RHR. Lastly, the THR is the product of training intensity (TI), generally 40% to 60% (moderate intensity), multiplied by the HRR then adding the RHR.

[THR = (MHR - RHR) x %TI + RHR]

For example, what is the THR for a 40 year old male with a RHR of 60 who is to exercise between 40% and 60% TI? His MHR is 205 minus 40 divided by 2, which equates to 185 beats per minute (BPM). Thus his HRR is 185 (MHR) minus 60 (RHR) which is 125 BPM. Forty percent TI equals 0.4 (TI) multiplied by 125 (HRR) plus 60 (RHR). This figure calculates to 110 BPM. Sixty percent TI when calculated using the same formula yields 135 BPM. Thus this individual would have a THR ranging from 110 to 135 BPM.

When a THR is calculated, the patient should be taught to monitor their heart rate at various stages of exercise. The easiest pulse to press is the carotid artery. Caution patients, specifically older individuals not to palpate hard when counting their pulse. In order to calculate beats per minute a patient counts their pulse for 15 seconds and then multiplies this figure by 4. Alternatively, the radial artery can be utilized. Commercial heart rate monitors are available for interested patients.

Intensity can also be judged as a rating of perceived exertion (RPE), which can be equated to desirable heart rate during individual activities. The original scale introduced by Borg in the early 1960's is a 15 grade category scale ranging from 6 to 20, with a verbal description at every odd number that is an important adjunct to heart rate monitoring during training. The RPE scale provides valuable information related to the amount of strain or fatigue the patient is experiencing during exercise. The original scale was validated in a young population to represent the actual heart rate at a given level of work. Unfortunately, heart rate maximums decline with age and therefore actual heart rates and RPE do not match. Despite these findings, the linear relationship between heart rate and work intensity remains for individuals at all ages.[76] The following rating of perceived exertion values should be followed:[81]

less than 12 - light, 40% to 60% of maximal heart rate (MHR)
12 to 13 - somewhat hard (moderate), 60% to 75% of MHR
14 to 16 - hard (heavy), 75% to 90% of MHR

The RPE can be a very powerful tool, particularly in populations who are uncomfortable in measuring pulse, those with arrhythmias (e.g., atrial fibrillation, atrial flutter), and patients on drugs that slow the heart rate (e.g., beta-blockers, certain calcium channel blockers). The RPE can be performed safely, efficiently and accurately without interfering aerobic activity. Table 15 summarizes the Borg scale.[79,81]

Table 15

Borg Scale for Rating Perceived Exertion

15-Grade Scale		10-Grade Scale	
6		0	Nothing
7	Very, very light	0.5	Very, very weak (just noticeable)
8		1	Very weak
9	Very light	2	Weak (light)
10		3	Moderate
11	Fairly light	4	Somewhat strong
12		5	Strong (heavy)
13	Somewhat hard	6	
14		7	Very strong
15	Hard	8	
16		9	
17	Very Hard	10	Very, very strong (almost maximum)
18			
19	Very, very hard		Maximum
20			

The rating of perceived exertion scales. The original scale (6-20) on the left and the newer 10-point category scale with ratio properties on the right. From Borg GA. Psychological bases of perceived exertion. Med Sci Sport Exerc 1982; 14: 377-387.

Exercise intensities have been reclassified based on realistic time periods for training, an individual's relative exercise intensity and relative intensity by age. Table 16 demonstrates the relationship between VO_2max, ratings of perceived exertion, maximum heart rate and METS. Table 14 depicts various activities with their respective METS and caloric expenditures. The ACSM has also established that lower intensity exercises provide health benefits without significantly improving cardiovascular fitness.

Table 16

Classification of physical activity intensity, based on activity lasting up to 60 minutes

	Endurance-type activity								Strength-type exercise
	Relative intensity			Absolute intensity (METs) in healthy adults (age in years)					Relative intensity*
Intensity	VO_2max (%) heart rate reserve (%)	Maximal heart rate	RPE+	Young (20-39)	Middle-aged (40-64)	Old (65-79)	Very old (80+)	RPE	Maximal voluntary contraction (%)
Very light	<25	<30	<9	<3.0	<2.5	<2.0	≤1.25	<10	<30
Light	25-44	30-49	9-10	3.0-4.7	2.5-4.4	2.0-3.5	1.26-2.2	10-11	30-49
Moderate	45-59	50-69	11-12	4.8-7.1	4.5-5.9	3.6-4.7	2.3-2.95	12-13	50-69
Hard	60-84	70-89	13-16	7.2-10.1	6.0-8.4	4.8-6.7	3.0-4.25	14-16	70-84
Very hard	≥85	≥90	>16	≥10.2	≥8.5	≥6.8	≥4.25	17-19	>85
Maximal†	100	100	20	12.0	10.0	8.0	5.0	20	100

Table provided courtesy of Haskell and Pollock.
*Based on 8-12 repetitions for persons under age 50 years and 10-15 repetitions for persons aged 50 years and older.
+Borg rating of Relative Perceived Exertion 6-20 scale (Borg 1982).
†Maximal values are mean values achieved during maximal exercise by healthy adults. Absolute intensity (METs) values are approximate mean values for men. Mean values for women are approximately 1-2 METs lower than those for men.

Reproduced from "The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults." Med Sci Sports Exerc 1998; 30: 975-991.

E. The Exercise Session

A typical exercise session includes a warm-up period, a cardiorespiratory phase, and a cool-down period. Warm-up should last five to ten minutes and is designed to prepare the body for transition from rest to the cardiorespiratory phase. A preliminary warm-up serves to stretch muscles, increase flexibility and gradually increases heart rate and circulation. An appropriate warm-up will decrease the incidence of both orthopedic injury and the potential for adverse ischemic responses. Thus warm-up has musculoskeletal and cardiovascular preventive value. An ideal warm-up for the endurance phase of training should be the same activity only at a lower intensity.

The cardiorespiratory phase of exercise should last 20 to 60 minutes at the individual's predetermined heart rate range or rating of perceived exertion. This phase serves to stimulate oxygen transport and maximize caloric expenditure. There appears to be little additional cardiovascular benefit beyond 30 minutes of the endurance phase.[82] Longer exercise sessions are also associated with a disproportionate incidence of musculoskeletal injuries.[63] Improvement in VO_2max increases linearly with increasing intensity of exercise to a peak of 80% VO_2max with little additional cardiorespiratory benefit thereafter.

The cool-down period follows the cardiorespiratory phase and should last 5 to 10 minutes. The cool-down period again may be the same exercise only at a much lower intensity. Exercises of a muscle-stretching or muscle lengthening nature are likewise encouraged. Specific muscle groups should include extensor muscle of the back, lower leg and upper extremity. These activities will gradually decrease the heart rate and blood pressure to near resting values.

F. Rate of Progression

The provider's first goal should be to engage the patient in a regular exercise program at an acceptable minimum frequency. Thereafter, emphasis is placed first on increasing frequency, second on increasing duration, and lastly, on increasing intensity. It is best to maximize the preceding variable prior to increasing subsequent variables.

The rates of progression can be separated into 3 phases: *initial conditioning phase*; *improvement conditioning phase*; and *maintenance conditioning phase*. The benefits derived from each of these phases will depend on the patient's age, current level of fitness, intensity of their physical activity program and individual goals. In general, the benefits of physical activity represent a dose-response curve.

Exercise Prescription

The **initial conditioning phase** lasts approximately 4 to 6 weeks. During this phase, training effects should be appreciated. These are a decrease in resting heart rate, more rapid recovery of resting heart rate following physical activity, and the ability to increase duration and intensity without increasing fatigue.

The **improvement conditioning phase** lasts approximately 4 to 6 months. Patients can be progressed to reach target heart rates or desired duration of physical activity. It is best to first increase the duration of activity to the desired length and then increase the intensity. The patient will continue to enhance cardiorespiratory fitness resulting in improved endurance and resistance to early fatigue.

Most patients enter the **maintenance** conditioning **phase** after 6 months of regular exercise. Individuals will have obtained the desired level of cardiorespiratory fitness and do not need to increase their duration or intensity of exercise. Emphasis may be refocused from an exercise program involving primarily fitness activities to one which includes a more diverse array of enjoyable activities. Patients should be advised that different forms of exercise or activities of similar intensity can be employed to maintain interest in exercise.

The use of a structured exercise program can facilitate patients through the phases of conditioning. Three fitness levels are assigned: beginner, intermediate and advanced. The patients should be assigned to one of these levels based on their level of fitness. Prior to initiating an exercise program, stress the importance of maintaining a training log. This log provides the patient with a record of their progress. Appendix E and F demonstrate two sample logs, one for beginner's and one for intermediate athletes. Patients who are at an advanced level of fitness generally have an existing structured program. Each level of fitness has 3 distinct phases designed to steadily increase cardiovascular fitness. These training logs are excellent resources for training and preparation for local races.

G. Muscle Conditioning

A comprehensive exercise prescription should contain instructions on muscular endurance and muscular strengthening. Muscular endurance is best developed by utilizing lighter weights with greater number of repetitions, while muscular strengthening, which uses heavier weights with fewer repetitions. Muscle conditioning can be accomplished best by means of static (isometric) or dynamic (isotonic or isokinetic) exercises. Resistance training for the average individual should be performed at rhythmical, slow to moderate speed through a full range of motion utilizing the major muscle groups.

In resistance training, 8 to 10 repetitions of each exercise should be performed or until volitional fatigue (if prior to minimum number of repetitions). Different muscle groups should be used and exercises performed 2 to 3 times per week. Small hand-held weights or wrist/ankle weights can be utilized as a means of resistance training. Most gymnasiums are staffed by weight trainers who can assist patients develop a weight training program. The resource and reference section at the end of this book contains specific weight training guidelines to help patients get started.

SPECIAL POPULATIONS

I. Cardiovascular Disease

Cardiovascular disease is the leading cause of mortality in the United States, accounting for almost 50% of all deaths. More than 1.5 million Americans sustain myocardial infarction each year; of these 600,000 will die.[10,83] Exercise training has become beneficial in the treatment of patients with coronary artery disease (CAD). Substantial evidence demonstrates improved survival in patients with CAD.[84,85] The general principles of an exercise prescription apply to CAD patients as they do to healthy persons. However, the physiological limitations imposed by CAD require certain precautions according to the patient's health and clinical status.

CAD is a chronic disorder characterized by a number of clinically defined phases spanning many years to decades. These phases include: asymptomatic, stable angina, progressive angina, unstable angina and myocardial infarction. In patients who have CAD or individuals suspected of having CAD, the most important management step is to risk stratify the patient. The main objective for risk stratification is to determine the likelihood of subsequent myocardial infarction, cardiac arrest, or heart failure in the future. Specific prognostic factors are listed in Table 17. Using the available data, the physician must formulate a diagnosis and select initial management strategies. Strategies may include non-invasive testing (e.g., EKG, Echocardiogram, GXT), referral to a cardiologist (e.g., cardiac catheterization) or performance of a therapeutic trial.

Table 17

Prognostic Factors for Patients with Coronary Artery Disease

- Left ventricular function/damage
- Severity of CAD
- Coronary plaque event
- Electrical stability
- General health
- Factors predisposing to disease progression
  - Smoking
  - Hyperlipidemia
  - Diabetes mellitus
  - Hypertension
- Other genetic/metabolic factors

Adapted from ACC/AHA Guidelines for Exercise Testing. J Am Coll Cardiol 1997; 30: 260-311.

Special Populations

Prior to prescribing an exercise program, patients with CAD must have some form of cardiac stress testing documented. Multiple forms of stress testing are available and include the traditional graded exercise stress test, myocardial perfusion imaging (e.g., thallium/adenosine), stress echocardiography, and exercise radionuclide cardiac angiography. Clinical condition, extent of disease, co-morbid factors, and availability will dictate the optimal testing strategy.

Upon completion of risk stratification, patients can be classified based on their functional characteristics.[61] The American Heart Association, subsequently utilizes this classification system to make recommendations concerning activity, supervision, and the need for monitoring.

Table 18

New York Heart Association Functional Classification for Congestive Heart Failure

Class	Functional Status
I	Patients with cardiac disease but without resulting limitations of physical activity. Ordinary physical activity does not cause undue fatigue, palpitations, dyspnea, or anginal pain.
II	Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitations, dyspnea, or anginal pain.
III	Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitations, dyspnea, or anginal pain.
IV	Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency or anginal syndrome may be present at rest.

Criteria Committee. New York Heart Association. Inc.: Diseases of the Heart and Blood Vessels. Nomenclature and Criteria for Diagnosis, 6th Ed. Boston. Little Brown and Co., 1964, pg 114.

Class A: Apparently healthy

There is no evidence of increased cardiovascular risk for exercise. This classification included (1) individuals under age 40 years who have no symptoms of or known presence of heart disease or major coronary risk factors and (2) individuals of any age without known heart disease or major risk factors and who have a normal exercise test.

Activity Guidelines: No restrictions other than basic guidelines.
ECG and blood pressure monitoring: Not required
Supervision required: None

Class B: Presence of known, stable cardiovascular disease with low risk for vigorous exercise but slightly greater than for apparently healthy individuals

Moderate activity is not believed to be associated with increased risk in this group. This classification includes individuals with (1) CAD (Myocardial infarction, coronary artery bypass surgery, percutaneous transluminal coronary angioplasty, angina pectoris, abnormal exercise test, and abnormal coronary angiography) whose condition is stable and who have the clinical characteristics outlined below; (2) valvular heart disease; (3) congenital heart disease; (4) cardiomyopathy; (5) exercise test abnormalities that do not meet the criteria outlined in class C below.

Class B clinical characteristics: (1) New York Heart Association (NYHA) class 1 or 2 (Table 18); (2) exercise capacity over 6 METs; (3) no evidence of heart failure; (4) free of ischemia or angina at rest or on the exercise test at or below 6 METs; (5) appropriate rise in systolic blood pressure during exercise; (6) no sequential ectopic ventricular contractions; and (7) ability to satisfactorily self-monitor intensity of activity.

Activity Guidelines: Activity should be individualized with exercise prescription by qualified personnel trained in basic CPR or with electronic monitoring at home.

ECG and blood pressure monitoring: Only during the early prescription phase of training, usually 6 to 12 sessions.

Supervision required: Medical supervision during prescription sessions and nonmedical supervision for other exercise sessions until the individual understands how to monitor his or her activity.

Class C: Those at moderate to high risk for cardiac complications during exercise and/or unable to self-regulate activity or to understand recommended activity level.

This classification includes individuals with (1) CAD with the clinical characteristics outlined below; (2) cardiomyopathy; (3) valvular heart disease; (4) exercise test abnormalities not directly related to ischemia; (5) previous episode of ventricular fibrillation or cardiac arrest that did not occur in the presence of an acute ischemic event or cardiac procedure; (6) complex ventricular arrhythmias that are uncontrolled at mild to moderate work intensities with medication; (7) three-vessel disease or left main disease; and (8) low ejection fraction (less than 30%).

Class C clinical characteristics: (1) Two or more MIs; (2) NYHA class 3 or greater (Table 18); (3) exercise capacity less than 6 METs; (4) ischemic horizontal or downsloping ST depression or 4 mm or more or angina during exercise; (6) a medical problem that the physician believes may be life-threatening; (7) previous episode of primary cardiac arrest; and (8) ventricular tachycardia at a workload of less than 6 METs.

Activity Guidelines: Activity should be individualized with exercise prescription by qualified personnel.

ECG and blood pressure monitoring: Continuous during exercise sessions until safety is established, usually in 6 to 12 session or more.

Supervision: Medical supervision during all exercise sessions until safety is established.

Class D: Unstable disease with activity restriction.

This classification includes individuals with (1) unstable ischemia; (2) heart failure that is not compensated; (3) uncontrolled arrhythmias; (4) severe and symptomatic aortic stenosis; and (5) other conditions that could be aggravated by exercise.

> **Activity Guidelines:** No activity is recommended for conditioning purposes. Attention should be directed to treating the subject and restoring him or her to class C or higher. Daily activities must be prescribed based on individual assessment by the subject's personal physician.

The exercise prescription will vary with the clinical state of each patient's CAD status. Certain cardiovascular end points must be considered when designating an appropriate and safe level for exercise. Cardiac stress testing is the tool by which cardiovascular end points can be determined. Results of the exercise test will determine the recommended quantity of exercise to be prescribed. Substantial data exists on the benefits of physical activity in secondary prevention of cardiovascular disease.[7,62,84]

General Principles of Exercise Prescription in Secondary Prevention

A. Prescription in the Absence of Ischemia or Significant Arrhythmias (Low Risk)[84]

Exercise intensity should approximate 50% to 80% of maximal oxygen consumption, determined by an exercise stress test (deconditioned individuals may begin at lower levels). If a patient is awaiting a GXT and desires to exercise, the MHR should not exceed 20 BPM over the RHR. Upon successful stratification and brief supervision, the long-term-goal for physical activity in low-risk CAD patients is to attain cardiovascular training zone of 50% to 75% TI.

If a patient intends to walk, activity can be prescribed as the treadmill step rate at the desired heart rate. The step rate is the number of steps achieved in 15 seconds while walking at the desired speed on the treadmill. Step rate can be easily counted since it requires less skill than monitoring heart rate.

Educate patients on the use of ratings of perceived exertion. The goal to achieve is a RPE of 12 to 13, perceived as somewhat hard or moderate intensity. This rating approximates to 60% to 75% of MHR.

After safe activity levels have been established, duration is increased in 5-minute increments each week. As patients become conditioned, resistance training can be incorporated into the exercise prescription.

B. Prescription in the Presence of Ischemia or Arrhythmias (Moderate to High Risk)[84]

An exercise stress test and medical supervision are essential for this type of prescription. Exercise testing is utilized to firmly establish a safe cardiovascular training zone. A standard exercise test is performed and the conditioning work intensity is derived from the heart rate associated with the abnormality. If the exercise test continues to a high level of effort, the heart rate at 50% to 60% of maximum can be used if it falls at least 10 BPM below the abnormal level. Otherwise, the recommended peak training heart rate is 10 BPM less than that associated with the abnormality.

It is preferred that these individuals have supervised cardiac rehabilitation and reevaluation to “restratify” them to a lower risk category. Supervision achieves several goals to include introducing patients to physical activity, motivating anxious patients and observing for possible complications such as angina, heart failure and arrhythmias. Current recommendations are to repeat yearly GXT as a means to reassess cardiovascular risk.

C. Summary

Most individuals in secondary prevention can be restratified as low risk and can implement their exercise prescription at home or in a community program. The intensity may be less than individuals exercising for primary prevention, however the benefits associated for overall health will be equal. Interval exercise stress testing is recommended and coronary risk factor modification should be addressed and treated aggressively.[85] It is encouraged that HCPs coordinate with the patient's cardiologist when initiating an exercise program.

Special Populations

II. Diabetes Mellitus

Diabetes Mellitus is a chronic disease characterized by poor regulation of serum glucose. The two major forms include type 1 (insulin dependent) and type 2 (non-insulin dependent) diabetes mellitus. Type 1 diabetes is an autoimmune disorder in which there is a relative or absolute lack of insulin. Insulin replacement is the standard treatment. Type 2 diabetes, the more common form, is a result of decreased insulin sensitivity and increased insulin production. Oral sulfonylureas, biguanides, thiazolidinediones, insulin, and some newer formulations are standard treatment options.

Patients with diabetes mellitus can benefit from a regular exercise program. HCPs will be faced with the challenge of recommending physical activity to this sub-population of patients. Adjustments in caloric intake and insulin may be required in certain situations. Unanticipated complications such as post-exercise hypo-and/or hyperglycemia must be addressed and a strategic plan must be formulated to deal with such issues. Prior to any exercise prescription it is imperative the patient has full knowledge of their disease process, to include adequate blood glucose control.

Patients with diabetes mellitus are 2 to 3 times at higher risk for heart disease than nondiabetics. For individuals with diabetes, 35 years and older, who have had diabetes in excess of 25 years, an exercise stress test is recommended prior to engaging in an exercise program.

A. Exercise in Type 1 Diabetes Mellitus

It is not the scope of this paper to review glucose metabolism during exercise, however, it is important to understand the metabolism of glucose in the diabetic patient. Changes in glucose metabolism in the insulin dependent diabetic are dependent on several factors: amount of insulin administration, prior metabolic control, presence or absence of autonomic dysfunction, and caloric intake.

Special Populations

An individual who has demonstrated good glucose control may engage in 30 to 45 minutes of sustained aerobic exercise without any complications. Skyler and associates recommend blood sugars in the range of 60 to 130 mg/dl before meals, 140 to 180 mg/dl 1 hour after meals, and 120 to 150 mg/dl 2 hours after meals as being well controlled.[86] Hypoglycemia can occur during exercise, if insulin is taken 1 to 2 hours before exercise. Unlike non-diabetics, type 1 diabetics are unable to adjust their serum insulin levels during exercise. As the exercise intensifies the need for insulin decreases as counter-regulatory hormones increase. After exercise the sustained insulin level in the diabetic enhances peripheral glucose uptake and inhibits gluconeogenesis and glycogenolysis thereby inducing hypoglycemia.[87] Signs and symptoms of hypoglycemia include vision changes, fatigue, excessive hunger, increased heart rate, headache, sweating and tremor.

Hyperglycemia may occur in exercising diabetics who are underreplaced with insulin prior to initiating exercise. In this scenario, substrate production (lipolysis, gluconeogenesis, and glycogenolysis) is unchecked because of the lack of opposition of the counterregulatory hormones. This results in an exaggeration of the pre-existing hyperglycemia and may predispose to the development of ketoacidosis. A therapeutic serum insulin range exists for each individual.

For the non-athletic patient who in not engaged in a vigorous or prolonged training program, adjustment of insulin is rarely required. If intensive training is anticipated, the insulin dose may need to be reduced 20% to 50%. Another alternative is to decrease the insulin that would normally peak during the required training period.[88] The preferred site for insulin injection is the abdomen. Patients should avoid injecting the extremities as increased blood flow to these areas during exercise accelerates insulin absorption, potentially inducing a hypoglycemic event. Table 19 provides useful guidance for insulin dependent diabetics.

Table 19

Prevention of Hypoglycemia or Hyperglycemia

Before Exercise

- Estimate intensity, duration, and energy expenditure of exercise
- Eat a meal 1-3 hours before exercise
- Insulin:
  - Administer insulin more than 1 hour before exercise
  - Administer insulin in abdomen and avoid extremity injections
  - Decrease insulin that has peak activity coinciding with exercise period (may not be required)
  - Assess metabolic control:
    - If blood glucose < 100 mg/dL, take supplemental pre-exercise snack
    - If blood glucose > 250 mg/dL or serum ketones are positive, delay exercise

During Exercise

- Supplement calories with carbohydrate feedings (30-40 grams for adults, 15-25 grams for children) every 30 minutes during extended, strenuous exercise
- Replace fluid losses adequately
- Monitor blood glucose during exercise of long duration

After Exercise

- Monitor blood glucose, especially if exercise is not consistent
- Increase calorie intake for 12-24 hours after activity, according to intensity and duration of exercise
- Reduce insulin, which peaks in the evening or night, according to intensity and duration of exercise (may not be required)

Adapted from Horton ES. Role and management of exercise in diabetes mellitus. Diab Care 1988; 11: 201-211.

B. Exercise in Type 2 Diabetes Mellitus

Exercise is a significant factor in controlling hyperglycemic events. Exercise improves peripheral insulin sensitivity, enhances insulin binding, and promotes weight reduction. These effects are lost if exercise is discontinued for more than 3 days. Type 2 diabetics do not suffer hypoglycemia as a result of maintenance of endogenous insulin. Individuals on sulfonylureas however, may be at increased risk of hypoglycemia during exercise. It is recommended that a small snack be consumed prior to exercise to decrease this incidence.

C. Complications

Patients with diabetes mellitus do incur additional risks not shared by non-diabetics. Autonomic neuropathy (blunted heart rate response and orthostatic hypotension), macrovascular disease (foot ulcer, stasis changes and angina), and microvascular disease (retinal hemorrhage and increased proteinuria) appear to occur at increased frequency. Individuals with known complications should choose exercise activities that will not aggravate their disease. For example a patient with peripheral neuropathy should be encouraged to ride a bicycle rather than running. The benefits of exercise still outweighs the risk, however, the patient must understand the effects of a particular exercise program on their disease process. Diet and medication adjustments may be required to ensure safe participation in a physical activity program. A handout for exercise in the diabetic patient may be found in the resource and reference section.

III. Osteoarthritis

Osteoarthritis (OA) is the most common form of joint disease in humans. It is characterized by progressive degeneration of the articular cartilage and bony hypertrophy of mobile joints. Risk factors associated with OA are trauma, repetitive stress, obesity, age, gender, race, developmental defects, metabolic/endocrine disorders and prior inflammatory joint disease.[89] Obesity in particular is a significant risk factor. A weight loss of 5 kilograms may be associated with a 50% reduction in developing symptomatic knee OA.[90] In patients with OA who are already symptomatic, weight reduction may decrease the severity of joint pain.[91]

Osteoarthritis is uncommon before the age of 40, but by age 65, 80% of individuals have OA.[92] Exercise has been controversial in the treatment of OA. Until recently, exercise was not recommended for fear that vigorous motion to an arthritic joint could further damage peri-articular tissue and worsen pain. It is now known that prolonged inactivity exacerbates pain and stiffness, results in loss of mobility, and eventually causes weakness and functional disability. Furthermore, weight bearing on articular joints has been shown to stimulate proteoglycan synthesis thereby maintaining integrity of the articular surface.[93] Recent studies have demonstrated the safety and efficacy of exercise for patients with arthritis.[94]

In persons over 65, 12% report limitations in physical activity secondary to pain from arthritis.[95] The most common and disabling joint is the knee, followed by the hip. Osteoarthritis can result in decreased muscle strength in the peri-articular muscles, decreased flexibility, weight gain, and diminished aerobic capacity.[96] Recent studies have shown that patients with osteoarthritis are able to tolerate weight bearing exercises such as walking. Goals of an exercise program in patients with osteoarthritis include maintaining joint motion, increasing strength and endurance of peri-articular muscles, increasing aerobic capacity, assisting in weight loss and improving activities of daily living. Specific regimens to achieve these goals are range of motion training, strengthening exercises and aerobic conditioning.

Special Populations

In considering an exercise prescription for patients with arthritis, certain factors must be taken into account. Strengthening exercises and range of motion training are an integral component to physical activity, particularly of the knee joints. Maximizing use of lower extremity joints will enable individuals to participate in aerobic activity. Prior to exercising, it is recommended to take an anti-inflammatory agent, which may reduce pain and inflammation.

Acute inflammation is an indication to postpone exercise that involves repetitive use of that joint. The affected joint should be protected. Once the acute phase has resolved, initial rehabilitation should emphasize improving range of motion and strength. Alternatively, recommend different forms of exercise that vary weight bearing. A stationary bicycle is a good alternative for walking on days when knees are sore and a walk may be a better choice of exercise than swimming on days when hands, wrists, and shoulders are painful. Aquatic exercises and newer strength machines have recently become popular, as these exercises place less stress on joints (see handout on aquatic exercise in the resource and reference section). Various strength and exercise machines are available for both home use or located at health clubs. Below are comparisons of different exercises and the stress across the particular joint (Table 20). Each patient must be educated for self-management, so he or she may adjust their exercise routine for changes in disease activity.

Table 20

Exercise and the stress across selected joints

	Hip	Knee	Ankle	Shoulder	Spine
Bicycling	++	++	+	---	+
Arm-cranking	---	---	---	++	++
Rowing	---	---	---	++	++
Cross-country skiing	+	±	±	±	+
Climbing	++	++	++	+	+
Water running	---	---	---	±	±

+ = degree of increased impact --- = no significant impact ± = potentially significant

Reproduced from Barry HC, Eathorne SW. Exercise and aging. Med Clin North Am 1994; 78: 357-376.

IV. Pregnancy

Women who are pregnant or plan to become pregnant are encouraged to maintain an active recreational lifestyle. Assuming, there are no obstetrical or medical complications, they may engage in a moderate level of physical activity throughout pregnancy. Limitations to activity generally will be defined by the physiologic changes associated with pregnancy.

Several physiologic changes occur during pregnancy. Cardiovascular changes include increased cardiac output/blood volume and decreases in systemic vascular resistance. Care must be taken after the first trimester to avoid long periods in the supine position. In this position, the enlarging uterus compresses against the inferior vena cava decreasing venous return to the heart. Increased work of breathing during pregnancy results in decreased performance during aerobic exercise. The effects of exercise on the fetus appear to be minimal. Investigators concluded that submaximal maternal exercise does not appear to adversely effect fetal heart rate.[97,98]

Recommendations for exercise during pregnancy are listed in Table 21, with accompanying handout in the resource and reference section. These are specifically designed for women without obstetrical or medical complications. Appropriate aerobic activities include walking, swimming, bicycling, low-impact aerobics classes and water exercises. Activities to be avoided are those that entail risk of abdominal trauma or that are performed in extreme environmental conditions. High impact activities, such as running, may increase the likelihood of musculoskeletal injury due to increased laxity of connective tissue. Many women find these activities increasingly uncomfortable as gestation progresses.

Contraindications to physical activity are hypertension associated with pregnancy, pre-term rupture of membranes, pre-term labor with prior or current pregnancy, incompetent cervix/cerclage, persistent second or third trimester bleeding and interuterine growth retardation. Additional medical complications should be carefully reviewed to determine if an exercise program is appropriate.[99]

Table 21

Exercise Guidelines for Pregnancy and the Postpartum Period

There are no data in humans to indicate that pregnant women should limit exercise intensity and lower target heart rates because of potential adverse effects. For women who do not have any additional risk factors for adverse maternal or perinatal outcomes, the following recommendations may be made:

1. During pregnancy, women can continue to exercise and derive health benefits even from mild to moderate exercise routines. Regular exercise (at least 3 times per week) is preferable to intermittent activity.
2. Women should avoid exercise in the supine position after the first trimester. Such a position is associated with decreased cardiac output in most pregnant women; because the remaining cardiac output is preferentially distributed away from splanchnic beds (including the uterus) during vigorous exercise, such regimens are best avoided during pregnancy. Prolonged periods of motionless standing should also be avoided.
3. Women should be aware of the decreased oxygen available for aerobic exercise during pregnancy. They should be encouraged to modify the intensity of their exercise according to maternal symptoms. Pregnant women should stop exercising when fatigued and not exercise to exhaustion. Weight-bearing exercises may under some circumstances be continued at intensities similar to those before pregnancy throughout pregnancy. Non-weight-bearing exercises, such as cycling or swimming, minimize the risk of injury and facilitate the continuation of exercise during pregnancy.
4. Morphologic changes in pregnancy should serve as a relative contraindication to types of exercise in which loss of balance could be detrimental to maternal or fetal well-being, especially in the third trimester. Further, any type of exercise involving the potential for even mild abdominal trauma should be avoided.
5. Pregnancy requires an additional 300 kcal/day to maintain metabolic homeostasis. Thus, women who exercise during pregnancy should be particularly careful to ensure an adequate diet.
6. Pregnant women who exercise in the first trimester should augment heat dissipation by ensuring adequate hydration, appropriate clothing, and optimal environmental surroundings during exercise. Avoid body temperatures above 100.4 degrees Fahrenheit (hot tubs, saunas, prolonged exercise in heat and humidity).
7. Many of the physiologic and morphologic changes of pregnancy persist 4 to 6 weeks postpartum. Thus, pre-pregnancy exercise routines should be resumed gradually based on a woman's physical capability. Acceptable guidelines are to resume activity 1 week after vaginal delivery and 6 to 10 weeks following a cesarean-section.
8. Strenuous exercise should not exceed 15 minutes and may require adjusting as the pregnancy advances.

The following conditions should be considered contraindications to exercise during pregnancy:

- -Pregnancy-induced hypertension
- -Pre-term rupture of membranes
- -Pre-term labor during the prior or current pregnancy or both
- -Incompetent cervix/cerclage
- -Persistent second or third trimester bleeding
- -Intrauterine growth retardation

From American College of Obstetricians and Gynecologist: Exercise During Pregnancy and the Postpartum Period. Technical Bulletin No. 189. Washington, DC, ACOG, 1994.

Most studies have shown that exercise during pregnancy has no adverse effect on the outcome of labor. Exercise during late pregnancy has been demonstrated to decrease labor time, incidence of arrested labor, and cesarean section rates.[100] In those women who vigorously exercise, birth weight is reduced by approximately 320 grams.[101] Head and axial growth remains unchanged. In

summary, there are no published data suggesting increased morbidity associated with exercise and pregnancy, for mother or fetus.

V. Asthma

Asthma is an obstructive disorder of the airways characterized by airway inflammation and hyperreactivity. Airway obstruction occurs as a result of bronchoconstriction, airway edema, smooth muscle hypertrophy and mucus plug formation.[102] Asthma associated with exercise is extremely common. Ninety percent of people who have asthma experience exercise-induced asthma (EIA) or exercise-induced bronchospasm (EIB) during the course of their disease.[103] In random testing of athletes, approximately 10% have exercise-induced asthma and 12% to 15% of the general population suffers from this disease.[104,105] When controlled, it places no physical limitations on an individual's performance. During the 1984 Summer Olympic games, 41 of 67 athletes known to have EIA won medals.

EIA is a clinical syndrome characterized by chest tightness, shortness of breath, coughing, wheezing, fatigue and prolonged recovery times from exercise. These symptoms are associated with a transient increase in airway resistance usually occurring during or shortly after exercise. Various stimuli have been identified that contribute to attacks of EIA. Conditions such as cold temperatures, low humidity, pollutants (e.g., allergens, dust, irritants), respiratory infections, fatigue, emotional stress and overtraining may increase the occurrence of EIA.

Most patients diagnosed with EIA give a classic history, however, many are unaware they have the condition. The symptoms are often perceived as normal for vigorous exercise or a result of being labeled as "out of shape."[106] Factors in a patient's history that suggest presence of EIA are listed in Table 22.

Table 22

Factors that Suggest Exercise-Induced Asthma

1. Coughing, wheezing, dyspnea, or chest discomfort occurring during or shortly after exercise
2. Symptoms that vary by season, temperature, or intensity of activity
3. Complains of decreased, limited exercise tolerance
4. Complains of "being out of shape"
5. Minimal problems with swimming or warm, humid weather
6. Complains of frequent "colds"

The diagnoses of EIA may be strongly suggested by history.[107] In mild cases, the diagnosis may be confirmed by a therapeutic trial of medication. Pulmonary function testing before and after exercise is essential in diagnosing EIA. FEV_1 (forced expiratory volume in 1 second) and FEV_1/FVC (forced vital capacity) values below 80% of predicted value indicate obstructive airway disease. Occasionally, when the history is unclear, a methacholine challenge test may be useful. Testing can help avoid overuse of unnecessary medications when the patient's breathing problems may be due to another etiology. Once the diagnosis is established, treatment options include non-pharmacologic and pharmacologic therapies (Figure 3).

Non-pharmacologic interventions may be helpful in the management of EIA. Individuals should choose activities they enjoy, as some sports are more conducive to asthmatics. Sports that involve skill and coordination more than endurance (e.g., golf, baseball), or are conducted in warm humid environments (e.g., swimming) may be better tolerated by the patient with EIA.

Patients should improve physical conditioning and avoid known precipitants such as cold/dry conditions. Incorporating warm-up activities and breathing through the nose (filters and warms the air) have also been effective in preventing asthma attacks. Prolonged submaximal warm-up activities have been shown to induce an EIA refractory period. Athletes are generally advised to perform a series of short sprints (10 to 12) or warm-up for 10 minutes or less with vigorous exercise one hour before an event to induce this refractory period.

Pharmacologic interventions include beta agonists, cromolyn sulfate, corticosteroids, oral theophylline and ipratropium bromide. The drugs of choice are the beta-agonists. These drugs

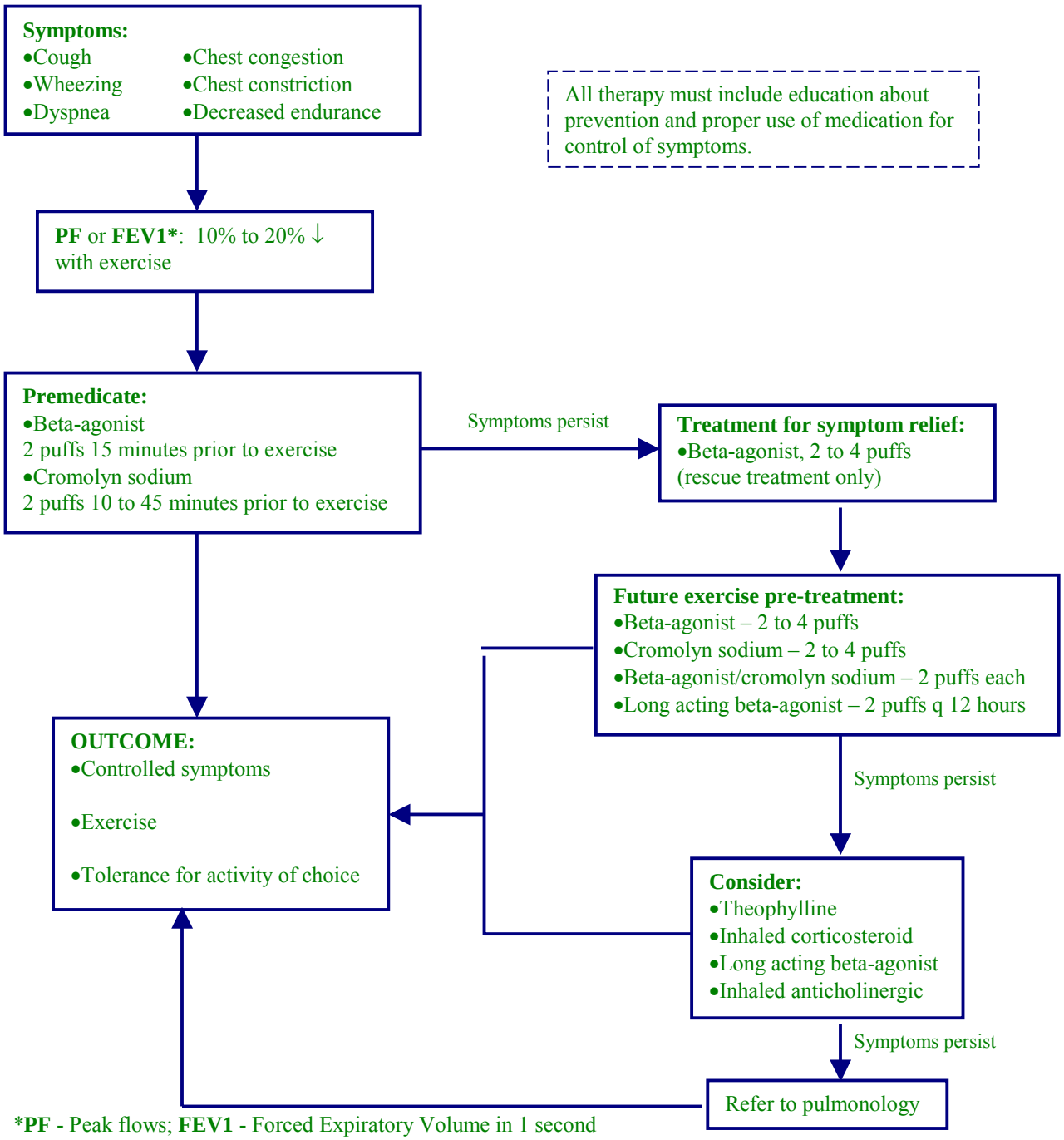
are used for preventive measure and rescue therapy. Short-acting beta-agonist are effective in 80% to 95% of patients.[108] The guidelines are to inhale a beta-agonist 15 minutes before exercise. If symptoms develop during exercise, on-demand beta-agonist therapy should be repeated.

Cromolyn sodium is the second most commonly used medication used for treatment of EIA. It is an anti-inflammatory agent shown to be effective in 70% to 85% of patients. A distinct advantage of this drug is its low incidence of side effects. Cromolyn is most effective when given 10 to 45 minutes prior to exercise. Cromolyn is not a bronchodilator and should never be used for rescue therapy. The other medications mentioned can be utilized in select patients or used in combination with beta-agonist or cromolyn sulfate.

EIA is common and should be recognized by HCPs. Education and prevention appear to be important factors in managing EIA. Fortunately, there are many non-pharmacologic and pharmacologic therapies available to control EIA. As a result, patients are able to perform at or near maximal activity levels.

Figure 3

Management of Exercise Induced Asthma



***PF** - Peak flows; **FEV1** - Forced Expiratory Volume in 1 second

Adapted from Expert Panel Report. Guidelines for the diagnosis and management of asthma. National Heart, Lung, and Blood Institute of Health publication # 91-3042: 121 August 1991.

VI. Pulmonary Disease

An estimated 15 to 25 million Americans suffer from chronic obstructive pulmonary disease (COPD) - including chronic bronchitis and emphysema.[109] It is a leading cause of mortality and is responsible for 200,000 deaths yearly. Despite trends in reduced tobacco consumption, mortality rates for COPD continue to rise primarily due to previous tobacco use in today's older population.[110] In patients with COPD, disability is primarily a result of progressive deconditioning. As the disease progresses, limited ventilatory capacity makes exertion unpleasant and leads to an increasingly sedentary lifestyle. Shortness of breath (breathlessness) and exercise intolerance are the most incapacitating symptoms patients develop. A counter-measure to progressive functional decline in patients with COPD is exercise training.

Irreversible destruction of lung parenchyma is the hallmark of COPD. Significant ventilation-perfusion mismatch occurs, impairing maximal gas exchange. Additionally, the work of breathing is increased secondary to increased airway resistance and hyperinflation.

It has clearly been demonstrated that exercise is beneficial for patients who have COPD. Structured exercise protocols and less demanding protocols alike produced significant improvement in exercise tolerance, decreased minute ventilation and improved dyspnea.[111] Although exercise may not lengthen life expectancy, it has been shown to improve the quality of life and therefore should be an integral adjunctive treatment for all pulmonary patients. The components of the COPD exercise prescription are presented below (Table 23).

Table 23

Components of the COPD Exercise Prescription

Evaluation

- -Assess cardiac risk
- -Assess exercise capacity using a treadmill (Naughton protocol) or stationary cycle, starting at a low workload and increasing extremely slowly, and monitoring desaturation with a pulse oximeter
- -Determine appropriate exercise levels to prevent arrhythmias or hypoxia in cardiac-impaired patients
- -Determine the amount of supplemental oxygen needed during exercise
- -Determine need for bronchodilators during exercise
- -Assess side effects of beta-agonist inhalers or aminophylline derivatives during exercise

Supervised Exercise

- -Direct patient to a supervised rehabilitation program if disease is significant
- -Set a goal of eventually graduating to independent exercise (many patients do this in about 6 weeks)

Independent Exercise

- -Suggesting an appropriate training mode: stationary cycling, bicycling, treadmill walking, outdoor walking, stair climbing, or arm ergometry
- -Set a goal of 60% to 80% of maximum heart rate for 20 to 30 minutes, 3 days a week (build on individual ability)
- -Expect a 70% to 80% increase over initial work capacity within 6 weeks
- -Provide active encouragement and reassurance (especially at first) to overcome anxiety associated with dyspnea

Exercise Aids

- -Oxygen supplementation
- -Bronchodilators
- -Mucolytics
- -Corticosteroids (inhaled or oral)
- -Monitoring

Reproduced from Mink BD. Exercise and Chronic Obstructive Pulmonary Disease. Phys Sportsmed 1997; 25: 43-52.

Prescribing exercise in the COPD patient requires a significant amount of planning and encouragement. Initially, they may benefit from formal cardiac risk stratification and supervised rehabilitation programs. The exercise prescription should proceed gradually since most individuals are extremely limited in the amount of exercise tolerated secondary to deconditioning or dyspnea. Extremity conditioning exercises is a key component to the exercise prescription. Those with severe COPD may initially only be able to perform extremity conditioning exercises. Exercise conditioning has been shown to improve maximal oxygen uptake, strength and endurance. Increased muscle mass and a better vascular system will help improve peripheral extraction of oxygen, which will lead to better physical activity. Evaluate the patients need for bronchodilator therapy, mucolytics or supplemental oxygen during exercise. Physicians will find

that frequent follow-up, encouragement and reassurance are integral to the success of the rehabilitation process. Progress in exercise tolerance may be minimal in this population, however diligent participation can reduce respiratory symptoms, reverse anxiety and depression, and increase the ability to perform activities of daily living.

Special Populations

VII. Obesity

Obesity is a common and serious health problem in the United States. The number of overweight and obese persons is increasing among American men and women. Approximately 33% of Americans are overweight. Recent data suggests that Americans are moving away from, rather than toward the goals set forth by Healthy People 2000 initiative.[112] Additionally, 50% of American women and 25% of American men attempt to lose weight, amounting to an annual expenditure of 30 billion dollars on weight loss treatments.[113]

Obesity is an excess of body fat defined as greater than 20% above ideal body weight and overweight implies excess body weight greater than 10% above ideal body weight.[114] These two terms in clinical practice are often used interchangeably. A more precise analysis of obesity is the use of body mass index (BMI). BMI is based on weight and height (in metric measurements) and can be calculated using the following equation:

[BMI = Weight (KG)/Height^2 (M)]

A BMI of 25 and above is considered overweight. A convenient Body Mass Index Table is provided in Appendix G. Table 24 classifies obesity, waist circumference and disease risk by BMI.

Table 24

Classification of overweight and obesity by BMI and associated disease risk*

			Disease Risk* (Relative to Normal Weight and Waist Circumference)	
	BMI	**Obesity Class**	**Men ≤ 40 in (≤ 102 cm) Women ≤ 35 in (≤ 88 cm)**	**> 40 in (>102 cm) > 35 in (> 88 cm)**
Underweight	< 18.5		----	----
Normal†	18.5 – 24.9		----	----
Overweight	25.0 – 29.9		Increased	High
Obesity	30.0 – 34.9	I	High	Very High
	35.0 – 39.9	II	Very High	Very High
Extreme Obesity	≥ 40.0	III	Extremely High	Extremely High

*Disease risk for type 2 diabetes mellitus, hypertension, and cardiovascular disease.
†Increased waist circumference can also be a marker for increased risk, even in persons of normal weight.
Adapted from National Heart, Lung, and Blood Institute. Clinical Guidelines on the Identification, Evaluation, and Treatment of overweight and Obesity in Adults: The Evidence Report. Bethesda, MD: National Institutes of Health. 1998.

Excess weight is independently associated with an increased mortality rate.[115] It is associated with other risks for excess mortality, specifically hypertension, hyperlipidemia and diabetes mellitus.[116] CAD is more prevalent in obese persons than non-obese persons. Male obese individuals are more likely to die of colorectal and prostatic cancers, whereas obese women have a greater risk of endometrial, cervical, ovarian, and breast cancers. Obesity is also associated with a variety of other medical disorders including degenerative joint disease, diseases of the digestive tract (cholelithiasis, reflux esophagitis), thromboembolic disorders, heart failure, respiratory impairment and skin disorders.[117] Approximately 280,000 deaths each year are attributable to "overnutrition," making it second only to smoking as a cause of death.[119]

Unfortunately, obesity is one of the most difficult and frustrating disorders to successfully manage. The clinician and patient must understand that obesity is a chronic medical condition that rarely is cured. A caloric deficit of 3,500 kilocalories is necessary to lose 1 pound of adipose tissue. Most experts recommend a loss of no more than 1 to 2 pounds per week.

Exercise, specifically aerobic training, is a key aspect to successful weight loss. A weight loss program must incorporate physical activity to increase caloric expenditure while intake is reduced in order to obtain the necessary caloric deficit. The amount of energy expended during most aerobic exercise for typical periods (200 to 300 kilocalories per session, five times a week) is modest, approximately 500 to 1,000 kilocalories consumed per week. This will probably have little effect on short-term weight loss.

The long-term impact of exercise for successful maintenance of weight loss is more clearly established. The cumulative effect of increased energy expenditure will cause long-term weight loss and maintenance of weight. If one expends 500 to 1,000 kilocalories per week for 52 weeks, approximately 7 to 15 pounds could be lost each year.

When establishing a weight-reduction program, exercise is an important component in aiding and sustaining weight loss. The mechanism for weight-reduction is through increased total energy expenditure, preservation of lean body mass, and changes in metabolism. The most recent ACSM guidelines suggest exercise programs conducted 3 times per week that expend 250 to 300 kilocalories per exercise session. This generally will require at least 30 to 45 minutes of exercise per session in an individual of average fitness. Expending 200 kilocalories per session also results

in weight reduction if the exercise is conducted at least 4 times per week. When structuring a weight-reduction program it is helpful to consider the guidelines suggested by the ACSM.[74]

1. Caloric intake **should not** be less than 1,200 kilocarlories/day for normal adults.
2. Include foods acceptable to the dieter.
3. Provide a negative caloric balance that results in a gradual weight loss.
4. The endurance exercise program should occur most days of the week for 20 to 60 minutes at an exercise intensity at least 65% maximum heart rate.
5. Include behavior modification techniques.
6. Insure that the suggested eating and physical activity habits can be continued for life.

Obesity must be conceptualized as a chronic illness, and the process of weight reduction and maintenance of loss requires lifelong care. The ability to lose fat and maintain a desirable body weight is not easy but can be attained through a firm commitment to a healthy lifestyle that incorporates physical activity.

VIII. Exercise in the Elderly

Evaluation of the 1990 census reveals that the average annual growth rate for the population over 65 years of age was twice that of the total population. In 1989, there were 25 million persons over age 65 in the United States, and it is expected that this figure will increase to almost 39 million in 2010 and more than 65 million by 2030 (20% of the population).[119] The fastest growing segment of the population is the group older than age 85 years, which has increased 24% during the past 10 years. Two-thirds of the population over 65 rate their health as good to excellent and 75% have no difficulties performing activities of daily living (ADLs). The secret to a long healthy life is a combination of inherited genetics, good fortune and living a healthy lifestyle. For the most part, the first two factors cannot be modified, however, the third lies in the hands of the individual.

Physical inactivity as stated previously is a risk factor for many medical conditions. Some of the physiologic changes seen in the elderly due to aging may in fact be more appropriately attributed to sedentary lifestyles. Functional changes associated with inactivity are reduced aerobic fitness, loss of postural reflexes, loss of muscle mass and calcium extraction. Rather than attributing much of the functional decline seen among the elderly, perhaps a more complex model should be considered. As people age there is a tendency toward a sedentary lifestyle. This results in deconditioning, fatigue and weakness. When the body is attacked by disease, disability or injury, one may see a greater tendency toward inactivity and further physical decline. As an individual continues to physically decline, there is a deterioration in the sense of wellness, resulting in poor self-esteem, anxiety, and depression. Individuals often lack motivation during this phase and a further reduction in physical activity ensues resulting in an irreversible cycle.

When discussing physical activity in the elderly, it is important to understand the physiologic changes associated with age. Lipsitz and Goldberger have described normal physiologic functions as the result of complex interactions of multiple control mechanisms that allow for the demands of daily existence.[119] Aging is marked by the progressive loss of these control mechanisms. This results in a loss of the normal dynamic range of physiologic function and a reduced capacity to adapt. Table 25 summarizes some of the functional changes attributed to aging.

Table 25

Functional Changes Associated with Age

Cardiovascular	
Decreased cardiac output	20-30% decline by age 65
Elevated systolic and diastolic blood pressure	10-40 mm Hg
Decreased maximum heart rate	10 beats/min/decade
Reduced hemoglobin, hematocrit and red cell mass	
Respiratory	
Decrease vital capacity	40-50% decline by age 70
Musculoskeletal	
Loss of muscle strength and mass	20% decline by age 65
Osteoporosis	1% loss per year after 35, 2-3% per year after menopause
Decreased elasticity and synovial fluid viscosity	
Height loss	Age 65-74, 1.5" loss; 85-94, 3.0" loss on average
Central Nervous System	
Reduced number of neurons	
Impaired motor response	
Decreased brain mass	

Adapted from Barry HC, Eathorne SW. Exercise and Aging. Med Clin N Am, 1994; 2: 357-376

The elderly can be stratified into 2 categories. The "apparently healthy" and "chronically ill" population. The apparently healthy individuals are those who have no significant limitations on physical activity and require no assistance performing functions beyond the activities of daily living. Prescribing exercise for this group poses no special consideration outside the aforementioned functional changes associated with aging. Prior to embarking on an exercise program, the patient's current level of fitness should be assessed. It may be necessary to administer a graded exercise test to fully evaluate stress tolerance.

The chronically ill elderly have increased medical conditions ranging from arthritis, cardiovascular disease, dementia and depression. They tend to heavily use the health care system, require more frequent hospitalizations and require more care within the home. Falls are the leading cause of fatal injury within this population.[120] Muscle weakness and impaired gait and balance are the most significant risk factors.

Special Populations

Prescribing exercise in chronically ill patients can be very challenging. Standard exercise programs may be exhausting, painful or literally impractical due to their physical limitations. These individuals often lack motivation and knowledge, thus show little interest in exercise.

Health Care Providers should educate patients in long-term medical benefits of exercise despite obvious medical limitations. The goal is to begin and maintain a low-intensity program that minimizes the risk and maximizes the benefits of adjuvant therapy.[121] There are many existing senior physical activity classes available through local YMCAs, Arthritis Foundations, community schools, or churches that can be beneficial to patients who are motivated to exercise. Generally speaking, the ill elderly are unlikely to initially participate in an aerobic program of moderate intensity. Physical activity with an emphasis on flexibility and strength may provide more benefit in improving the functional capacity in this group. General guidelines for exercise prescribing in chronically ill patients are listed below (Table 26).

Table 26

General Guidelines for the Exercise Prescription in Chronically Ill Patients

Evaluation

-Discuss benefits of exercise with patients (increased functional capacity, increased strength and endurance, and improved medical status)
-Review on-going medical conditions, medications and potential physical limitations
-Assess the need for formal exercise testing. Not all chronically ill patients require exercise testing since most patients are rarely fit enough to undergo the intensity of testing required to produce an adequate rate-pressure-product.
-Educate patients on warning symptoms and risk of exercise based on their medical condition
-Assess the need for exercise aids

Component of Training

-Exercise daily if not fatigued
-Adequate warm-up for minimum of 3 minutes
-Initiate exercise at a target heart rate of no more than 20 beats per minute over resting heart rate, or at normal walking pace (if intensity effort improves, it may then be reasonable to consider exercise stress testing)
-Mode of activity should include walking or equivalent aerobic activity (will be based on physical limitations) to include resistance training and stretching exercises as tolerated
-Accumulate 20 to 30 minutes of exercise daily in one or several sessions
-Progression should be gradual

Injury Prevention

-Include warm-up and cool-down periods
-Low intensity activity
-Adequate hydration
-Appropriate clothing and footwear
-Encourage safer modes of aerobic activity (walking-with or without walker, stationary bicycle)
-Inform patient on injury prevention (proper biomechanics)
-Consider home health visit to assess hazards in the home

Compliance

-Set realistic goals
-Reassess every 1-2 months initially then every 3 months thereafter
-Praise compliance and instill motivation

Adapted from Lampman RM. Exercise prescription for chronically ill patients. Am Fam Physician 1997; 55: 2185-2192.

An area that will require clinical judgment is the use of stress testing in chronically ill patients. In general, these individuals are rarely fit enough to undergo the rigors of stress testing. The level of intensity required for stress testing usually exceeds the patient's exercise capability. As a result, exercise stress testing is often impractical and not cost-effective.[121] If a patient's medical history is known and current medical conditions are stable, it is reasonable to initiate an exercise prescription of low-intensity without stress testing. If a patient has been exercising without difficulty for several months and desires to increase their intensity, it may be appropriate to consider stress testing.[122]

Special Populations

Improved quality of life should be the ultimate goal in recommending an exercise routine. Enjoyment and socialization are key components to a successful program. Compliance with an exercise program increases as the activity is shared with others. The social interaction provides mental and intellectual stimulation that enables individuals to remain motivated in fulfilling exercise requirements.

Another key element for elderly patient is limited financial resources. The majority of older patients are on fixed income and have minimal financial reserve for recreational expenses. Patients with specific rehabilitation requirements may be eligible for Medicare reimbursement for therapeutic exercise programs. By large, those individuals who are still ambulatory, walking is the single most important form of physical activity.

Safety is of primary importance for all exercising individuals, but the elderly present some unique challenges. They are at increased risk for falls due to decreased sensory abilities (e.g., proprioception, sight, hearing, balance), muscle weakness and gait disturbances. Exercise should be performed on even surfaces with adequate footwear and appropriate lighting.

The elderly are also more susceptible to cold injuries because of decreased ability to perceive ambient air temperatures. This may be related to loss of subcutaneous fat, peripheral vascular disease, vasoconstriction, autonomic dysfunction or effects of certain medications. Patient education on appropriate dress such as layered clothing is recommended.

An exercise program should initially focus on improving flexibility. For some patients, especially those with severe medical limitations, this may be the entire focus of the exercise program. For those who are more ambulatory, exercise intensity should be advanced slowly to allow for physiological adaptation.

Special Populations

The elderly patient has much to gain by participating in a program of total physical activity in an enjoyable atmosphere with others who have similar interests. Through exercise, the older individual will feel healthier and younger. Functional state, mobility, cardiovascular fitness and outlook are bound to improve. Aging not only means degeneration, but also adaptation. Regular exercise and training are an essential component in slowing premature aging.

IX. Army Personnel

The United States Army has always maintained high standards regarding physical fitness. The logo "fit to fight" attests to this standard. All soldiers who are not on profile are required to take the Army Physical Fitness Test (APFT) two times a year. For some, these two days can induce a significant amount of anxiety. Failing this test can result in unfavorable action, loss of promotion and eventual removal from the Army.

For many, the performance requirements have become more difficult with the new APFT standards.[123] More will be required of soldiers to pass this test. Additionally, many units are setting higher standards and goals for their soldiers' physical readiness. The ability to improve one's score will require consistent physical fitness sessions and the desire to go the extra mile. The rewards for doing well on the APFT include not only health and fitness benefits but also better evaluation reports and early promotions.

The question that is so often asked is "How can I improve my APFT score?" While this question sounds simplistic it bears further investigation. Telling a soldier to train harder or longer is inadequate. Improper training and lack of formal instruction can result in inefficient training and/or injury.

Three components represent the APFT; sit-up event, push-up event and the two-mile run. Each event has a maximum of 100 possible points. Minimum passing score per event is 60 points. All three events must be performed to standard (60 points) to score a pass on the APFT.[124]

To perform well individuals must first analyze strengths and weaknesses for each component of the APFT. One must develop an effective training program to allow proper conditioning. It is important to emphasize that planning for the APFT requires **TIME**. It is unrealistic to train two weeks before the APFT and expect maximum performance.

Special Populations

In order to improve a particular event, physical training must focus on specific muscle groups. Push-ups are designed to assess upper body strength. Sit-ups assess abdominal muscles and hip flexors. Lastly, the two-mile run assesses cardiovascular fitness and endurance. A sample training schedule is outlined in the reference/resource section. Following these simple guidelines will improve APFT scores (Ref-13).

Most importantly, individuals must plan ahead when preparing for the APFT. Two to three months should be reserved to prepare for the APFT. Three weeks before the test, soldiers should train at the testing site at least once per week and self-administer a diagnostic APFT. Two days before the APFT, soldiers should be instructed to avoid muscle overuse – stop training and relax. On test day, individuals should eat a light meal prior to testing and conduct a thorough warm-up session. During the push-up and sit-up events, soldiers should be instructed to maintain a steady pace to avoid muscle fatigue. When approaching muscle fatigue, pausing for several seconds in the authorized rest position should be encouraged, with a subsequent return to complete more repetitions. During the run, soldiers are encouraged to maintain a steady pace to prevent fading at the end. When running, individuals should plan to increase their pace during the final quarter-mile.

The secret to performing well lies in hard work, motivation, mental toughness and determination. Encourage soldiers to set goals to perform well on the APFT. The rewards are improved physical fitness, heightened unit morale and improved performance evaluations.

CONCLUSION

As one can see, exercise and physical activity can have a tremendous impact on health and cardiorespiratory fitness. As referenced by numerous organizations, exercise should become a lifestyle of every American, regardless of their health status. It remains the responsibility of HCPs to offer exercise to all their patients.

As HCPs become more comfortable prescribing exercise and reimbursement for preventive services improve, the conscience of the American public will be heightened. Effective counseling and motivation will enable the objectives set forth by Healthy People 2000 become a reality. This paper has been specifically designed to assist health care providers in prescribing appropriate exercise. A user friendly and efficient approach has been utilized to assist provider to assess an individual's desire to exercise through the use of a questionnaire. The exercise assessment form can be distributed and completed in the patient waiting area and given to the HCP during the patient encounter. If an individual chooses to exercise, several handouts are provided in the resource and reference section to assist patients in pursuing safe and fun exercise. Evidence based medicine has clearly demonstrated that "fit" individuals live better and healthier lives. Few medical prescriptions can make a similar claim.

Glossary

Aerobic training – training that improves the efficiency of the aerobic energy-producing systems and that can improve cardiorespiratory fitness.[19]

Anaerobic training – training that improves the efficiency of the anaerobic energy-producing systems and that can increase muscular strength and tolerance for acid-base imbalances during high-intensity effort.[19]

Body composition – a health-related component of physical fitness that relates to the relative amounts of muscle, fat, bone, and other vital parts of the body.[19]

Body Mass Index (BMI) – an index utilized to measure the degree of body fat. Defined as weight in kilograms divided by the square of height in meters.

Endurance – the body's ability to withstand and endure stress under conditions of increased physical activity.

Exercise – a planned, structured and repetitive body movement designed to improve physical fitness.[19]

Exercise prescription – the ability to recommend a particular quantity of physical activity required to achieve specific therapeutic goals such as health benefits or improved cardiorespiratory fitness.

Flexibility training – a health related component of physical fitness that relates to improving range of motion of a particular joint.

Graded Exercise Test (GXT) – a clinical assessment tool used to determine cardiorespiratory fitness, exercise capacity and diagnose coronary artery disease. It is a test that provides clinical, hemodynamic and electrocardiographic information in a noninvasive, safe, controlled manner.

Glossary

Health – a state of optimal physical, mental and social well-being and not merely the absence of disease.[19]

Intensity – a measure of cardiovascular conditioning that can be measured utilizing maximum heart rates or ratings of perceived exertion.

Isometric exercise – muscle contraction against a resistance so there is no effective joint movement. Resistance can be adjusted by changing the force of the muscle being contracted.[85]

Isostatic exercise – muscle contractions against a fixed speed of movement in which the resistance not only varies but accommodates though the range of motion according to the input ability of the musculoskeletal lever system.[85]

Isotonic exercise – muscle contractions performed against a constant resistance with a concentric (shortening contraction) and eccentric (lengthening contraction) phase. Resistance can be applied with ankle weights, free weights, elastic bands or the individuals body weight.[85]

Kilocalorie – amount of heat energy required to raise the temperature of one kilogram of water one degree Celsius. Used to indicate the value of food in production of heat and energy.

Physical activity – bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above basal levels.[19]

Physical fitness – set of attributes that people have or achieve that relates to the ability to perform physical activity. The components of physical fitness include cardiorespiratory endurance, skeletal muscle endurance, speed, flexibility and body composition.[19]

Relative perceived exertion (RPE) – a person's subjective assessment of how hard he or she is working. the Borg scale is a numerical scale for rating perceived exertion.

Glossary

Resistance training – training designed to increase strength, power and muscle endurance.

Sedentary – performing minimal physical activity or exercise.

Sensitivity – the percentage of times a test correctly identifies individuals with the disease.

Specificity – the percentage of times a test correctly identifies individuals without the disease.

Strength training – the use of resistance to increase one's ability to exert or resist force.

Exercise-Related Sudden death – an instantaneous fatal cardiorespiratory event occurring during or immediately following exercise.

VO_2max – reflects the maximal ability of the body to *take in*, *transport* and *use oxygen*. It is the gold standard to measure cardiorespiratory fitness. Commonly measured or estimated utilizing treadmill or cycle ergometer exercise testing.[63]

APPENDICES

Appendices

Appendices

Appendix A

Exercise Assessment Form

Primary Care Sports Medicine
Uniformed Services University

NAME:_____ **DATE:**____/____/____
SSN: _____ **AGE:**_____

I. PACE SCORE

Project PACE (**P**hysician-based **A**ssessment and **C**ounseling for **E**xercise) is designed to encourage patients to engage in appropriate levels of physical activity. The PACE score will assist your doctor in determining your current physical fitness habits and interests. Choose the number that best describes your current level of physical activity or your interest in physical activity. Do **not** include activities that you do as part of your occupation. Examples of "vigorous" and "moderate" exercise activities are shown below.

"Vigorous" exercise includes activities like jogging, running, fast cycling, aerobics classes, swimming laps, and racquet sports. Any activity that makes you work as hard as jogging and lasts 20 minutes at a time should be counted. These types of activities usually increase your heart rate, and make you sweat, and get you out of breath. (Do not count weight lifting)
"Moderate" exercise includes activities like brisk walking, gardening, slow cycling, dancing, doubles tennis, or hard work around the house. Any activity that makes you work hard as brisk walking and that lasts at least 30 minutes at a time should be counted.

Current Physical Activity Status

Circle One
Number Only

1. I do not exercise or walk regularly now, and I do not intend to start in the near future.
2. I do not exercise or walk regularly, but I have been thinking of starting.
3. I am trying to start to exercise or walk. (or) During the last month I have started to exercise or walk on occasion (or on weekends only).
4. I have exercised or walked infrequently (or on weekends only) for over one month.
5. I am doing vigorous or moderate exercise, less than 3 times per week (or moderate exercise less than 2 hours per week).
6. I have been doing moderate exercise, 3 or more times per week (or more than 2 hours per week) for the last 1 to 6 months.
7. I have been doing moderate exercise, 3 or more times per week (or more than 2 hours per week) for 7 months or more.
8. I have been doing vigorous exercises, 3 to 5 times per week for 1 to 6 months.
9. I have been doing vigorous exercises, 3 to 5 times per week for 7 to 12 months.
10. I have been doing vigorous exercises, 3 to 5 times per week for 7 to 12 months.
11. I do vigorous exercises 6 or more times per week.

II. CARDIOVASCULAR RISK ASSESSMENT

1. Do you have diagnosed cardiovascular disease? (Circle all that apply)
    - Hypertension
    - Angina and or a history of myocardial infarction (heart attack)
    - History of a cerebrovascular event (stroke)

2. Do you have any of the following? (Circle all that apply)
    - Hyperlipidemia
    - Smoking history
    - Diabetes mellitus
    - Family history of heart disease

3. Do you have any of the following symptoms? (Circle all that apply)
    - Chest pain brought on by activity
    - Unaccustomed shortness of breath brought on by mild exertion
    - Dizziness or syncope (passing out)
    - Extra heart beats or racing heart

III. PERFORMANCE GOALS

Circle One
Number Only

1. I'm not interested in discussing an exercise program at this time.
2. I'm interested in activities for the sedentary individual.
3. I'm interested in moderate activities to improve my health and fitness.
4. I'm interested in pursuing vigorous activities.
5. I'm interested in beginning a weight training program.

IV. PHYSICIAN ASSESSMENT

1. **PACE** Score_____
    - Precontemplator (Score 1)
    - Contemplator (Score 2 – 5)
    - Active (Score 6 – 11)
2. Cardiovascular Assessment: (Figure 2)
    - High Risk
    - Low Risk
3. Performance Goals:
    - Moderate
    - Vigorous

4. Exercise Stress Test Requirement:_____

5. Patient Handout Issued:_____

6. Schedule Follow-up Appointment:_____

PHYSICIAN:_____

Appendix B

Treatment of The National Cholesterol Education Program (NCEP) Expert Panel Guidelines for Diagnosis and High Blood Cholesterol

LDL Cholesterol Goals and Cutpoints for Therapeutic Lifestyle Changes (TLC) and Drug Therapy in Different Risk Categories

Risk Category	LDL* Goal (mg/dL)	LDL Level at Which to Initiate TLC (mg/dL)	LDL Level at Which to Consider Drug Therapy (mg/dL)
CHD† or CHD Risk Equivalents (10 year risk > 20%)	<100	≥100	≥130 (100 – 129: drug optional)
2 + Risk Factors (10 year risk ≤20%)	<130	≥130	10 year risk 10 – 20%: ≥130 10 year risk <10%: ≥160
0 –1 Risk Factors	<160	≥160	≥190 (160 – 189: LDL lowering drug optional)

* LDL indicates low-density lipoproteins.
† CHD indicates coronary heart disease.

Major Risk Factors (Exclusive of LDL Cholesterol) That Modify LDL Goals*

- Cigarette smoking
- Hypertension (BP ≥140/90 mm Hg or on anti-hypertensive medications)
- Low HDL cholesterol (≤40 mg/dL)†
- Family history of premature CHD (CHD in male first degree relative <55 years; CHD in female first degree relative <65 years)
- Age (men ≥45 years; women ≥ years)

* In ATP III, diabetes in regarded as a CHD risk equivalent.
† HDL cholesterol ≥60 mg/dL counts as a "negative" risk factor; its presence removes one risk factor from the total count.

Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment or High Blood Cholesterol in Adult (ATPIII) can be obtained at http://www.nhlbi.nih.gov/about/ncep/index.htm.

Appendices

Appendix C

Effects of Medication on Heart Rate, Blood Pressure, and Exercise Capacity

Courtesy from Project PACE Physician Manual

Medications	Heart Rate		Blood Pressure	Exercise Capacity
	Rest	Exercise	Rest(R) & Exercise(E)	
Beta blockers (including labetolol)	⇓	⇓	⇓	⇑ in patients with angina; ⇓ or ⇔ in patients w/o angina
Nitrates	⇑	⇑	⇑	⇑ in patients with angina; ⇔ in patients w/o angina; ⇑ or ⇔ in patients with CHF
Calcium channel blockers Nifedipine Dilitiazem Verapamil	⇑ ⇓ ⇓	⇑ ⇓ ⇓	⇓ ⇓ ⇓	⇑ in patients with angina ⇔ in patients w/o angina
Diuretics	⇔	⇔	⇔ or ⇓	⇔ except possibly in patients with CHF
Vasodilators Nonadrenergic vasodilators Adrenergic blockers Antiadrenergic agents without blockade of peripheral receptors	⇑ or ⇔ ⇔ ⇑ or ⇔	⇑ or ⇔ ⇔ ⇑ or ⇔	⇓ ⇓ ⇓	⇔ except ⇑ or ⇔ in patients with CHF ⇔ ⇔
Bronchodilators Methylxanthines Sympathomimetic agents Cromolyn Sodium Corticosteroids	⇑ or ⇔ ⇑ or ⇔ ⇔ ⇔	⇑ or ⇔ ⇑ or ⇔ ⇔ ⇔	⇔ ⇑ or ⇔ ⇔ ⇔	Bronchodilators ⇑ exercise capacity in patients with limited bronchospasm
Hyperlipidemic agents	Clofibrate may provoke arrhythmias, angina in patients with prior myocardial infarction; Dextrothyroxine may ⇑ HR and BP at rest and during exercise, provoke arrhythmias, and worsen myocardial ischemia and angina; Nicotinic acid may ⇓ BP; Probucol may cause QT interval prolongation; All other hyperlipidemic agents have no effect on HR and BP.			
Nicotine	⇑ or ⇔	⇑ or ⇔	⇑	⇔ except ⇓ or ⇔ in patients with angina
Antihistamines	⇔	⇔	⇔	⇔
Cold medicine with Sympathomimetic agents	Effects similar to those described in Sympathomimetic agents, Although magnitude is usually diminished.			⇔
Thyroid medication Levothyroxine only	⇑	⇑	⇑	⇔ unless angina worsens
Alcohol	⇔	⇔	Chronic use may ⇑ BP	⇔
Hypoglycemic agents Insulin and oral agents	⇔	⇔	⇔	⇔

Appendices

Appendix D

Cardiovascular Exercise Prescription

NAME:_____ **DATE:**____/____/____
SSN:_____ **AGE:**_____

I. Mode of Activity: ☐ Running ☐ Aerobics ☐ Rowing ☐ Walking ☐ Cycling ☐ Swimming ☐ Racquet Sports ☐ _____

II. Duration: ☐ 20 minutes ☐ 40 minutes ☐ ____ minutes

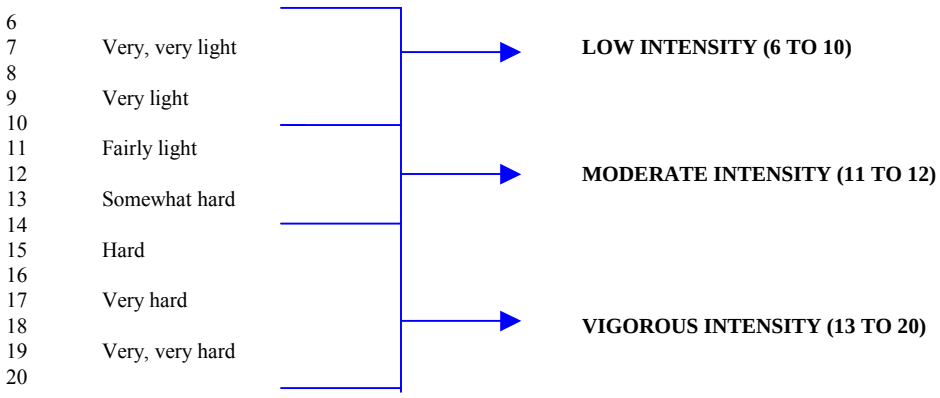
III. Frequency: _____ times per week

IV. Intensity: ☐ low ☐ moderate ☐ vigorous

Low Intensity Exercise: 20 – 40 % VO_2 max or heart rate reserve (HRR)
Moderate Intensity Exercise: 40 – 60% VO_2 max or HRR (Borg 11 = 60% HRR)
Vigorous Intensity Exercise: >60% VO_2 max or HRR (Borg 13 = 80% HRR)

A. Estimate your own maximal heart rate (Max HR). Women use 220 minus age (220-age), men use 205 minus one-half their age (205 – ½ age).
   MAX HR: ____ – ____ = ____ BPM
B. Determine your resting heart rate (RHR) = ____BPM
C. Heart Rate Reserve (HRR) = MAX HR – RHR
   HRR: ____ – ____ = ____BPM
D. Training Intensities (TI) = HRR x TI% + RHR
   Lower limit TI: ____ x ____% + ____ = ____ BPM
   Upper limit TI: ____ x ____% + ____ = ____ BPM
E. **Cardiovascular Training Zone:** Exercise to maintain heart rate between _____ and _____BPM.

Borg Relative Perceived Exertion Scale



V. Progression

☐ Initial Conditioning Phase
Duration – 4 to 6 weeks
Goal is to increase frequency

☐ Improvement Conditioning Phase
Duration – 4 to 6 months
Goal is to increase duration and intensity

☐ Maintenance Conditioning Phase
Occurs after 6 months of regular exercise
Goal is to maintain cardiorespiratoy fitness

VI. Special Considerations

☐ Coronary heart disease

_____

☐ Diabetes Mellitus

_____

☐ Osteoarthritis

_____

☐ Pregnancy

_____

☐ Asthma

_____

☐ Pulmonary Disease

_____

☐ Obesity

_____

☐ Elderly/Chronically Ill

_____

☐ Army Personnel

_____

☐ Other

_____

VII. Follow-up Appointment: _____

Physician: _____

Appendix E

Beginner's Program Phase 1

Adapted from "A Physician's Guide To Heart Rate Training" by Francene M Fleegler, MD and Edward M Fleegler, MD

	Day	Training Effort	Duration	Comments
Week 1	Sunday	Rest		
	Monday	60 – 70%	20 – 30 minutes	
	Tuesday	Rest		
	Wednesday	60 – 70%	20 – 30 minutes	
	Thursday	Rest		
	Friday	60 – 70%	20 – 30 minutes	
	Saturday	Rest		
Week 2	Sunday	Rest		
	Monday	60 – 70%	20 – 30 minutes	
	Tuesday	Rest		
	Wednesday	60 – 70%	20 – 30 minutes	
	Thursday	Rest		
	Friday	60 – 70%	20 – 30 minutes	
	Saturday	Rest		
Week 3	Sunday	Rest		
	Monday	60 – 70%	20 – 30 minutes	
	Tuesday	Rest		
	Wednesday	60 – 70%	20 – 30 minutes	
	Thursday	Rest		
	Friday	60 – 70%	20 – 30 minutes	
	Saturday	Rest		

Appendices

Beginner's Program Phase 2

Adapted from "A Physician's Guide To Heart Rate Training" by Francene M Fleegler, MD and Edward M Fleegler, MD

	Day	Training Effort	Duration	Comments
Week 4	Sunday	Rest		
	Monday	60 – 70%	25 – 40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 – 75%	25 – 40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	25 – 40 minutes	
	Saturday	Rest		
Week 5	Sunday	Rest		
	Monday	60 – 70%	25 – 40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 - 75%	25 – 40 minutes	
	Thursday	Rest		
	Friday	65 – 75%	25 – 40 minutes	
	Saturday	Rest		
Week 6	Sunday	Establish benchmark this week: 30 minutes at 70%		Distance covered:
	Monday	60 – 70%	25 – 40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 - 75%	25 – 40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	25 – 40 minutes	
	Saturday	Rest		
Week 7	Sunday	Rest		
	Monday	60 – 70%	25 – 40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 - 75%	25 – 40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	25 – 40 minutes	
	Saturday	Rest		

Appendices

Beginner's Program Phase 3

Adapted from "A Physician's Guide To Heart Rate Training" by Francene M Fleegler, MD and Edward M Fleegler, MD

	Day	Training Effort	Duration	Comments
Week 8	Sunday	Rest		Enter race for 12th week
	Monday	60 – 70%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 - 75%	40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	40 minutes	
	Saturday	10/20/10 60 - 75%/85%/60 - 75%	40 minutes	
Week 9	Sunday	Rest		
	Monday	60 – 70%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 - 75%	40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	40 minutes	
	Saturday	10/20/10 60 - 75%/75 - 80%/60 - 75%	40 minutes	
Week 10	Sunday	Rest		
	Monday	60%	40 minutes	
	Tuesday	Rest		
	Wednesday	75%	40 minutes	
	Thursday	Rest		
	Friday	60%	40 minutes	
	Saturday	75%	40 minutes	
Week 11	Sunday	Rest		
	Monday	60 – 70%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 - 75%	40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	40 minutes	
	Saturday	10/20/10 60 - 75%/75 - 80%/60 - 75%	40 minutes	
Week 12	Sunday	Rest		
	Monday	60 – 70%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 60 - 75%/75 - 80%/60 – 75%	40 minutes	
	Thursday	Rest		
	Friday	60 – 70%	40 minutes	
	Saturday	Race!		

Appendices

Appendix F

Intermediate Program Phase 1

Adapted from "A Physician's Guide To Heart Rate Training" by Francene M Fleegler, MD and Edward M Fleegler, MD

	Day	Training Effort	Duration	Comments
Week 1	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	75%	40 minutes	
	Thursday	Rest		
	Friday	10/20/10 75%/85%/75%	40 minutes	
	Saturday	75%	40 minutes	
Week 2	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	75%	40 minutes	
	Thursday	Rest		
	Friday	10/20/10 75%/85%/75%	40 minutes	
	Saturday	75%	40 minutes	
Week 3	Sunday	Rest		
	Monday	65%	40 minutes	
	Tuesday	Rest		
	Wednesday	65%	40 minutes	
	Thursday	Rest		
	Friday	80%	40 minutes	
	Saturday	65%		
Week 4	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	75%	40 minutes	
	Thursday	Rest		
	Friday	10/20/10 75%/85%/75%	40 minutes	
	Saturday	75%	40 minutes	
Week 5	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	75%	40 minutes	
	Thursday	Rest		
	Friday	10/20/10 75%/85%/75%	40 minutes	
	Saturday	75%	40 minutes	

Appendices

Intermediate Program Phase 2

Adapted from "A Physician's Guide To Heart Rate Training" by Francene M Fleegler, MD and Edward M Fleegler, MD

	Day	Training Effort	Duration	Comments
Week 6	Sunday	Rest		Enter race for 9th week
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 75%/85%/75%	40 minutes	
	Thursday	Rest		
	Friday	75%	40 minutes	
	Saturday	70 – 80%	50 minutes	
Week 7	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 75%/85%/75%	40 minutes	
	Thursday	Rest		
	Friday	75%	40 minutes	
	Saturday	70 – 80%	50 minutes	
Week 8	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 75%/85%/75%	40 minutes	
	Thursday	Rest		
	Friday	75%	40 minutes	
	Saturday	70 – 80%	50 minutes	
Week 9	Sunday	Rest		
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 75%/85%/75%	40 minutes	
	Thursday	Rest		
	Friday	75%	40 minutes	
	Saturday	Race		
Week 10	Sunday	Benchmark for this week: 30 minutes at 75%		Distance covered:
	Monday	75%	40 minutes	
	Tuesday	Rest		
	Wednesday	10/20/10 75%/85%/75%	40 minutes	
	Thursday	Rest		
	Friday	75%	40 minutes	
	Saturday	75%	50 minutes	

Intermediate Program Phase 3

Adapted from "A Physician's Guide To Heart Rate Training" by Francene M Fleegler, MD and Edward M Fleegler, MD

	Day	Training Effort	Duration	Comments
Week 11	Sunday	75%	45 minutes	
	Monday	10/20/10 75%/85%/75%	40 minutes	
	Tuesday	Rest		
	Wednesday	75%	45 minutes	
	Thursday	75%	50 minutes	
	Friday	75%	45 minutes	
	Saturday	Rest		
Week 12	Sunday	75%	45 minutes	
	Monday	10/20/10 75%/85%/75%	40 - 45 minutes	
	Tuesday	Rest		
	Wednesday	75%	45 minutes	
	Thursday	75%	55 minutes	
	Friday	75%	45 minutes	
	Saturday	Rest		
Week 13	Sunday	75%	45 minutes	
	Monday	10/20/10 75%/85%/75%	40 - 45 minutes	
	Tuesday	Rest		
	Wednesday	75%	45 minutes	
	Thursday	75%	55 minutes	
	Friday	75%	45 minutes	
	Saturday	Rest		
Week 14	Sunday	75%	45 minutes	
	Monday	10/20/10 75%/85%/75%	40 - 45 minutes	
	Tuesday	Rest		
	Wednesday	75%	45 minutes	
	Thursday	75%	55 minutes	
	Friday	75%	45 minutes	
	Saturday	Rest		
Week 15	Sunday	75%	45 minutes	
	Monday	10/20/10 75%/85%/75%	40 - 45 minutes	
	Tuesday	Rest		
	Wednesday	75%	45 minutes	
	Thursday	75%	55 minutes	
	Friday	75%	45 minutes	
	Saturday	Rest		

Appendices

Appendix G

Body Mass Index Table

Calculations of body mass index (BMI) is recommended as a means of assessing body fat.* Persons with a BMI of 18.5 to 24.9 are considered to be of normal weight. Those with a BMI of 25.0 to 29.9 are overweight. Patients with a BMI of 30.0 to 34.9 or 35.0 to 39.9 are in obesity class I or II, respectively; and those with a BMI of 40 and over are considered extremely obese (obesity class III).

BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Height (inches)	Body Weight (Pounds)																	
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295

BMI	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
58	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	257	264	271	278	285	292	299	306	313	320	327	334	341	348	355	362	369	376
71	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	295	303	311	319	327	335	343	351	359	367	375	383	391	399	407	415	423	431
76	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

*National Heart, Lung, and Blood Institute. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report. Bethesda, MD: National Institutes of Health; 1998.

RESOURCES/REFERENCES

Individual Guidelines for Cardiovascular Exercise

1. Exercise only when feeling well. It is advisable to postpone exercise for 2 days after signs and symptoms of a cold or flu (including fever) have been absent.

2. Do not exercise vigorously soon after eating. It is best to wait 2 hours or more before resuming activity. During exercise, the demand for blood may exceed the ability of the circulation to supply both the bowel and the muscles, resulting in cramps, nausea or faintness.

3. Adjust exercise to weather. Exercise should be adjusted to environmental conditions. During hot weather conditions it may be necessary to lower work intensity. A good rule of thumb is to work-out at the usual rating of perceived exertion, 12 to 16, which may be of lower intensity due to environmental conditions. If acclimatizing to new conditions allow 12 to 14 days to accommodate to higher temperatures. Exercise is best tolerated in low humidity weather and a breeze present. Be alert for heat injuries and drink adequate fluid to maintain hydration.

4. Slow down for hills. When ascending hills, decrease speed to avoid overexertion. A useful tool is to maintain the same rating of perceived exertion as in a usual workout.

5. Wear proper clothing and shoes. Dress in loose-fitting, comfortable clothes made of porous material appropriate for the weather. In direct sunlight, wear light-colored clothing and a cap. Wear shoes specifically designed for the type of activity being performed.

6. Understand personal limitations. When under the guidance of a physician's care, ask if there are limitations. Activities should never exceed set ratings of perceived exertion or target heart rates.

7. Select appropriate exercises. Cardiovascular (aerobic) exercises should be a major component of activities. For a well-rounded program, flexibility and strengthening exercises should be included.

8. Be alert for symptoms. If any symptoms occur during exercise, contact a physician immediately. Specific symptoms are:

   A. Discomfort in the upper body such as burning, aching, tightness or sensation of fullness.

   B. Faintness accompanying exercise. Brief light-headedness may follow unusually vigorous exercise. This condition does not usually indicate heart disease and may be managed by exercising at a lower intensity. If "fainting spells" or feelings or faintness develop during exercise, discontinue the activity until after evaluation by a physician.

   C. Shortness of breath during exercise. During exercise the rate and depth of breathing should increase but should not be uncomfortable. Breathing should not be so difficult that an ordinary conversation is an effort, wheezing develops, or more than 5 minutes are required for recovery.
   D. Discomfort in bones and joints either during or after exercise. Mild muscle soreness may develop when beginning exercise, however, if joint and back pain develop, consult a physician.

9. Watch for the following signs of overexertion:

   A. Inability to finish. Training sessions should be completed with reserve.

   B. Inability to converse during exercise.

   C. Faintness or nausea after exercise. A feeling of faintness after exercise may occur if the activity has been stopped too abruptly. Decrease the intensity of the workout and prolong the cool-down period.

   D. Chronic fatigue. During the remainder of the day after exercise, an individual should feel stimulated, not tired. If fatigue persist during the day, intensity and/or duration of the workout should be decreased.

   E. Sleeplessness. If unable to sleep well despite feelings of fatigue, the amount of activity should be decreased until symptoms subside. A proper training program should make it easier, not more difficult, to have good night's rest.

   F. Aches and pains in the joints. Mild muscle soreness may accompany exercise, however joint should not hurt or feel stiff. Check exercise procedure, particularly, stretching and warm-up exercises, to ensure correct technique. If symptoms persist, check with a physician before continuing.

10. Start slowly and progress gradually. Intensity and duration may be increased every 4 to 6 weeks.

Adapted from American Heart Association. Exercise Standards: A statement for Healthcare Professionals. Circulation 1995; 91: 580-615.

Exercise Guidelines for Patients with Diabetes Mellitus

1. Exercise only when feeling well. It is advisable to postpone exercise for 2 days after signs and symptoms of a cold or flu (including fever) have been absent.

2. Generally, it is best to exercise with a friend who is aware of your diabetes.

3. Become familiar with specific blood glucose patterns in connection with different activities. Exercise should be started after a stable relationship has been established between food intake and insulin and/or medications.

4. Know the symptoms of too much and too little glucose in your blood.
   - ⇒Low blood glucose – lightheadedness, rapid heart beat, sweating
   - ⇒High blood glucose – frequent urination, vision difficulty, increase appetite and thirst, weight loss

5. Before Exercise
   - ⇒Estimate intensity, duration, and energy expenditure of exercise.
   - ⇒30 to 45 minutes of exercise is safe when diabetes is under good control.
   - ⇒Good control is defined as blood sugar between 90 to 140 mg/dl.
   - ⇒Eat a meal 1 to 3 hours before exercise.
   - ⇒Insulin:
     - -Administer insulin more than one hour before exercise
     - -Administer insulin in abdomen and avoid extremity injection
     - -Decrease insulin that has peak activity coinciding with exercise period (may not be required during short workouts)
   - ⇒Monitor blood glucose:
   - -If blood glucose <100 mg/dl, take supplemental pre-exercise snack
   - -If blood glucose >250 mg/dl or urine ketones positive, delay exercise

6. During Exercise
   - ⇒Supplemental calories with carbohydrate feeding (hard candies, candy bars, or juice) every 30 minutes during extended, strenuous exercise.
   - ⇒Drink plenty of fluid.
   - ⇒Monitor blood glucose intermittently when engaging in prolonged exercise.

7. After Exercise
   - ⇒Monitor blood glucose, especially if exercise is not consistent.
   - ⇒Increase caloric intake for 12 to 24 hours after exercise.
   - ⇒Be aware of post-exercise symptoms of too much/little blood glucose.
   - ⇒Reduce insulin, which peaks in the evening or night of exercise (may not be required during short workouts).

8. You are advised to wear shoes and socks at all times to avoid trauma to the feet. Inspect your feet on a regular basis for blister, corns, bunions or any other abnormalities.

9. If you have diabetic retinopathy, avoid activities such as contact sports, heavy weight training or inverted hanging to minimize the risk of eye complications.

10. Consult your physician if any symptoms develop during/after exercise. Notify your physician when changing your exercise routine.

Exercise Guidelines for Pregnancy and the Postpartum Period

1. In the absence of obstetric or medical complications, it is safe for you to engage in moderate levels of physical activity. Your physician will review your medical health and previous pregnancies prior to recommending exercise.

2. Exercise only when feeling well. It is advisable to delay exercise when recovering from an illness or when experiencing episodes or lightheadedness, nausea, or vomiting.

3. The frequency and duration of exercise should be similar to your pre-pregnancy state. As your pregnancy progresses you may find it more difficult to maintain previous fitness levels and should adjust your routine according to your abilities. The recommendation is to exercise 20 to 60 minutes at a minimum of 3 days per week. Strenuous exercise should not exceed 15 minutes.

4. Acceptable aerobic activities are walking, light jogging, swimming, stationary bicycles, low-impact aerobics, low intensity racquet sports, and water exercises.

5. Avoid high impact activities such as running, contact sports, or competitive racquet sports. Activities that may cause abdominal trauma such as horse back riding and diving are not recommended. Do not engage in activities in which loss of balance could be detrimental to you or your baby.

6. Avoid exercises that require prolonged time on your back, specifically, after your first trimester. The weight of your growing baby compresses the large vessels in you abdomen preventing blood return to the heart. As result you may feel faint or lightheaded.

7. Maintain an appropriate diet. Pregnancy requires an additional 300 calories per day. When exercising this requirement will be higher.

8. When exercising ensure adequate hydration, appropriate clothing, and optimal environmental conditions. Particularly, avoid activities such as hot tubs, saunas, or prolonged exercise that may elevate your body temperature.

9. Stop exercising and contact your physician if you develop chest pain, extreme shortness of breath, abdominal pain/cramping/contractions or vaginal bleeding.

10. Acceptable guidelines are to resume exercise 1 week after vaginal delivery and 6 to 10 weeks following a cesarean-section. Pre-pregnancy exercise routines should be resumed gradually, based on your physical capabilities.

11. Conditions in which exercise is not recommended are: pregnancy induced hypertension, pre-term rupture of membrane, history of pre-term labor, persistent vaginal bleeding and fetal growth delay.

Weight Training Guidelines for Healthy Adults and "Low-Risk"* Cardiac Patients

1. To prevent soreness and injury, initially choose a weight that will allow the performance of 10 to 15 repetitions comfortably, corresponding to approximately 50% to 60% of the maximal weight load that can be lifted in one repetition. Adults with major coronary risk factors and "low-risk" cardiac patients should select an initial weight load that can be lifted for 12 to 15 repetitions.

2. Perform one set of 8 to 12 exercises that condition major muscle groups 2 to 3 times per week. Individuals under 50 years if age should complete 8 to 12 repetitions of each exercise and persons 50 years and older, 10 to 15 repetitions or until your muscles are fatigued.

3. Don't strain! Ratings of perceived exertion should not exceed "fairly light" to "somewhat hard" during lifting.

4. Avoid breath-holding. Breath in when lowering the weight and breath out when lifting the weight overhead.

5. Increase weight loads by 5 to 10 pounds when 10 to 15 repetitions can be comfortably accomplished; for high-risk adults and cardiac patients, weight may be added when 12 to 15 repetitions can be managed easily.

6. Raise the weight to a count of two and lower the weight gradually to a count of four. Work the muscle through its whole range of motion.

7. Exercise large-muscle groups before small-muscle groups. Include devices for both the upper and lower body.

8. Rest 60 to 90 seconds between exercises. Avoid sustained handgripping when possible because this may evoke excessive blood pressure response to lifting.

9. Allow 48 hours of muscle recovery following a session of muscle failure/overload.

10. Stop exercise in the event of warning signs or symptoms, especially dizziness, abnormal heart rhythm, unusual shortness of breath, or chest pain.

11. Weight lift with a partner when possible. This serves to motivate and encourage each other and spot for one another when utilizing free weights.

*Arbitrarily defined as individuals with good left ventricular function (ejection fraction $\geq$ 50%) and reasonable cardiorespiratory fitness (e.g., completion of Stage III, full Bruce protocol) without ischemic ST segment depression, significant blood pressure abnormalities, or serious ventricular arrhythmias or symptoms.

Aquatic Exercise Workout

1. Aquatic exercise is an effective mode of physical activity designed to attain and maintain physical fitness through exercise in water. It can improve muscular endurance. Cardiorespiratory fitness, flexibility, coordination, and muscular strength.

2. Due to its low impact to the body, an aquatic exercise program is ideal for individuals who are overweight, those who suffer arthritis, or those who have muscle weakness. If one is able to exercise, it is recommended they incorporate other activity modalities, such as walking, jogging, or cycling to achieve fitness goals.

3.

Advantages	**Disadvantages**
Less joint stress	Access to swimming pool
Enjoyable	Intimidating for the non-swimmer
Improved flexibility	Less effective in increasing strength
Improved coordination	Financial requirement

4. Below is a sample program and several different exercises one may incorporate during a fitness session.

   A. Warm-up – 5 to 7 minutes of stretching that can be done on the deck or in the water.

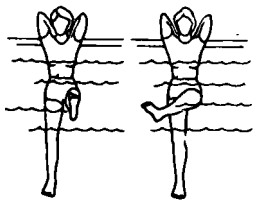
   B. Conditioning phase – 30 to 45 minutes

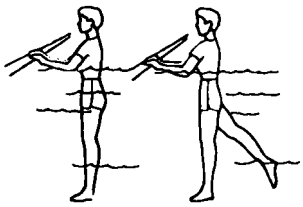
      1. Side leg raise – in shoulder deep water with either side of the body at arm's length to wall of pool, raise outside leg sideward and upward from the hip then return. Perform 15 to 30 seconds with each leg.
      2. Rear leg lift – in shoulder deep water with hand's on pool edge and chest to wall, raise one leg back and up then return. Perform 10 to 20 seconds with each leg.
      3. Leg over – in shoulder deep water with back facing pool and arms back reaching the pool edge raise one leg in front of body and return. Perform 15 to 30 seconds with each leg
      4. Stride hop – in waist deep water with hands on hip and feet together, jump, moving left forward and right leg backward. Repeat and alternate legs. Perform 2 to 4 minutes.
      5. Running – Duration 10 to 20 minutes.
      6. Additional exercises are shown on the following page. Exercise routine need not be limited to the above exercises. Lap swimming is also an effective mode of cardiorespiratory and health related benefit activity. Tailor the program according to individual preference.

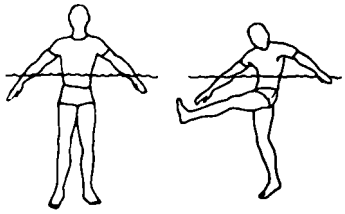
   C. Cool-down – 5 to 7 minutes to bring body back to pre-exercise state.

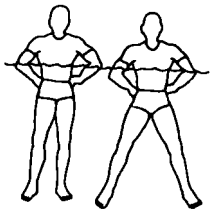
AN AQUATIC EXERCISE WORKOUT CENTER

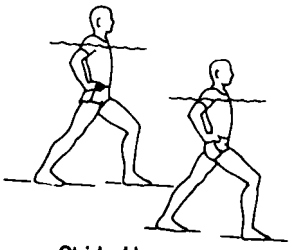

Side Leg Raises

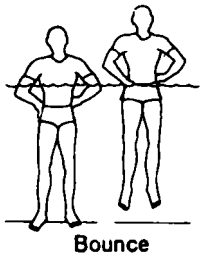

Leg Overs

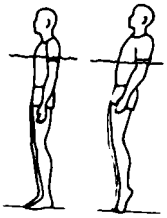

Rear Leg Lifts

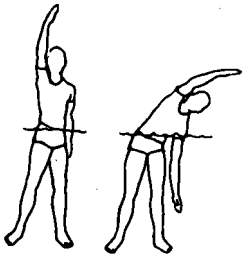

Alternate Toe Touch

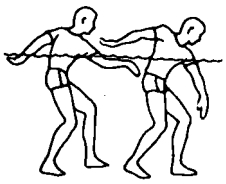

Side Straddle Hop

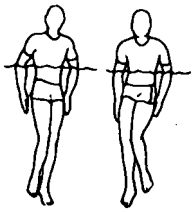

Stride Hop

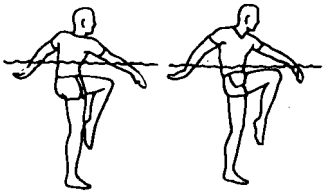

Bounce

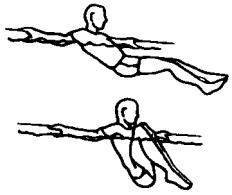

Raise on Toes

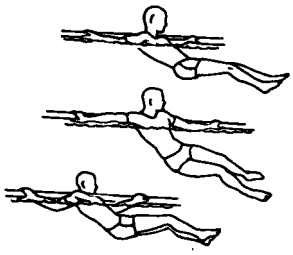

Side Bender

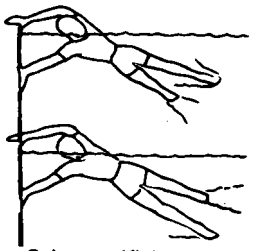

Walking Crawl

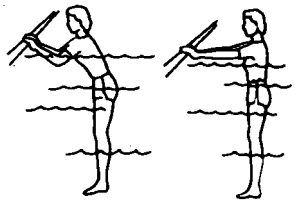

Bouncing

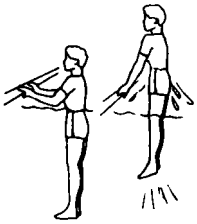

Bounding in Place

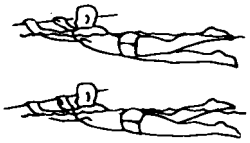

Poolside Knees Up,Supine

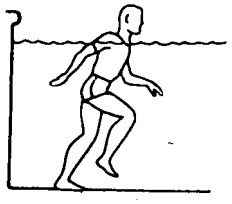

Twisting Legs Supine

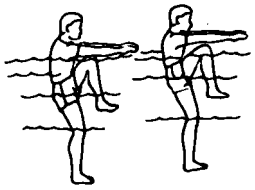

Scissors Kick


Push Away


Gutter Push Ups


Front Flutter Kick


Running


The Engine

Training for the Army Physical Fitness Test (APFT)

Improving APFT scores require dedicated training sessions and hard work. Soldiers are looking for ways to improve test scores now that the Army has announced new standards. By targeting training, soldiers can expect to improve performance in all three events.

Push-ups and Sit-ups

The best way to improve push-up and sit-up scores is to perform circuit training and timed sets utilizing proper form and technique as outlined in Field Manual (FM) 21-20. These exercises should be performed at a minimum of three times per week. Below is an example of a circuit training session.

Push-up and Sit-up Circuits

Push-up Improvement

Exercise	Time	Rest
Regular PU	1:15	2:00
Close PU	1:00	1:45
Wide PU	1:00	1:45
Regular PU	0:45	1:30
Close PU	0:45	1:15
Wide PU	0:30	-----

Sit-up Improvement

Exercise	Time	Rest
Sit-up	1:15	2:00
Crunch	1:00	1:45
Flutter Kick	1:00	1:45
Sit-up	1:00	1:30
Abd Crunch	1:00	1:15
Supine Bicycle	1:00	-----

Combined Push-up and Sit-up

Exercise	Set#1	Set#2
Regular PU	1:00	0:45
Sit-up	1:00	0:45
Wide PU	1:00	0:30
Flutter Kick	1:00	0:30
Close PU	0:45	0:30
Abd Crunch	0:45	0:30
Elevated PU	0:45	0:30
Supine Bicycle	0:45	0:30

Rest 2 minutes then complete Set#2

Two-mile Run

The best way to improve the two-mile run is to increase your pace. This is best accomplished by running faster when you train, not for longer period at your normal pace. Running faster can be achieved through interval training and sprints. Interval training on a quarter-mile track is probably the best way to improve the two-mile run time. Fartlek training (set time or distance at various speeds) is also helpful. Running should be performed at least 3 times per week with a minimum of one day of fast running. An example for a running training schedule is outlined below.

Day 1 2 – 3 mile run at normal pace
Day 2 Interval training (400 meter/440 yard sprint 8 times with 2 – 5 minute rest period)
Day 3 Rest
Day 4 3 – 4 mile run at slightly slower to normal pace
Day 5 Rest
Day 6 Fartlek training or Sprints (5 – 6 consecutive 100 meters sprints/2 – 3 sets)
Day 7 Rest

Adapted from Palmer C. Training for the APFT. Soldiers February 1998: 8.

Getting Out of Your Chair

On your PACE Assessment you said that you are not very interested in physical activity. Have you thought very much about what you can get out of being active?

- *Physical Activity can help you feel better*
- *Physical Activity can help you look better*
- *Physical Activity can help you be healthier*

What would be the two most important benefits of physical activity for you? Be specific.

1. _____
2. _____

Do you know you can get most of the benefits of physical activity just by *walking* on a regular basis? You do not have to jog or go to aerobic classes to be an exerciser.

Many things can interfere with physical activity. Here are some of the reasons people give for not being physically active. Check the ones that apply most to you.

_____ Exercise is hard work
_____ I am usually too tired for exercise
_____ I do not have anyone to exercise with
_____ The weather is too bad
_____ There is no convenient place
_____ I am too overweight
_____ I do not enjoy exercise
_____ I hate to fail, so I will not start
_____ I do not have a safe place to exercise
_____ Exercise is boring
_____ I do not have the time
_____ I am too old

What are the two main things that keep you from wanting to be physically active?

1. _____

2. _____

The good news is you can do something about the reasons you are not physically active. If you think of them as *roadblocks* between you and physical activity, you can figure out how to get around them. You can change the roadblock itself (I will get up earlier in the morning to make time for physical activity). You can also change your attitude about the roadblock (I really can find some time to exercise).

How can you get around your two main roadblocks? Look at the ideas on the back of this sheet.

1. _____

2. _____

THE FIRST STEP IN BEING PHYSICALLY ACTIVE IS GETTING OUT OF YOUR CHAIR

Based on your health status, your doctor recommends you do the following to improve your health:

_____ You appear to be able to do either moderate or vigorous physical activities.
_____ You can benefit greatly by starting a program of regular walking or other moderate activity. If you want to do activities as hard as jogging, you need to have an exercise tolerance test.*
_____ Before you increase your physical activity, you need to have an exercise tolerance test.*

*Call this office for an appointment or referral Provider's Signature _____

Your physician strongly encourages you to:

- think about the benefits you can get from physical activity and
- think about how you can avoid some of the roadblocks between you and physical activity.

Most people can improve their health a great deal by taking a walk for 30 minutes 3 – 4 times every week. If you want information on how to start doing more physical activity, ask your doctor.

Benefits of Physical Activity

⇒ IMPROVE YOUR HEALTH

- Reduce your risk of *heart disease*
- Reduce your risk of some *cancer*
- Reduce your risk of *diabetes*
- Strengthen your *bones*

⇒ INCREASE YOUR ENERGY

⇒ MAINTAIN OR LOSE WEIGHT

⇒ IMPROVE YOUR MOOD AND SELF-ESTEEM. FEEL BETTER ABOUT YOURSELF.

HOW TO GET PAST ROADBLOCKS

ROADBLOCK:	HOW TO GET PAST IT:
_____ Exercise is hard work	Pick an activity that you enjoy and that is easy for you. "No pain, no gain" is a myth.
_____ I do not have time	We're only talking about three 30 minute sessions each week. Can you do without three TV shows each week?
_____ I do not enjoy exercise	Do not "exercise." Start a hobby or way of playing that gets you moving.
_____ I am usually too tired to exercise	Tell yourself, "This activity will give me more energy." See if it doesn't happen.
_____ I do not have a safe place to exercise	If your neighborhood is not safe, you can walk at work, walk in a group, or walk in the morning.
_____ I do not have anyone to exercise with me	Maybe you have not asked. A neighbor, family member or co-worker may be a willing partner. Or you can choose an activity that you enjoy doing by yourself.
_____ There is no convenient place	Pick an activity you can do near your home or work. Walk around your neighborhood or do aerobics with a TV show at home.
_____ I am afraid of being injured	Walking is very safe, and it is an excellent activity to improve your health.
_____ The weather is too bad	There are many activities you can do in your home, in any weather.
_____ Exercise is boring	Listening to music during your activity keeps your mind occupied. Walking, biking, or running can take you past lots of interesting scenery.
_____ I am too overweight	You can benefit from physical activity regardless of your weight. Pick an activity that you are comfortable with, like walking.
_____ I am too old	It's never too late to start. If you are ill, it is important to talk to your doctor about physical activity.

How to Start a Walking Program

Walking—it's easy, it's cheap, it's safe. **You can do it with a friend, you can do it indoors or out, and you have known how to do it since you were a toddler! So take a walk. And enjoy yourself.**

Illustrations: Bonnie Timmons

Why Walk?

The sort of walking program you start depends on why you're walking.

Do you want to improve the health of your heart?
If so, you may want to walk 20 to 30 minutes, three to five times a week.

Would you like to control your weight?
If so, besides being careful about what you eat, walk for a longer time—say, 40 to 60 minutes—in one outing.

Are you walking to manage your stress level?
If so, try walking whenever you feel stressed—at the end of each workday, for example.

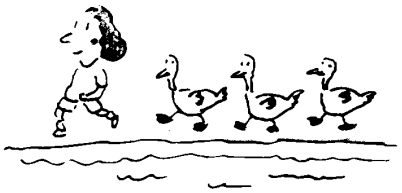
Do you just want to get "out and about" and have a little fun?
If so, do it! Moderate exercise— even short walks—can have important benefits: It might help improve your flexibility, increase your mental sharpness, and even lengthen your life.

Whatever your reason for walking, don't be discouraged if you can't reach your goals at first. The important thing is just to get started. If you have any questions, ask your physician.

How Long? Where?

One way to get started is to set a modest goal for how long you want to walk. Start out easy and work up to walking 20 minutes, three to five times a week.

Choose a safe place to walk—with little traffic and few obstacles like stoplights. If you walk along a road-



way, be sure to walk against the flow of traffic.

You may wish to measure out a route by using a car odometer. You may decide to walk a certain number of blocks, on a walking trail, or around a park or lake. Or you may want to use a premeasured track.

Walk on terrain that feels comfortable. You might feel most secure on flat, evenly paved surfaces. If you are concerned about falling, stay away from uneven or wet surfaces. Perhaps you can find a place close to your home or workplace so that your walk can be readily incorporated into your daily routine.

Can You Talk While You Walk?

- Walk slowly the first minute or so. Then pick up the pace, but maintain it

at a "conversational" level. If you can't talk because you're gasping for breath, your pace is too fast. If you can talk effortlessly, you are walking too slowly.

- Use your natural stride, and swing your arms naturally at your sides.

- About 2 or 3 minutes before you come to the end of your route, slow down the pace to "cool down."

Walk With a Partner

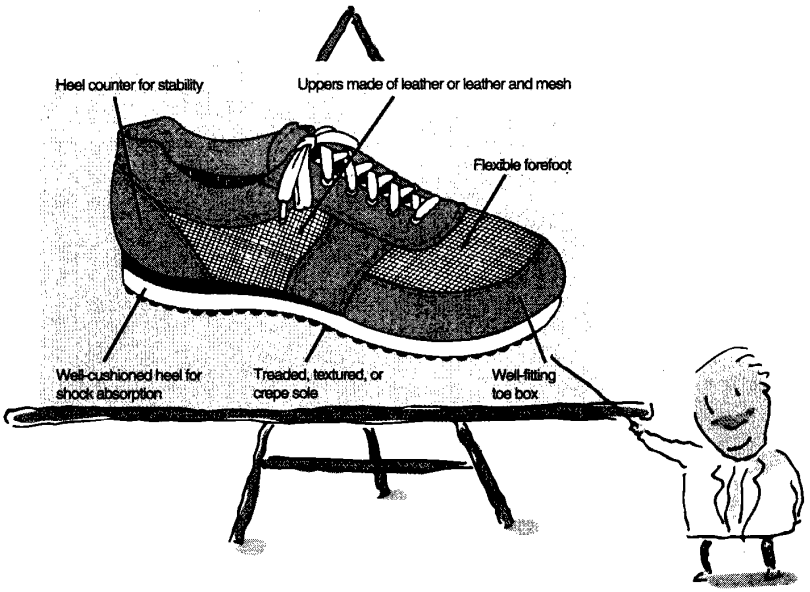
Walking with a partner or a group of friends makes it easy to use the "talk test." But joining someone else can

also enhance your enjoyment of the walk—and help you stick with your program. Many areas now have walking clubs you may want to check out.

CHOOSING THE RIGHT SHOE

If the shoe fits well and it's comfortable, wear it. An oxford or athletic shoe is best. Well-cushioned shoes with treaded, textured, or crepe soles give a better grip. Wear socks to provide a little added cushioning and help prevent blisters.

You don't necessarily have to buy shoes marketed specifically for walking. Look for the basic features shown below when choosing a new pair of shoes.



HELPFUL HINTS

What to wear

Wear loose-fitting clothing. When walking at night, wear light-colored clothes with reflective patches. It's a good idea to carry a flashlight.

Good grooming

Toenails should be trimmed properly.

Cold weather walking

Dress warmly in layers. The best hand gear is woolen mittens with wind-resistant outer shells. Because 55% of your body heat escapes through your head, consider wearing a hat.

When you can, start out by walking into the wind, and return with the wind at your back. This practice helps you to avoid chilling caused by perspiration.

Warm weather walking

Try to take your walk early or late in the day when temperatures are lower. And be sure to drink plenty of liquids, particularly water.

Be on guard for symptoms of heat exhaustion; these include fatigue,

light-headedness, and weakness. If you stop sweating or feel unusually hot, stop—and if the problem continues, seek medical attention.

Finally, if the weather is unpleasant, you can walk indoors. Many malls have walking programs that begin before the stores open. In fact, you can walk just about anywhere, anytime. Take a walk in the airport during a layover, for instance. The important thing is just to start walking!

LIVING FIT

From the President's Council on Physical Fitness & Sports

Exercising In Cold Weather

When the temperature drops, many fitness enthusiasts move their exercise program to the warmth of a gym, fitness center, or their own home. But if outdoor activity is what keeps you going and you've made the decision to brave the cold weather, good for you!

Be Prepared

To prepare yourself for outdoor exercise, first check the radio, TV, or newspaper for the temperature and wind-chill factor. Wind can make the temperature feel much colder. When the temperature starts to hover close to freezing (32°F), follow these tips and outdoor cold weather exercise will be a fun and safe experience.

To protect your skin, try using a thin layer of petroleum jelly on exposed areas. This acts as insulation against the cold and wind.

Pay careful attention to slick surfaces and reduced visibility caused by rain and snow. Since your footing won't be as stable, be more attentive, slow your pace, and wear proper footwear.

Carefully choose your clothing to provide the best protection against the elements. Shoes that are water repellent nylon or leather are good choices. One pair of socks of moderate insulation and thickness is a good choice. Wearing two or more pairs of socks can cause too much friction between your foot and shoe and result in a painful blister.

Layer Clothing

As a general rule, wear one layer less of clothing than you would wear if you were outdoors but not exercising. Several layers are usually better than one. As you exercise your body will produce heat. By wearing several layers of thin garments, you can peel one or two off as you get warmer. The air between the layers also acts as extra insulation to keep you warm.

The first layer, closest to your skin, should be of absorbent, non-irritating material. The second layer should be a good insulator, like wool, to keep in the warmth but let your sweat escape. Follow with a sweat shirt and windbreaker and your upper body will be well protected.

Generally, two layers of clothing are enough protection for your legs. A pair of long johns or thermal pants covered by sweat pants or wind resistant pants are good choices for the lower half of your body.

If you think you will be too warm with several layers, consider warming up with some heavier outerwear such as a jacket or sweat shirt and then shedding the heavier layer before continuing your workout. When you're done, you can put the heavy layer back on for your cool down.

Ways To Protect Yourself

To protect yourself against frostbite and hypothermia (an extreme drop in body temperature), always wear mittens or gloves and a hat. You may even want to add a face mask for extra protection. Up to 40 percent of your body's heat may be lost through your neck and head. Even though you may not feel as though you're sweating as much as in warmer weather, your body still loses fluids during exercise, so be sure to stay well hydrated throughout your workout.

Always warm up first since your muscles will be cold from both inactivity and the colder temperature. Always end with a gradual cool-down. As tempting as it may be, don't head for the fireplace after vigorous exercise. Give your body time to adjust by tapering off the intensity of your workout until your body is back to its pre-exercise level. Remember to stretch in order to keep your muscles from tightening.

A word of caution to those with heart or lung-problems. Certain conditions can make you more likely to collect moisture in your lungs. Cold weather can aggravate this and your heart may not be able to pump the fluid out. Always check with your physician first if you have any questions about whether you should avoid cold weather exercise.

Go For It

Exercising in the colder months can be a beautiful as well as beneficial experience. So make sure you're well prepared for your activity, enjoy the winter season and stay fit!

SENSIBLE SHOES

Choosing The Right Exercise Shoes

When most of us were kids, there was only one kind of exercise shoe—the canvas-topped, rubber-soled footwear commonly known as "sneakers" (or, in some quarters, as "tennis shoes"). Our only choice regarding these shoes was whether to purchase the regular-cut or hi-top variety. Now, however, with the "fitness" revolution in full-swing, our choice of exercise shoes seems limitless. How can you be sure that you've chosen the right footwear for your activity? These guidelines can help you.

Running Shoes

Activities where your feet strike the ground forcefully for an extended period of time (such as running and jogging), require shoes with adequate cushioning for shock-absorption. Shoes for these activities must also provide arch and heel support to prevent the foot from turning in and out. Padded heels (to protect the Achilles tendon) are also important.

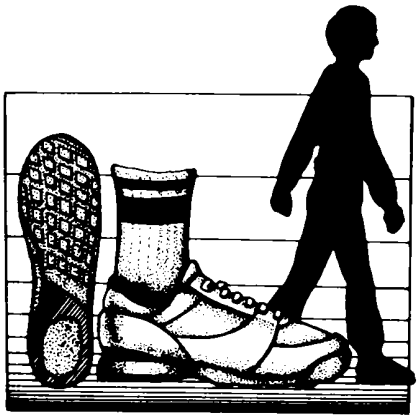
Walking Shoes

When selecting a good walking shoe, choose one with flexible soles. Heel cushioning is important, since this is where your foot strikes the ground, but since your foot swings through as you walk, too much cushioning in the front part of the shoe may make you trip.

"Aerobic" Shoes

Like running and jogging, aerobic dance can be a high-impact activity. Aerobic shoes should have well-cushioned soles and good overall support. Aerobic shoes also require firm, yet flexible soles for ease of movement. If you suffer from weak ankles, a hi-top variety can provide additional ankle support.

Running Shoe



Walking Shoe

"Aerobic" Shoe

Specialty Shoes

There are numerous types of footwear designed for specific sports—bicycling, golf, football, baseball, skiing, and so on. Each shoe has characteristics designed to improve comfort and performance for specified activities. No matter what your activity, the key to the right shoe is one that *fits* and provides adequate support and stability.

Does The Shoe Fit?

A properly-fit shoe should allow enough "toe room" when standing so that neither the big nor the little toe extends over the sole of the shoe. The heel of the shoe should feel "snug" without pinching. For the best support, the inner side of exercise shoes should be made of a firm material to prevent the foot from collapsing inward. An arch support that conforms to one's own foot is also important for good fit, support, and comfort.

Wear It!

Whether you run, jog, walk, or "dance," shoes can make a difference. The best exercise shoe is one that fits *your* foot. Try on several pairs of shoes by various manufacturers before making your final selection. Shoes are perhaps the most basic piece of "equipment" for any sport, so make sure your shoe has the right fit—then wear it.

FITNESS INJURY PREVENTION

Tips for Exercising Safely

There's hardly an athlete alive—"weekend," amateur, or professional—who hasn't known the pain, disappointment, and frustration that can result from a fitness-related injury. While some accidents are beyond our control, the vast majority of fitness injuries *can be prevented* by following these guidelines for exercising safely.

Warm Up/Cool Down

The most important times for preventing fitness injuries occur while you're not even engaged in your activity! The periods before and after exercise are critical times for preventing unnecessary pain and injury. By "warming up" for 5 minutes prior to exercise with gentle activities like running in place, you can increase blood flow to inactive muscles, and gradually raise your heartrate to its target zone. Similarly, you can gradually lower your heartrate to its resting rate by simply walking for 5 minutes or so after exercise.

Stretch

Gentle static stretching is actually a part of the warm up/cool down process. Stretching before exercise limbers tight muscles and improves joint flexibility thereby reducing your risk of sprains and tears. Concentrate on stretching those muscle groups used in your particular activity. For example, runners will want to concentrate on stretching out the legs, while swimmers will want to pay extra attention to upper body muscles. Static stretching for a few minutes after exercise is also recommended to prevent muscle soreness.

Use the Right Equipment

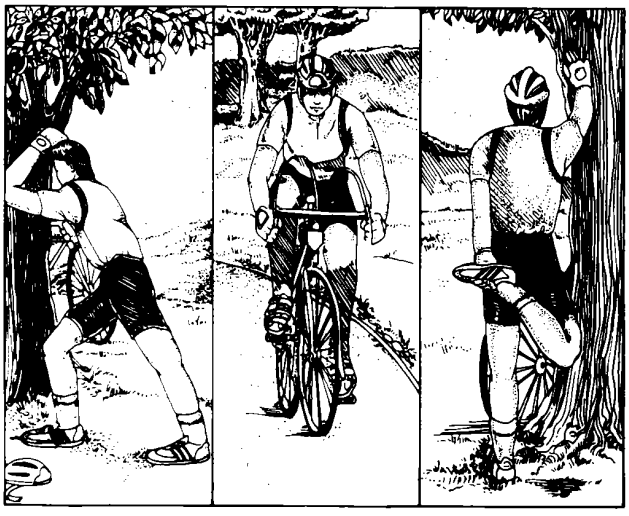
Improper equipment—worn exercise shoes, an ill-fitting bicycle, etc.—can cause more harm than is generally realized. Always check your equipment before *and* after your activity and be sure to make replacements or repairs promptly. Your worn out running shoes may bring you "good luck," but they can also bring you an ankle or leg injury if they fail to support your foot properly. Even though cycling places less stress on bones and joints than other high-impact sports, an ill-fitting bicycle can lead to back and knee pain and/or injury. Whatever your activity, be sure that your equipment is in top condition before risking your health and safety.

Use Safety Devices

Helmets, goggles, gloves, mitts, braces, guards, pads, even sunscreen, are just a few of the numerous safety "devices" available for today's active person. Each activity carries its own risks, and which devices you use will depend on your particular activity. The point, however, is to *use* them. While some safety gear may feel awkward or "look funny," keep in mind that these minor inconveniences are far outweighed by the risk reduction you'll enjoy.

Use Common Sense

The most important factor in fitness injury prevention is common sense. Make sure your muscles are conditioned before engaging in vigorous activities and use the right equipment and available safety devices. Fitness should be fun. The best way to enjoy your activity and prevent unnecessary injuries is to use your common sense.



To prevent fitness injuries, make sure you warm up, cool down, and use the right equipment and available safety devices.

CONDITIONING EXERCISE

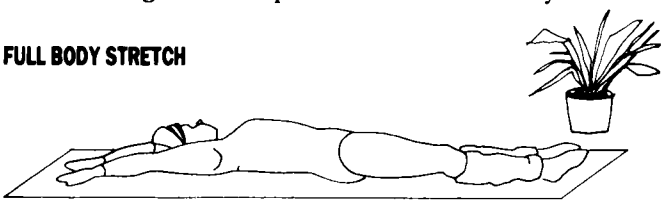
Your Personal Plan For Muscular Fitness

Conditioning exercise builds muscle flexibility and strength and helps keep your body in top physical condition. The following exercises are designed to condition the major muscle groups that are likely to become tight and weak from inactivity. Try these simple exercises each day to stretch and strengthen your muscles.

Stretching Exercises

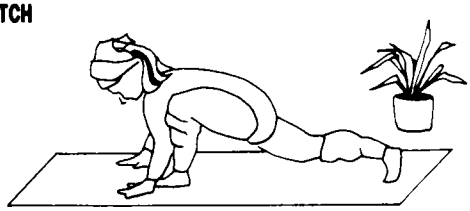
The following exercises promote muscle flexibility.

FULL BODY STRETCH



Lie flat with your lower back on the floor. Extend your arms as shown and reach back as far as you can while pointing your toes. Hold for 8 – 12 seconds. Repeat 4 times.

LEG STRETCH

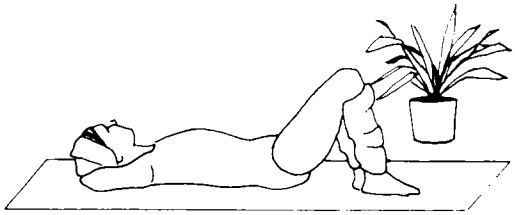


Position yourself as shown. Gently lower your torso as close to the floor as you can. Hold for 8 – 12 seconds. Repeat 4 times, then switch leg positions and repeat.

ARM STRETCH

Raise your arms above your head, fingers interlaced, palms facing up. Push up. Hold 8 – 12 seconds. Repeat 4 times.

LOWER BACK STRETCH

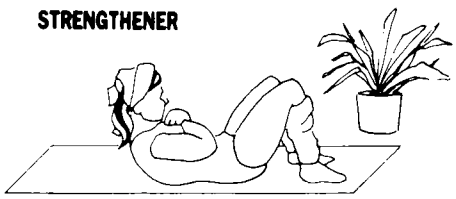


Lie as shown keeping your knees bent and feet flat on the floor. Gently push your lower back onto the floor. Hold for 8 – 12 seconds. Repeat 4 times.

Strengthening (Resistance) Exercises

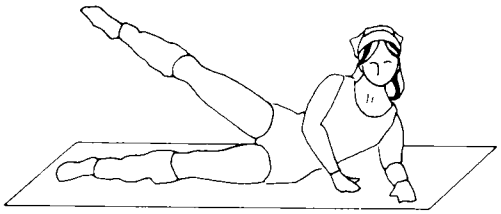
The following exercises build muscle strength.

ABDOMINAL STRENGTHENER



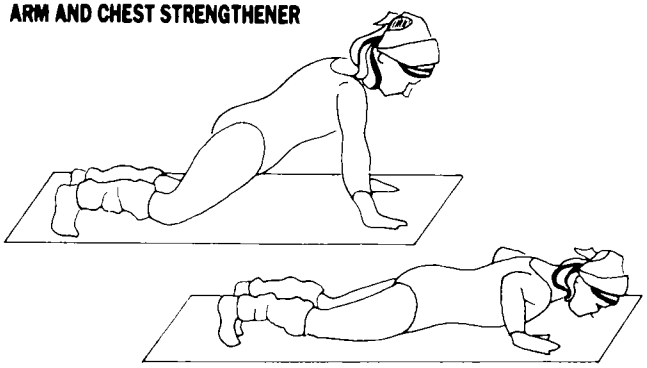
Lie as shown keeping your knees bent and feet and lower back flat on the floor. Gradually raise your shoulders off the floor. Slowly lower yourself back to the floor. Relax. Repeat 4 times.

LEG STRENGTHENER



Lie on your side supporting your upper body with forearm as shown. Gently raise your top leg about 12 or so, then lower. Repeat 4 times, then switch to your other side and repeat the sequence again.

ARM AND CHEST STRENGTHENER



1) Kneel with feet flexed, toes on floor. Support your upper body with arms placed at shoulder distance apart as shown.

2) Lower your upper body to a few inches above the floor. Raise your torso as you return to starting position. Repeat 4 times.

The End Result

Flexible strong muscles allow us to move freely and help support our bodies. Stretching exercises are helpful when done before and after strenuous exercise. Strengthening exercises can be alternated with aerobic activities to round out your total fitness plan. The end result is a more flexible, stronger, fitter, healthier, you.

BEND AND STRETCH

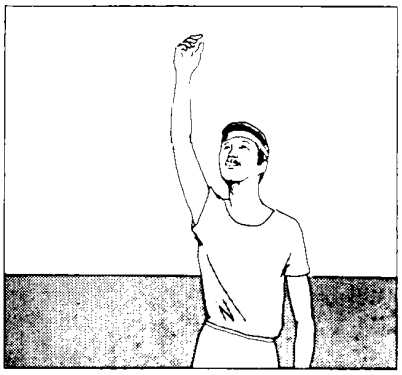
A Flexibility "Sampler"

The importance of flexibility can't be overemphasized—flexible muscles and joints allow us to move freely without pain or restriction, are less likely to become injured, and help to support our bodies better. The following exercises provide a bend and stretch sampler that improves flexibility in muscles commonly used in everyday activities. Remember, when doing these exercises, use slow, steady, controlled movements ("static" stretching), and don't bounce.

Head & Neck Roll

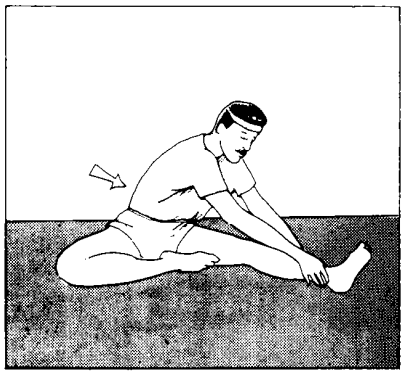
Relax and let your head roll forward, chin to chest. Slowly rotate your head from side to side without straining neck. Repeat 5 times in each direction.

Overhead Reach



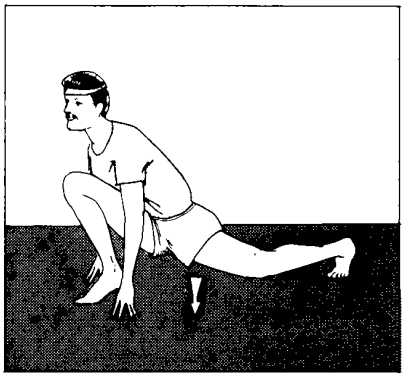
Alternating arms, reach each hand over head as if you were trying to reach the ceiling. Hold 8-12 seconds. Repeat 5 times with each arm.

Hamstring Stretch



Sit as shown and slowly reach toward the ankle of your straight leg. Hold 8-12 seconds. Repeat 5 times on each side.

Leg Stretch

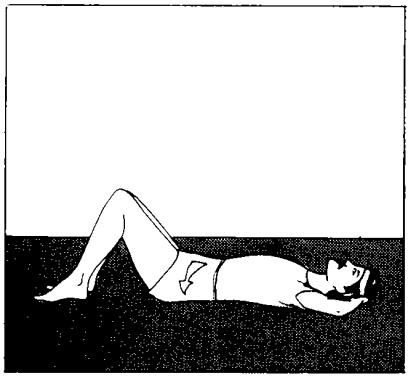


Position yourself as shown and slowly lower your torso to your forward knee. Hold 8-12 seconds. Repeat 5 times on each side.

Chest and Back Stretch

With hands clasped behind your head as shown, slowly push backward with your elbows. Hold 8-12 seconds. Repeat 5 times.

Lower Back Stretch



Lie on the floor as shown. Press the small of your back toward the floor while tightening your stomach muscles. Hold 8-12 seconds. Repeat 5 times.

National Organizations

1. **American College of Sports Medicine (ACSM)**
   401 West Michigan Street
   Indianapolis, IN 46206-1440
   (327) 637-9200
   Fax (317) 634-7817

2. **American Heart Association (AHA)**
   7320 Greenville Avenue
   Dallas, TX 75231
   (800) 233-1230

3. **YMCA**
   YMCA Program Store
   Box 5077
   Champaigne, IL 61820
   (217) 351-5077
   (800) 872-9622

4. **American Alliance for Health, Physical Education, Recreation, and Dance (AAHRERD)**
   AAHPERD Publications
   PO Box 704
   Waldorf, MD 20604
   (800) 321-0789
   Fax (703) 476-9527

5. **President's Council on Physical Fitness**
   450 5th Street, NW, Suite 7103
   Washington, DC 20001
   (202) 272-3424

6. **National Institute of Health's Publications**
   Health Promotion Resource Center
   Stanford Center for Research in Disease Prevention
   1000 Welch Road
   Palo Alto, CA 94304-1885
   (415) 723-0003

7. **National Heart, Lung and Blood Institute**
   National Heart, Lung and Blood Institute Information Center
   4733 Bethesda Avenue, Suite 530
   Bethesda, MD 20814
   (301) 951-3260

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