

CHAPTER 8

Risk Reduction

The presence of CVD is associated with characteristic modifiable and non-modifiable risk factors. There is general agreement, although not consensus, that modifying risk factors can reduce the likelihood of developing or slow the progression of CVD. This chapter provides guidelines for primary, secondary and tertiary prevention strategies for risk reduction.

Levels of Prevention

Levels of prevention comprise a 3-tiered model of intervention that promotes optimum health by promoting health, preventing disability or reducing disease progression, reducing morbidity and mortality, and preserving function and quality of life. The presence or absence of clinical disease defines the level of prevention and *not* the nature of the intervention.

Primary Prevention

1. Primary prevention is concerned with promoting health and delaying or preventing disease in the general population. Primary preventive interventions occur before there is a clinical indication of disease.
2. Primary prevention of CVD involves helping children make healthy lifestyle choices and avoid choices that increase risk (eg, tobacco use, physical inactivity, excessive body weight, and high-fat diet).
3. Primary prevention strategies include education, public law and policy (eg, no tobacco for people <18 years of age), the reduction of environmental hazards (eg, secondhand smoke), and chemoprophylaxis (eg, aspirin use among individuals without known CVD).

Secondary Prevention

1. Secondary prevention is concerned with the early detection of disease or health problems and intensive treatment while the outcome can be favorably altered.
2. Secondary prevention of CVD involves detecting and treating risk factors such as HTN and dyslipidemia before a cardiac or vascular

- event (eg, MI, stroke, or arterial occlusion) occurs. Secondary prevention includes intensive management of risk after an acute event for purposes of preventing subsequent events and death.
3. The goal of secondary prevention is to control risk factors and to achieve therapeutic protection of arteries from plaque rupture.

Tertiary Prevention

1. Tertiary prevention is concerned with the treatment of the disease or health problem to avoid negative sequelae and to return the individual to the highest possible functional level.
2. Tertiary prevention of CVD includes post-stroke rehabilitation programs and programs that modify work responsibilities to enable people to return to work after an acute cardiac event. (Cardiac rehabilitation programs use both secondary and tertiary prevention strategies. The emphasis on adopting a healthy lifestyle to prevent future events is an example of secondary prevention. The emphasis on resuming role responsibilities after an acute cardiac event is an example of tertiary prevention.)
3. The goals of tertiary prevention are to minimize disability and to preserve or restore function and quality of life.

CVD Prevention

1. Preventing CVD requires individual, community, and societal effort.
2. Data support the benefits of preventing and treating CVD.
3. CVD is present in almost fifty million Americans and is the leading cause of death for both men and women in the US.
4. CVD is a large source of the chronic disability and health costs encountered in the world making prevention a cost-effective goal with far reaching consequences.
5. Lifestyle modifications can reduce the risk of developing CVD by approximately 50%.
6. Mortality from CVD in all races has been reduced by about 50% from the 1960s. It is believed that this reduction represents the effect of multidisciplinary prevention and management strategies including changes in dietary and smoking habits, physical activity, and lipid and HTN management.
7. Future research should be multidisciplinary, aimed at prevention across the lifespan, and examine disease progression and precipitants of acute events among various ethnic, racial, and socioeconomic groups.

Risk Factor Modification

1. Many of the risk factors of CVD are modifiable: physical inactivity, tobacco use, obesity, HTN, diabetes, and lipid management.
2. Successfully applied preventive interventions can reduce mortality and morbidity, acute coronary event rate, and re-hospitalization for disease progression — thereby reducing health care costs.
3. An organized system to reduce risk through a variety of preventive strategies is more likely to be effective than single strategies applied unsystematically.
 - a. Health needs assessment can identify populations at risk and prioritize individual and environmental interventions.
4. Health care professionals need to assess patient need for information, ability to comply, and barriers to successful change before selecting strategies to promote change in lifestyles.
5. Educating individuals about the benefits that can be obtained from risk factor reduction may motivate individuals to trial and then to adhere to lifestyle changes.

Relative Risk

Relative risk is the ratio of the likelihood of CHD developing with and without a given risk factor. Absolute risk is the probability of developing CHD in a specified finite period, meaning a high relative risk early in life may correspond to a high absolute risk later in life.

Exercise and Activity

Physical activity can be cost-effective, flexibly scheduled, and need not require special equipment or location.

Activity Guidelines

1. Physical activity is recommended for primary and secondary prevention of CVD.
 - a. An active lifestyle from childhood is key to primary prevention of atherosclerosis.
 - b. School programs should include aerobic activities (such as running, swimming, walking, and dancing) and resistance exercises with freeweights or exercise machines.
 - c. Physical inactivity is associated with at least a 2-fold increase in risk for cardiac events.
2. Exercise and activity reduce CVD risk through lowering blood pressure, reducing platelet aggregation, raising HDL-C and improving glucose metabolism.

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- a. Physical activity also helps psychologically to improve mood (reduces feelings of depression and anxiety).
 - b. Personal satisfaction is an important consideration in selecting an activity that will become an almost everyday choice.
 - c. Intensity, duration, and frequency of exercise as well as mode and progression need to be included in exercise prescriptions.
3. Primary prevention
- a. All children and adults should accumulate at least 30 minutes of moderate physical activity on most, if not all, days of the week.
 - 1) Activities of moderate intensity include brisk walking, cycling, swimming, and yard work.
 - 2) Children (and adults) who already meet this standard of activity will receive additional benefits from increased duration or intensity of activity.
 - b. The American Heart Association (AHA) recommends vigorous activity for at least 30–60 minutes, 3–4 days per week at 50–75% of maximum heart rate for most healthy individuals.
 - c. Intensity may be measured by the onset of breathlessness or fatigue. The Borg scale rates perceived exertion (scaled from 6 to 20) and is used in outpatient cardiac rehabilitation programs.
 - d. Individuals with acute illnesses such as influenza or upper respiratory infections should decrease or stop physical activity for up to 2 to 3 weeks, while recovery occurs.
 - e. Exercise testing (measurement of functional capacity) is not required for primary prevention.
 - f. Physical activity can be accumulated in intervals of 10–15 minutes throughout the day to total 30 to 60 minutes.
 - g. For those unable to maintain or increase intensity level, frequency and duration should be increased to compensate.
4. Secondary prevention
- Secondary prevention is physical activity occurring after a heart attack or stroke has occurred or for those at great risk of developing CVD. The goal is to prevent further cardiac and vascular events or disability from disease.
- a. Walking has been shown to increase survival, decrease recurrent events, and may slow the progression of CVD.
 - b. Additional benefits of walking include improved quality of life, decreased incidence of hospitalization, and reduced need for repeat invasive procedures, such as angioplasty, stenting, or laser therapies.
 - c. Walking for patients with intermittent claudication should be 60 minutes a day with stops for rest if pain develops.

- d. Regular light or moderate physical activity started in middle age or older age has been shown to reduce mortality from CVD.
- 5. Tertiary prevention
Tertiary prevention minimizes disability, improves function, and improves quality of life.
 - a. Exercise testing is recommended before starting an exercise program after an acute cardiac event.

Safety Considerations

1. Risk should be assessed, preferably with an exercise test, prior to the initiation of an exercise prescription following a cardiac event.
2. In the early recovery period following a cardiac event, (eg, during the second week), the goal is to walk 5 to 10 minutes and perform nonresistive range of motion.
3. Later in recovery, activity is guided by the results of a symptom-limited exercise test and includes:
 - a. Warm-up and cool-down periods before and after exercise involving large muscle groups performed for a total of 20 to 30 minutes at least 3 to 4 times per week.
 - b. Low risk patients are characterized by the absence of ischemia and significant dysrhythmia.
 - 1) The majority of patients requiring secondary prevention is classified as low risk and can implement an exercise prescription at home or in the community.
 - 2) In low risk patients, primary prevention guidelines apply.
 - 3) Follow-up exercise testing is recommended on an annual basis.
 - c. Activities progress as tolerated up to a moderate level of intensity.
 - d. During early recovery from an acute event and in the initial stages of an exercise program, an increase of 20 beats per minute above resting heart rate may be used as a guideline for the progression of activity.
 - e. Once a steady state of activity is tolerated without symptoms, dysrhythmia, or excessive tachycardia, the duration of exercise may be increased in 5-minute increments each week, while intensity can be increased at a frequency of 3–6 times weekly.
4. High-risk patients are encouraged to attend medically supervised exercise sessions.
 - a. Moderate-to-high risk patients have ischemia and/or significant dysrhythmia on symptom-limited exercise testing.

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- 1) Significant dysrhythmia includes ventricular tachycardia, symptom-producing dysrhythmia, and hemodynamic instability.
- 2) Signs of ischemia include the presence of chest pain, 2 mm ST-segment depression or elevation, or a decrease in systolic blood pressure ≥ 20 mm Hg from base line.
- b. Exercise prescriptions for moderate-to-high risk patients require medical supervision, such as cardiac rehabilitation.
- c. Exercise for older individuals may best be done under initial supervised conditions for a brief period of time.

Nutrition

Skills

Required skills for patients to engage successfully in dietary modification include reading food labels before purchasing groceries, selecting appropriate foods from restaurant menus, using appropriate cooking styles, and taking medications, if indicated.

Lipid Management

Normalizing blood lipids may reduce the rates of coronary events and death from CVD.

1. Diet, exercise, and drug therapy have been shown to be effective strategies in achieving optimum cholesterol levels.
 - a. LDL-C 100 mg/dL
 - b. HDL-C > 40 mg/dL
 - c. Triglyceride < 200 mg/dL
2. Low fat, low cholesterol choices for a healthy diet include:
 - a. 5 servings of a variety of fruits and vegetables daily.
 - b. 6 or more serving of grain daily.
 - c. Include fat-free or low-fat items.
 - d. Balance daily caloric intake by calorie expenditure
 - 1) Multiply weight in pounds by 15 (if active) or by 13 (if sedentary).
3. Individuals without CVD, diabetes, or high LDL-C should consume
 - $< 30\%$ of their total calories as fat; $< 10\%$ as saturated fat, and < 300 mg of cholesterol per day.
4. Individuals with CVD, diabetes, or high LDL-C should consume
 - $< 30\%$ of total calories as fat, $< 7\%$ as saturated fat, and < 200 mg of cholesterol per day.

Weight Management

1. Body mass index (BMI) is used to define overweight and obesity.
 - a. BMI = weight in kilograms divided by height in meters squared **or**
 - b. Estimated BMI = (weight in pounds divided by height in inches squared) multiplied by 704.5
2. The healthy range for BMI is 18.5 to 24.9.
 - a. Overweight is defined as a BMI of 25–29.9
 - b. Obesity is defined as a BMI ≥ 30
3. Treatment goals for cardiovascular health are:
 - a. BMI < 25 throughout adult life. (BMI of 25 corresponds to 110% of ideal body weight).
 - b. If BMI is 25–30, diet and exercise management is recommended.
 - 1) A caloric deficit of 400 calories per day should result in weight loss of 0.45kg (1 lb) per week. The recommended weight loss rate is 1 lb per week.
 - 2) Pharmacologic agents may be indicated for BMI > 30 .
4. A threshold level of BMI is not entirely appropriate, because the distribution of adipose tissue to the abdomen effects the risk of CHD more than distribution in the pelvic area.
 - a. BMI does not take into account distribution of body fat.
 - b. Research shows that increased waist circumference and waist-to-hip ratio predict comorbidities and mortality from obesity.
 - 1) Desirable waist circumference is < 35 inches (88 cm) for women and < 40 inches (102 cm) for men.
 - 2) Waist-to-hip ratio is the waist measurement divided by the hip measurement. Desirable waist-to-hip ratio is < 0.8 for women and ≤ 1.0 for men.
5. BMI or obesity independently predicts coronary atherosclerosis in whites. The relationship between obesity and CVD morbidity and mortality is less clear for non-whites.
 - a. Weight loss is associated with improved lipid levels, less insulin resistance, and lower BP.
 - b. Cardiac rehabilitation may aim for a reduction of 5 to 10% of body weight to improve risk factors.
6. Prevention of obesity by diet and regular physical activity is a high priority to reduce CVD risk.
7. Obesity is associated with a number of comorbidities, which include heart disease.
8. Heredity may explain 30% to 70% of obesity, but environmental factors must be considered as contributors to the increasing prevalence of obesity.

9. Weight loss is particularly important for patients with HTN, elevated triglycerides, or elevated blood glucose levels.

Metabolic Syndrome

1. Metabolic syndrome is a clustering of several metabolic risk factors in one patient, which predisposes the individual to premature CHD.
 - a. Metabolic syndrome is diagnosed when 3 or more of the following factors are present.
 - b. Abdominal obesity, elevated triglycerides, low HDL cholesterol, high blood pressure ($\geq 130/\geq 85$ mm Hg), or fasting glucose ≥ 110 mg/dL.
2. Metabolic abnormalities include defective glucose uptake by the skeletal muscle, increased release of free fatty acids by adipose tissue, over production of glucose by the liver, and hypersecretion of insulin by pancreatic beta-cells.
3. The Framingham Study did not contain all of the risk determinants used to diagnose the metabolic syndrome. The importance of metabolic syndrome as a risk factor may be underestimated.

Divalent Cations

1. Sodium
 - a. For the general population, the AHA recommends eating less than 6 grams of salt or 2,400 mg. of sodium per day.
 - b. Lower sodium guidelines may be recommended for patients with HTN and heart failure.
2. Potassium, calcium, and magnesium
 - a. Low calcium consumption (300 to 600 mg per day) is associated with HTN.
 - b. High potassium consumption is associated with lower blood pressure in people with HTN.
3. DASH — **D**ietary **A**pproaches to **S**top **H**ypertension — manipulated dietary intake of potassium, calcium, and magnesium while holding sodium intake constant.
 - a. A diet rich in fruits, vegetables, and low-fat dairy products significantly reduced systolic and diastolic pressure in comparison with a “normal” diet.
 - b. The DASH diet has recently been shown to reduce homocysteine levels also.

Alcohol Use

1. Urban residents tend to have more education beyond high school, higher alcohol use, and engage in more cigarette smoking, and have higher medical specialist usage than rural populations.
2. There is a J-shaped relationship between alcohol consumption and blood pressure. Light drinkers have lower BP than both those who abstain and those who drink more heavily.
3. There is evidence from observational studies that red wine reduces risk of heart attack.
4. AHA recommends moderate alcohol consumption in appropriate individuals.
 - a. Not more than one alcoholic beverage for women and two for men per day.
 - b. An alcoholic beverage is defined as 12 oz. of beer, 4 oz. of wine, 1-1/2 oz. of 80-proof liquor, or 1 oz. of 100 proof liquor.

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Tobacco Use and Exposure

Physiologic Effects

1. Cigarette smoking is a powerful risk factor for developing CVD.
2. Smoking accelerates the rate of coronary plaque development.
3. Facts from the Framingham study indicate that smoking may destabilize coronary plaques and promote plaque rupture and therefore myocardial infarction.
4. Smoking is the major cause of peripheral arterial disease and doubles the risk of ischemic stroke.
5. The longer and the more packs per day smoked the greater the risk of developing CVD.

Cessation Techniques and Guidelines

1. Smoking intervention systems increase the proportion of smokers who are identified, counseled about cessation, referred to cessation programs, and supported in their efforts to quit.
2. Cessation of smoking may reduce mortality and reinfarction rates by 50%.
3. Cessation techniques may include temptation management, cue extinction, contingency management, persuasive techniques, pharmacologic agents, and behavior modification.

Cardiac Rehabilitation

First developed in the 1960s cardiac rehabilitation programs are designed to take advantage of the benefits of walking during prolonged hospitalization and promote secondary prevention in a formal, structured program.

1. Cardiac rehabilitation involves medical supervision and electrographic monitoring of patients post cardiac event while they follow an exercise prescription over a period of 4 to 12 weeks.
2. A medical referral is necessary to enroll in outpatient cardiac rehabilitation.
3. Base line exercise stress test is done to determine if exertional ischemia or dysrhythmia is present.
4. The exercise prescription is followed under medical supervision, with nurse monitoring and input by exercise physiologists on exercise activities and progression of exercise intensity.
5. Aerobic exercise, resistance training, and work capacity are included in rehabilitation.
6. Health insurance may require a co-payment paid per visit or program.

Expected Benefits

1. The expected benefits of cardiac rehabilitation include reduced CVD morbidity and mortality, increased functional capacity and exercise tolerance, as well as improvement in patient-reported ability to perform activities of daily living.
2. Cardiac rehabilitation has been shown to increase HDL cholesterol levels and modestly reduce triglycerides that are above 200 mg/dL.
3. The minimal effect of cardiac rehabilitation on low-density LDL cholesterol suggests a need for concurrent nutritional counseling and drug therapy.
4. Oral hypoglycemic agents or insulin may need to be adjusted downward in response to increased sensitivity to insulin caused by exercise.

Content

Cardiac rehabilitation includes nutritional counseling, smoking cessation, review of medications, dietary modification, and exercise prescriptions to reduce modifiable risk factors, subsequent coronary events, and rehospitalization.

1. Cardiac rehabilitation may be covered by health insurance for a specific number of visits (12 to 36 per single cardiac event), after MI, PTCA, chronic stable angina, or open heart surgery.
2. Visits may be 2 or 3 times a week.
3. Cardiac rehabilitation is also appropriate for patients with chronic heart failure and cardiac transplantation.
4. Only 10% to 20% of appropriate cardiac candidates participate in outpatient cardiac rehabilitation.

Programs

Cardiac rehabilitation provides structured programs to reduce cardiovascular risk for patients with established CVD who are at risk for recurrent cardiac events and death from cardiac causes.

1. More than 50% of patients in cardiac rehabilitation are 65 years or older.
2. Preventing and minimizing disability is of prime concern in this age group.

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