



How to Make Sure the Beat Goes On Protecting a Woman's Heart

Paula A. Johnson, MD, MPH; JoAnn E. Manson, MD, DrPH

Hear disease remains the leading killer of women in the United States, although fewer than half of US women know it. Despite progress, American women are 6 times more likely to die of heart disease than of breast cancer, and heart disease kills more women over age 65 than all cancers combined. The most common form of heart disease, coronary heart disease, results from atherosclerosis, or the accumulation of fatty plaques in artery walls that causes arteries to narrow. If a blood clot or plaque rupture blocks a narrowed artery leading to the heart, it can cause a heart attack.

Several factors are known to increase the risk for heart disease. The more risk factors a woman has, the greater her risk of a heart attack. Some risk factors cannot be controlled, such as increasing age and a family history of heart disease. Women with a father or brother who developed heart disease before age 55 or a mother or sister who developed heart disease before age 65 are at increased risk. Race is also a factor, with black women being more likely than white women to develop heart disease. However, the majority of factors that contribute to heart dis-

ease, including smoking, high cholesterol, high blood pressure, and high blood sugar, can be controlled or modified by making simple changes in your lifestyle and, if necessary, taking certain medicines.

How Do I Estimate My Risk of Developing Heart Disease?

Using a tool developed by investigators from the Framingham Heart Study, the longest-running study of heart disease, you can estimate whether your chance of having a heart attack or dying of heart disease during the next 10 years is "high," "intermediate," or "low" (see Table 1 or go to <http://hin.nhlbi.nih.gov/atp/iii/calculator.asp> or <http://www.nhlbi.nih.gov/about/framingham/riskabs.htm>). You receive points on the basis of your age, total cholesterol level, high-density lipoprotein ("good") cholesterol level, blood pressure, and smoking status. The points are then totaled and converted into a 10-year risk. Your risk can be interpreted as the likelihood that you will develop or die from heart disease in the next 10 years. A risk greater than 20% is considered high; a risk between 10% to 20% is intermediate; and a risk less than 10% is low. Knowing your risk may motivate you to

make lifestyle changes and will help your doctor determine whether to prescribe certain medications.

Other Blood Markers of Risk

In the last decade, other substances in the blood besides cholesterol have also been linked to an increased risk of heart disease, including C-reactive protein, homocysteine, lipoprotein(a), and fibrinogen. However, it is still unclear what levels of these markers put you at elevated risk and whether controlling them will help lower your risk. These markers may be most helpful in improving risk prediction for persons already determined to be at intermediate risk by the Framingham assessment tool.

What Can I Do to Protect Myself?

Epidemiologic studies suggest that more than 80% of heart attacks in women can be prevented by making simple lifestyle changes (Figure). Adopting these changes is your first line of defense against heart disease.

Don't Smoke

Your chance of having a heart attack doubles if you smoke as few as 1 to 4

From the Divisions of Women's Health (P.A.J.) and Preventive Medicine (J.E.M.), and the Connors Center for Women's Health and Gender Biology (P.A.J., J.E.M.), Brigham and Women's Hospital, Boston, Mass.

Correspondence to Paula A. Johnson, Women's Health, Brigham and Women's Hospital, 75 Francis St, Boston, MA 02115. E-mail pajohnson@partners.org

(*Circulation*. 2005;111:e28-e33.)

© 2005 American Heart Association, Inc.

Circulation is available at <http://www.circulationaha.org>

DOI: 10.1161/01.CIR.0000155364.54434.E6



TABLE 1. Framingham score: Estimate of 10-year coronary heart disease risk for women. Find your point score in Boxes A through E, and then add up these points to get your point total. Look up your point total in Box F to find an estimate of your 10-year risk. A risk greater than 20% is considered high; a risk of 10% to 20% is intermediate; and a risk less than 10% is low.

BOX A.

Age, y	Points
20 to 34	-7 points
35 to 39	-3 points
40 to 44	0 points
45 to 49	3 points
50 to 54	6 points
55 to 59	8 points
60 to 64	10 points
65 to 69	12 points
70 to 74	14 points
75 to 79	16 points

BOX B.

Total Cholesterol, mg/dL	Age, y				
	20 to 39	40 to 49	50 to 59	60 to 69	70 to 79
Less than 160	0 points	0 points	0 points	0 points	0 points
160 to 199	4 points	3 points	2 points	1 points	1 points
200 to 239	8 points	6 points	4 points	2 points	1 points
240 to 279	11 points	8 points	5 points	3 points	2 points
280 or more	13 points	10 points	7 points	4 points	2 points

BOX C.

Smoking Status	Age, y				
	20 to 39	40 to 49	50 to 59	60 to 69	70 to 79
Nonsmoker	0 points	0 points	0 points	0 points	0 points
Smoker	9 points	7 points	4 points	2 points	1 points

BOX D.

High-Density Lipoprotein Cholesterol, mg/dL	Points
60 or more	-1 point
50 to 59	0 point
40 to 49	1 point
Less than 40	2 points

BOX E.

Systolic Blood Pressure, mm Hg		
	Untreated	Treated
Less than 120	0 points	0 point
120 to 129	1 point	3 points
130 to 139	2 points	4 points
140 to 159	3 points	5 points
160 or more	4 points	6 points

BOX F.

Point Total	10-Year Risk of Developing Coronary Heart Disease
Less than 9	Less than 1%
9	1%
10	1%
11	1%
12	1%
13	2%
14	2%
15	3%
16	4%
17	5%
18	6%
19	8%
20	11%
21	14%
22	17%
23	22%
24	27%
25 or more	30%

cigarettes per day and increases 6-fold if you are a heavy smoker. If you stop smoking, your risk of heart attack drops by 50% within 1 year, and after 5 years, your risk approaches that of nonsmokers. Regular exposure to smoke from someone else's cigarettes is also bad for your heart and lungs. If you live with someone who smokes, encourage him or her to quit.

Be Physically Active

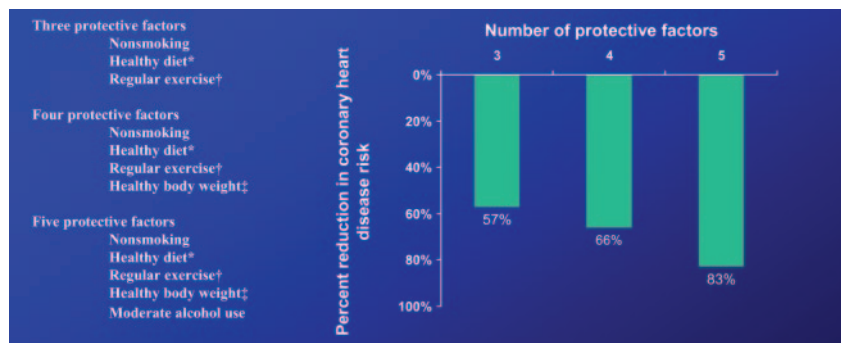
Get at least 30 minutes of moderate-intensity aerobic exercise, such as brisk walking, on most, and preferably all, days of the week. In several studies of middle-aged and older women, those who walked briskly for at least 2 to 3 hours per week—or burned an

equivalent amount of energy through more vigorous exercise—cut their risk of coronary heart disease by 30% to 40%. Exercise doesn't need to be a "production number" involving structured workout sessions at the gym; incorporating several short bouts of activity into your daily routine (eg, taking walks during lunch or coffee breaks or using the stairs instead of the elevator) may be sufficient to obtain the recommended amount of activity. The use of a pedometer may also encourage daily activity. Aim for 10 000 steps per day. In addition to aerobic exercise, consider strength training (ie, exercising with arm and/or leg weights) for 20 minutes 2 to 3

times per week to maintain a healthy body weight and to further reduce heart disease risk.

Eat a Heart-Healthy Diet

Include in your diet a variety of fruits, vegetables, whole grains, low-fat or non-fat dairy products, fish, nuts, legumes, and other sources of protein low in saturated fat such as poultry and lean meats. Limit intake of saturated



Importance of lifestyle in preventing coronary heart disease in women. *Diet high in fruit, vegetables, whole grains, fiber, and fish and low in saturated and *trans* fatty acids. †At least 30 minutes of moderate or vigorous exercise daily. ‡Body mass index <25 kg/m². These data are from the Nurses' Health Study, which assessed health-related behaviors in 84 000 initially healthy US women and then followed these women for 16 years to determine the development of coronary heart disease. Data from Stampfer MJ, Hu FB, Manson JE, Rimm EB, Willett WC. Primary prevention of coronary heart disease in women through diet and lifestyle. *N Engl J Med*. 2000;343:16–22.

fats to 10% or less of your daily calories, and avoid *trans* fats. (The main dietary sources of *trans* fats are stick margarine and many commercially prepared fried and baked goods. An indication that *trans* fat is present in these foods is that the ingredient list contains “partially hydrogenated“ or “hydrogenated vegetable oil.”) Drinking modest amounts of alcohol (eg, 1 glass of wine or one 12-ounce beer per day) may lower the risk of heart disease by 20% to 40%, but it also increases the risk of breast cancer. Women who do not currently drink should not begin drinking for heart benefits.

Maintain a Healthy Body Weight

Aim for a body mass index (BMI) of between 18.5 and 24.9 and a waist circumference of less than 35 inches. To measure your waist circumference, hold a tape measure at the level of your navel and circle your torso with it. Be sure to measure below, not at, the narrowest part of your abdomen. To calculate your BMI, multiply your weight in pounds by 703, and then divide that number by the square of your height in inches. (If you don't want to do the math, use the BMI calculator at <http://nhlbisupport.com/bmi/bmicalc.htm>.) Persons with a BMI of 25 to 29.9 are considered over-

weight, and those with BMI of 30 or greater are obese. If your BMI is in 1 of these categories, don't despair. Losing just 5% to 10% of your body weight favorably affects cholesterol, blood pressure, blood sugar, and other risk factors for heart disease. For most women, reducing food intake by 500 calories per day, in combination with 30 minutes of moderate-intensity physical activity, will result in a weight loss of 1 to 2 pounds per week. Controlling calories is best achieved by reducing portion sizes; minimizing snacks, desserts, and sugar-sweetened beverages; limiting high-fat foods; and increasing fruit and vegetable intakes.

Reduce Stress and Treat Depression

Chronic stress and depression are now recognized as risk factors for heart disease. In a study of 6300 women from many countries, experiencing habitual stress at home or at work was associated with a 75% increased risk of heart attack. To manage stress, choose health-promoting strategies such as physical activity, adequate sleep, and meditation or other relaxation techniques rather than unhealthy ones such as smoking and overeating. For depression and anxiety, seek the help of a healthcare professional.

Know Your Numbers

Schedule and keep appointments with your primary healthcare provider to monitor your blood pressure, blood sugar, cholesterol, triglycerides (a type of blood fat), BMI, and waist circumference on a regular basis. Aim for values within the ranges listed in Table 2. In many instances, adopting the heart-healthy behaviors outlined above will go a long way toward achieving these goals. For example, poor eating habits and excess weight gain are leading causes of type 2 diabetes (high blood sugar), a disorder that is becoming increasingly common in the United States. Left untreated, diabetes can lead to a heart attack, stroke, or other debilitating disease. Indeed, women with diabetes are 3 to 7 times more likely than women without diabetes to develop heart disease. If you have diabetes, diet, exercise, and medication are essential to regulate your blood sugar level. Long-term control of blood sugar in people with diabetes is measured with a glycosylated hemoglobin test; glycosylated hemoglobin levels should ideally be less than 7%.

What Medications Are Available to Prevent Heart Disease?

Women who are considered to be at highest risk for developing heart disease, including those who already have cardiovascular disease, diabetes, or chronic kidney disease, are most likely to benefit from drug therapy. Drugs that lower blood pressure or favorably affect cholesterol and triglyceride levels have been shown to prevent heart attacks or increase survival in high-risk women.

Antihypertensive medications are drugs that lower blood pressure. If, after attempting the lifestyle changes detailed above, your blood pressure stays at 140/90 mm Hg or higher (130/80 mm Hg or higher if you have diabetes), your doctor will likely prescribe one of these drugs. Because different patients respond differently to these medications, you may need to go through a trial period to find out

TABLE 2. Goals to Reduce Heart Disease Risk in Women

Risk Factor	Goal	Frequency With Which the Risk Factor Should Be Assessed
Body measurements		At every physical exam
BMI	18.5 to 24.9	
Waist circumference	Below 35 inches	
Lipids, lipoproteins		Every 5 years*
Total cholesterol	Below 200 mg/dL	
High-density lipoprotein cholesterol	Above 60 mg/dL	
Low-density lipoprotein cholesterol	Below 100 mg/dL†	
Triglycerides	Below 150 mg/dL	
Blood pressure	Below 120/80 mm Hg	Age 20 to 39: Every 2 years* Age 40 or older: Every year*
Blood sugar	Below 110 mg/dL	Every 3 years*

*More often for those at increased risk.

†For patients who have low-density lipoprotein cholesterol level below 100 mg/dL but still have a Framingham score that places them in the high-risk group, a goal of below 70 mg/dL is recommended.

which drug works best for you with the fewest side effects.

- Diuretics, or “water pills,” are often the first medication chosen. Diuretics lower blood pressure by eliminating excess salt and water from the body.
- Beta-blockers lower blood pressure by slowing the heart rate and reducing the force of the heartbeat, lightening the heart’s workload. Beta-blockers are recommended for women who have had a heart attack or have ongoing angina (chest pain).
- Angiotensin-converting enzyme inhibitors interfere with the body’s production of angiotensin II, a chemical that causes the arteries to narrow. These medications, as well as angiotensin-receptor blockers, are often of benefit for people with congestive heart failure or diabetes.

Cholesterol-lowering drugs may be prescribed individually or in combination with one another.

- Statins reduce low-density lipoprotein (“bad”) cholesterol and triglyceride levels in the blood by blocking an enzyme that is necessary for the liver to manufacture cholesterol. Studies show that statins are helpful in preventing heart attack in high-risk patients, even when their low-

density lipoprotein cholesterol levels are already below 100 mg/dL. Statins also reduce the risk of stroke.

- Niacin is available as a prescription drug that reduces low-density lipoprotein cholesterol and triglyceride levels while also raising high-density lipoprotein cholesterol levels. Niacin can also be purchased as a dietary supplement; however, because this form of niacin can vary widely in strength and composition, it should not be used as a substitute for prescription niacin.
- Fibrates such as gemfibrozil and clofibrate lower triglycerides and, to some extent, can help raise high-density lipoprotein cholesterol levels.

Aspirin and other antiplatelet drugs, which prevent blood from clotting, have long been recommended for preventing heart attacks in people with a history of heart disease and, more recently, for preventing first heart attacks in other high-risk individuals. However, the jury is still out on whether regular aspirin use can prevent heart attacks in women at low risk and whether any potential heart protection benefits are outweighed by risks such as stomach bleeding or ulcers. Most studies of aspirin have been conducted in men. The scientific community is awaiting findings from a 10-

year clinical trial of the benefits and risks of low-dose aspirin use in 40 000 US women; the results of this study, which will be available within the year, are expected to provide guidance for women and their doctors regarding aspirin use.

Postmenopausal hormone therapy is no longer recommended to prevent heart disease in healthy women or in women with a history of heart disease.

The putative benefit of vitamin E and other antioxidant vitamin supplements in heart disease prevention, especially among high-risk individuals, has recently been called into question by a comprehensive review of available studies. Pending the outcome of ongoing trials, antioxidant vitamin supplements are not recommended to prevent heart disease. Supplementation with 2 other nutrients, folic acid and omega-3 fatty acids, is provisionally recommended for high-risk women, with the caveat that data from large, well-conducted clinical trials are still needed to support such a recommendation.

What Are the Symptoms of Heart Disease in Women?

The symptoms traditionally identified with ischemic heart disease include chest pain or pressure that occurs in the center of the chest. These chest symptoms are often described as a pressure, fullness, squeezing or pain. The chest symptoms can radiate to the arms, neck, jaw, back, and/or to the abdomen. Shortness of breath can also occur either alone or with discomfort, and nausea may also occur. More recent data suggest that women may be more likely than men to experience atypical symptoms, such as unusual fatigue and weakness, as signs of an acute heart attack, and they may be more likely to experience these symptoms along with sleep disturbance as symptoms leading up to their heart attack. Therefore, if you are experiencing any of these symptoms in ways that are new or different you should seek medical attention.

Diagnostic Testing for Coronary Heart Disease in Women

Noninvasive testing is most frequently the next step when there is a suspicion that coronary artery disease is present. Appropriate testing is important so that diagnoses can be made in a timely manner and treatment can be undertaken. The American Heart Association consensus statement on the "Role of noninvasive testing in the clinical evaluation of women with suspected coronary artery disease"¹ points out that most of the current recommendations for noninvasive testing are based on studies in middle-aged men. It is recommended that women with symptoms or women who are asymptomatic and at high risk for ischemic heart disease (including those with diabetes and/or peripheral vascular disease) discuss the need for diagnostic testing with their physician. These tests may include standard exercise electrocardiography, exercise stress testing with imaging (echocardiography or radionuclide imaging), or pharmacological stress testing with dobutamine, dipyridamole, or adenosine in patients who cannot exercise. Standard exercise electrocardiography remains the recommended initial test in women who can exercise and have normal electrocardiograms.

There are a number of imaging tests, including computed tomography, cardiovascular magnetic resonance imaging, and measurements of carotid intimal thickness using carotid ultrasound, that are considered emerging tests that hold promise for better evaluating risk of ischemic heart disease in women and men. Although there are only early data specific to women, given the increasing use of these tests in some practice settings, a description of the tests and potential utility is worthwhile.

Computed tomography is used to identify and quantify the amount of calcium in the coronary arteries, which is a marker for atherosclerosis of the coronary arteries. Low calcium scores

are associated with low rates of coronary events and high calcium scores are associated with higher rates of coronary events. At this time, it is not clear whether this test adds significantly to our ability to stratify women by their level of risk beyond identifying conventional risk factors for coronary heart disease.

Cardiovascular magnetic resonance imaging holds great promise for having the capability of identifying stenoses and measuring blood flow in the coronary arteries, and evaluating the function of the heart muscle. Although cardiovascular magnetic resonance imaging holds great promise, it is not recommended at this time for detection of coronary artery disease and risk assessment in women.

Increased thickness of the intimal and medial layer in the wall of the carotid artery measured using carotid ultrasound has been shown to be a marker of increased risk for coronary artery disease in women. Early data in women suggest that a finding of increased thickness of the intima and media of the carotid artery may provide increased information above that of traditional risk factors. As in the other emerging tests, there are inadequate data to recommend this test as part of a diagnostic evaluation for coronary artery disease in women at this time.

Revascularization in Women

The 2 main procedures used to treat blocked arteries to the heart and to restore needed blood flow to the heart muscle are percutaneous coronary interventions (eg, stenting, balloon angioplasty) and coronary artery bypass graft surgery. Recent advances in equipment, technique, pharmacotherapy (drug-eluting stents and new antiplatelet agents), and anesthesia have improved outcomes of these procedures in women and men.

Although women are more likely to have vascular complications such as bleeding and hematomas at the site of catheter insertion (for percutaneous coronary interventions), the benefit of

aggressive treatment including antiplatelet drugs, diagnostic cardiac catheterization, and appropriate revascularization has been proven in women with acute coronary syndromes (unstable angina or non-ST-elevation myocardial infarction). How quickly a myocardial infarction is treated is an important determining factor in how well patients will do. Given that women experience more delays in treatment, it is critical for women to understand the possible symptoms and signs of myocardial infarction and to seek medical attention quickly. Equally important is the focus of medical institutions on ensuring prompt and accurate diagnosis and treatment of myocardial infarction in women.

Cardiac Rehabilitation

Cardiac rehabilitation programs are designed to improve physical and psychological functioning and to improve management of risk factors in patients who have had myocardial infarction, unstable angina, or revascularization procedures. Data from numerous studies suggest that women are less likely to be referred for cardiac rehabilitation. Women may also face more barriers in completing these programs because of advanced age, multiple responsibilities at home, and economic barriers. Although medical institutions are devising better methods of enrolling women in cardiac rehabilitation programs, it is important that women who have had a myocardial infarction, unstable angina, or a revascularization procedure inquire about enrolling in cardiac rehabilitation.

Additional Resources

American Heart Association. Women and cardiovascular disease. Available at: <http://www.americanheart.org/presenter.jhtml?identifier=1200011>. Accessed January 4, 2005. This free, easy-to-read guide to heart disease prevention in women includes a list of questions to ask your healthcare provider so that you can work as a team to keep your heart healthy. Also, see the American Heart Association's web site, available at <http://www.americanheart.org>, for information on the "Go Red for Women" program, a national campaign to raise awareness of heart disease among women.



The Harvard Center for Cancer Prevention. Your disease risk. Available at: <http://www.yourdiseaserisk.harvard.edu/hccpquiz.pl?func=start&quiz=heart>. Accessed January 4, 2005. This online interactive tool developed by researchers at the Harvard School of Public Health estimates your risk of coronary heart disease and provides personalized tips for prevention. It incorporates a broader array of risk factors than does the Framingham assessment tool.

Braunwald E, Zipes DP, Libby P, Bonow P. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. Philadelphia, Pa: WB Saunders, 2004. Written primarily for clinicians and researchers, this academic textbook contains up-to-date reviews on the prevention and treatment of all forms of heart disease.

Reference

1. Mieres JH, Shaw LJ, Arai A, Budoff MJ, Flamm SD, Hundley WG, Marwick TH,

Mosca L, Patel AR, Quinones MA, Redberg RF, Taubert KA, Taylor AJ, Thomas GS, Wenger NK. Role of noninvasive testing in the clinical evaluation of women with suspected coronary artery disease: consensus statement from the Cardiac Imaging Committee, Council on Clinical Cardiology, and the Cardiovascular Imaging and Intervention Committee, Council on Cardiovascular Radiology and Intervention, American Heart Association. *Circulation*. In press.