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# Prescribing exercise for women

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**Abstract** One- half of women in the United States do not meet the weekly dose of physical activity recommended by the Centers for Disease Control. Many women could benefit tremendously if they were to adopt a more active lifestyle. Health benefits from exercise include lowering the risk for cardiovascular disease, slowing the rate of bone loss in osteoporosis, and improving mood during pregnancy. In this article, we review the health benefits that women may gain from physical activity and the recommendations for physical activity for adults in the United States. We offer evidence supporting use of the exercise prescription, discuss how to write an exercise prescription, and how to tailor the exercise prescription for women with particular medical problems.

**Keywords** Exercise prescription · Physical activity · Exercise · Women · Primary care · Fitness · Cardiovascular disease · Hypertension · Congestive heart failure · Diabetes · Osteoarthritis · Osteoporosis · Depression · Cognitive decline · Pregnancy · Obesity

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## Introduction

There is a large body of evidence supporting the health benefits of physical activity and exercise. Despite this literature, however, the majority of people in the United States do not achieve the recommended goal of 150 min/wk of moderate intensity aerobic exercise [1]. Furthermore, women often get less exercise than men. According to the Center for Disease Control's Behavioral Risk factor surveillance system in 2007, 26.2 % of women reported getting no leisure-time physical activity compared with 21.7 % of men [2]. In this article, we review the health benefits of exercise, the utility of exercise prescriptions to encourage physical activity, and the principles of writing exercise prescriptions for women.

## Definitions

A review of definitions is important in any discussion of exercise prescriptions. Physical activity includes any movement of the body such as shopping, gardening, riding a bike to work, or walking upstairs. Exercise is a type of physical activity that is planned and structured with the intention of improving physical fitness. An exercise prescription is a written or verbal order from a healthcare provider to a patient describing the type, duration, intensity, and frequency of exercise recommended for the patient to achieve a particular health goal.

## Benefits of exercise for women's health

Coronary heart disease

Cardiovascular benefits of exercise have been well established through large epidemiological studies. In studies

combining women and men, women have had similar findings to men with reductions of 30 %–50 % risk of cardiovascular events with regular physical activity [3]. In the Women's Health Initiative Observational Study, a prospective multicenter trial of 73,743 postmenopausal women ages 50 to 79 years from diverse racial and ethnic backgrounds, women who walked briskly or exercised vigorously at least 2.5 hours per week had 30 % risk reduction of cardiovascular events including myocardial infarction and congestive heart failure [3]. Physical activity lowers cardiovascular risk in a dose-dependent fashion. Even small amounts of exercise are better for cardiovascular health than no exercise [4]. The longer the exercise duration the lower the cardiovascular risk [5].

### Hypertension

Exercise decreases blood pressure and lowers mortality in women with hypertension [6]. During moderate aerobic or resistance activity, systolic blood pressure modestly increases while diastolic blood pressure is unchanged or mildly decreases. After 1 aerobic exercise session, systolic and diastolic blood pressure acutely decrease by 8 and 9 mm Hg, and there is sustained peripheral vasodilation for a few hours [7, 8].

### Congestive heart failure

Historically, patients with heart failure were prohibited from exercising until it was recognized that physical deconditioning leads to worsening of heart failure symptoms and exercise intolerance. Short-term aerobic, endurance, and resistance training programs can improve exercise capacity, quality of life, and cardiac function in women and men with heart failure [9–13]. The (Heart Failure) HF-ACTION randomized controlled trial (RCT) demonstrated that exercise training leads to modest reductions in all-cause mortality and hospitalization in heart failure patients [13].

### Osteoarthritis of the knee

Aerobic and strength exercises are beneficial for lower extremity osteoarthritis [14, 15]. Walking and home quadriceps strengthening exercises have been shown to decrease pain and improve function. The Arthritis, Diet and Activity Promotion trial, where >70 % of participants were women, demonstrated that moderate exercise and weight loss resulted in significant improvement in self-reported and observed function as well as decreased pain [16]. Aquatic therapy has not been as well-studied as land-based activity in osteoarthritis, but can also lead to small short-term improvements in function and reductions in pain [17].

### Osteoporosis

Exercise interventions including weight bearing exercise and strength training have been shown in a variety of studies to decrease loss of bone density, especially in postmenopausal women [18–20]. In the Nurse's health cohort, increased amounts of physical activity were associated with a significant decrease in the risk of hip fracture [21]. In this study, participants who did at least 24 metabolic equivalent hours per week of physical activity were found to have a 55 % reduction in their risk of fracture compared with the sedentary participants.

### Pregnancy

Aerobic exercise during pregnancy is associated with many health benefits including decreased maternal hypertension [22] and gestational diabetes [23]. One RCT of nulliparous women found that aerobic exercise during pregnancy helps reduce depressive symptoms during pregnancy [24]. Daley et al. found that exercise significantly reduced symptoms of postpartum depression [25].

### Diabetes

The Diabetes Prevention Program established the effectiveness of lifestyle intervention in prevention of type II diabetes in patients at risk [26]. In this landmark trial, intensive lifestyle modification with improved diet and exercise habits resulted in a 58 % reduction in the development of diabetes compared with placebo [26]. In a 10-year observation period after completion of the intervention, the intervention group had a 34 % reduction in the risk of type 2 diabetes compared with the placebo group [27]. The Finnish prevention trial also showed a significant decrease in the incidence of diabetes with an intensive lifestyle intervention, with a 43 % reduction in the relative risk of diabetes in the intervention period and a 36 % reduction in risk in the 3-year observation period following the intervention [28]. Exercise helps improve glycemic control and reduce the risk of cardiovascular disease in diabetics. Diabetic women who participate in more than 4 hours per week of exercise have a 40 % lower risk of cardiovascular events than sedentary diabetic women [29].

### Obesity

Exercise clearly leads to health benefits in obese patients. Patients lose more weight when dieting if they add an exercise program [30]. Exercise is important in maintenance of weight loss after a patient has lost weight from dieting [31–33]. Even without loss of weight, physical activity lowers the risk of cardiovascular disease and death in obese patients. In the nurse's health study, obese patients who

exercised 3.5 hours per week significantly decreased their risk of coronary artery disease compared with obese patients who did not exercise [34].

### Cancer

Lack of physical activity has been associated with increased risk for developing colon cancer [35], postmenopausal breast cancer [36], and endometrial cancer [37]. The risk reduction for colon cancer appears to be approximately equal for men and women [35]. The Nurse's Health study reported a 23 % reduction in colon cancer risk between the most active and least active patients [35]. Many trials have studied physical activity and breast cancer patients. According to a systematic review of RCTs by McNeely et al., higher levels of physical activity are significantly associated with improvement in quality of life and reduction of fatigue in women with breast cancer [38].

### Depression

According to the National Health and Nutrition Evaluation survey, women are more likely to be depressed than men, and patients with depression are less likely to participate in vigorous physical activity than patients without depression [39]. The benefit of physical activity on depressive symptoms is well established [40]. Herring et al. conducted a large meta-analysis of the effect of exercise on depression for patients with chronic illness [41]. Exercise was more effective for improving depressive symptoms if it was of moderate to vigorous intensity. There was a trend toward increased effectiveness of group or leader-led exercise interventions compared with solo exercise.

### Cognitive impairment

Exercise has been shown to significantly decrease cognitive decline. One large meta-analysis of RCTs evaluating the effect of exercise in patients with cognitive impairment, demonstrated that aerobic and resistance exercises significantly increased physical fitness and improved cognitive outcomes [42]. Maki et al. conducted a RCT of 150 adults (106 women and 44 men) studying the effect of introducing a walking program and found significant improvements in quality of life, word fluency, and functional capacity [43].

### Risks of exercise

Most data on adverse events from physical activity comes from studies of walkers, runners, and military recruits. The prevalence of injuries in recreational walkers and runners varies depending on the study, from <10 % to 40 % [44]. Injury rates increase linearly with minutes per week of

physical activity [45]. The majority of injuries reported are lower extremity injuries [44].

Sudden cardiac death can be triggered by intense exercise, usually in adults >35 years of age who do not exercise regularly [46]. Sudden cardiac death during exercise is a very rare event in women. Regular moderate to vigorous exercise >2 hours per week may actually mitigate the very small risk of exertion-related sudden death by improving overall health status and leading to a decrease in long-term mortality from cardiovascular disease [47].

### The exercise prescription

Several high-quality RCTs demonstrate the efficacy of exercise prescriptions. Elley et al. found that exercise prescriptions increased the total number of people exercising and were associated with modest health benefits [48]. Lawton et al. conducted a RCT of physically inactive women and found an increase in physical activity, self-reported physical function, and mental health parameters by combining exercise prescription with telephone counseling [49].

It is possible that not every patient benefits from exercise counseling in the office. The U.S. Preventive Services Task Force (USPSTF) recently issued a grade C recommendation for primary care providers conducting behavioral counseling on exercise with their patients who do not have risk factors for cardiovascular disease. The evidence suggests that the effects of counseling on lowering blood pressure, lipids, and blood sugar in these low-risk patients are small. The interventions yielding benefit involved a significant amount of time (at least 360 minutes of counseling), the majority of which was done by health educators, nurses, dietitians, or exercise instructors (not primary care providers). The USPSTF suggests that primary care providers consider offering counseling on diet and physical activity for a select group of patients, such as patients who are ready to change or who have risk factors for cardiovascular disease. The USPSTF also suggests that clinicians consider community resources in helping patients achieve diet and physical activity goals [50].

### Exercise prescription under-utilized in primary care

The exercise prescription can affect change in patients, particularly those who are motivated to change and those with risk factors for or existing cardiovascular disease. However, many practitioners do not incorporate exercise prescriptions into their practice. On self-report, primary care providers found that 40 % of the time they provided less than 1 verbal or written exercise prescription per month [51]. One study observed primary care physicians counseling about exercise and found that physicians did not assess activity type or amount in detail, rarely assessed readiness

for change for patients not meeting exercise goals, and offered minimal assistance if a patient admitted ambivalence toward behavior change [52].

### Barriers to using the exercise prescription

Providers cite the following limitations in their ability to provide behavioral health counseling: the need to concentrate on more medically pressing issues, lack of time, lack of compensation, lack of training, and lack of knowledge of available resources [53].

There are many potential barriers that prevent patients from following an exercise prescription. Simons-Morton evaluated a series of nearly 900 primary care patients and found that lack of exercise was associated with being female, being over the age of 65, and with having low self-efficacy around exercise [54]. Barriers preventing indigent internal medicine patients with arthritis from being more active included perceived bad health and pain [55]. Environmental factors, such as living in an unsafe neighborhood or living too far from the local park, are also cited by patients as limiting their ability to exercise [56]. Targeting counseling around patients' concerns may increase the likelihood of effectively adopting an exercise regimen.

### Action plan: writing the exercise prescription

#### Assess the patient

Using exercise as medicine in the primary care setting first requires that the provider determine whether or not the patient is meeting current goals for physical activity. We ask patients to describe the frequency, intensity, duration, and type of activity they are doing. Next we evaluate the patient's stage of change. The Stages of Change model describes patients' behavior regarding addiction and has been validated for use in physical activity counseling [57, 58]. The model describes 6 stages: precontemplation (not intending to exercise), contemplation (planning to exercise in the next 6 months), preparation (exercising less than the recommended amount), action (meeting the exercise goal for less than 6 months), maintenance (exercising more than 6 months), and relapse (slipping to earlier stage). The closer a patient is to the maintenance stage, the more likely he or she is to adopt the given behavior, whether this is quitting smoking or exercising [57].

Next, we determine whether or not the patient is healthy enough to start exercising. We ask our patients whether or not they have chest pain with or without physical activity. We ask about any history of syncope, dizziness, coronary artery disease, hypertension, diabetes, or pulmonary disease. We review all medications. Patients with certain medical problems will benefit from accommodations in their exercise prescription

(see section below). Most asymptomatic adults can undertake an exercise program without additional work-up.

### Physical activity dose

The 2008 Physical Activity Guidelines for Americans and the Centers for Disease Control recommend that adults age 18–64 undertake a minimum of 150 minutes of moderate-intensity aerobic activity and 2 days of strength training of all major muscle groups each week [1, 59•]. The American College of Sports Medicine (ACSM) recommends 4 types of exercise: cardiorespiratory, resistance, flexibility, and balance. Each type is modified using the FITT principle. FITT stands for Frequency, Intensity, Time, and Type. See Table 1 for the ACSM recommendations using the FITT principle for each type of exercise [60•]. For our patients who are in the contemplation, action, and maintenance stages we write an exercise prescription in the primary care setting. We write the prescription by selecting 1 to 4 types of exercise for the patient (depending on the patient's comfort level and experience), then describing the frequency, intensity, and amount of time to be spent on that type of activity.

Which exercise prescriptions are most likely to facilitate adherence?

After motivating a patient to adopt a physical activity intervention, the next challenge is adherence. Clinicians should be aware of factors associated with low adherence as patients with these characteristics may benefit from higher intensity counseling. Factors associated with poor adherence to exercise programs include baseline inactivity, lack of time to exercise, and female gender [61, 62]. For patients who are new to exercise, adherence is higher for moderate-intensity exercise prescriptions than vigorous-intensity programs [59•].

Like other forms of behavior change, increasing physical activity requires follow-up to motivate the patient and to address barriers to regular exercise. Exercise programs that support individualized goals, provide social support, and offer ongoing therapeutic contact may increase patient compliance. In a systematic review of RCTs evaluating long-term exercise adherence, authors found that use of written exercise prescriptions had the most evidence as an effective means of increasing long-term exercise adherence [63].

### Prescribing exercise for special patient populations

#### Coronary heart disease

Patients who have experienced a major cardiac event, including myocardial infarction, should be referred to a cardiac rehabilitation program. Although these programs are

**Table 1** Summary of the American College of Sports Medicine exercise recommendations for adults in the US [56]

	Frequency	Intensity	Time	Type
Cardiorespiratory	5 d/wk	Moderate	30 min	Vigorous walking, jogging, swimming, hiking, cycling
Strength	2–3 d/wk	60 %–70 % of one-rep max for novice, 40 %–50 % of one-rep max for older person or sedentary person	8–12 repetitions, 2–4 sets with rest of 2–3 min between each set	Involving all major muscle groups. Can be body weight, free weights, bands, weight machines.
Flexibility	2–3 d/wk	Stretch to point of feeling tightness	Hold stretch for 10–30 s, repeat each flexibility exercise 2–4 times.	Involving all major muscle-tendon units. Can be ballistic, static, dynamic, or proprioceptive neuromuscular facilitation.
Balance	2–3 d/wk	Has not been determined	20–30 min	Tai Chi, Yoga, Qigong

typically underutilized and have low attendance, they are beneficial in these at-risk patients. Patients who are not enrolled in a formal cardiac rehabilitation program can be prescribed aerobic exercise for 30 minutes at least 5 days a week at a moderate intensity or 65 %–85 % of peak heart rate [64]. Perceived exertion should be 5–7 on a scale of 0 (rest) to 10 (high-intensity exercise training). Moderate intensity resistance training consisting of 10–15 repetitions, 1–3 sets of 8–10 different exercises for both upper and lower extremities 2–3 times/week can be recommended to supplement aerobic exercise [63].

### Hypertension

Patients who have hypertension should be advised to gradually increase their intensity and duration of exercise. Their exercise prescription can otherwise have similar goals as the general population: moderate intensity aerobic exercise for 30 minutes at least 5 days a week [65, 66]. For those patients who are achieving the goals for moderate aerobic exercise, there may be a role for high intensity training. High intensity interval training may lead to higher levels of cardiorespiratory fitness than the standard recommendation of continuous moderate intensity exercise training in hypertensive patients [67]. Similarly, young normotensive women at high familial risk for hypertension have lower recovery heart rate and higher functional capacity with high intensity interval training than with continuous moderate intensity training [68]. Patients who have severe baseline hypertension (BP > 180/110 mm Hg) should be started on medication prior to starting an exercise program.

### Congestive heart failure

The American College of Cardiology and the American Heart Association recommend exercise training in stable outpatients with chronic heart failure [69]. Heart failure patients should undergo exercise testing for ischemia in conjunction with a cardiologist evaluation before starting an exercise program [9]. Establishing the maximum heart

rate to guide exercise training can be done during initial testing. Heart failure patients need a longer warm-up period and should increase the length of low-intensity aerobic exercise gradually by 1 to 2 minutes until they can tolerate 15–30 minutes of exercise approximately 3–5 times per week. Ideally, initiation of the exercise program with the goal of achieving 60 %–70 % of heart rate reserve (peak heart rate on exercise testing minus resting heart rate) would be done under medical supervision and then transitioned to a home maintenance program when appropriate [70]. High-intensity interval training (at 85 %–95 % of peak heart rate lasting 1 to 4 minutes interspersed with intervals of rest or active recovery) as tolerated in heart failure patients may lead to further improvements in functional capacity [10]. However, large studies to establish safety of high intensity training in this patient population are required before changing the current paradigm [71].

### Patients taking beta blockers

Beta blockers are used to treat patients with heart failure, hypertension, post-myocardial infarction, cardiomyopathy, and/or arrhythmias. Beta blockers can decrease exercise performance. It can be difficult to use the general recommendation of exercise training at 70 %–85 % of peak heart rate in these patients because of their blunted heart rate response. In one small study of predominately men with coronary artery disease on a beta blocker, a heart rate-driven exercise prescription led to undertraining and lower intensity exercise than using workload or patient feelings of perceived exertion [72]. In these patients, using the Borg scale of perceived exertion may be helpful to assess their target response to exercise with a goal of about 13 [73, 74]. The Borg scale ranges from 6 to 20 with 6 being no exertion at all, 11 being light exertion, 15 hard, and 19 extremely hard.

### Osteoarthritis of the knee

The American Academy of Orthopaedic Surgeons (AAOS) recommends that patients with osteoarthritis of the knee

participate in low-impact aerobic exercise that focusses on quadriceps strengthening, muscle flexibility, and knee range of motion. Evidence is strong regarding the benefits of low-impact activity for knee osteoarthritis. The AAOS reviewed 13 RCTs evaluating the effect of walking or cycling on patients' pain and disability. They found that low-impact activity significantly lowered disability and pain in these patients. Studies on knee range of motion and muscle flexibility in patients with knee osteoarthritis are lacking; thus the AAOS recommendation is an expert opinion. Data on quadriceps strengthening is heterogeneous; however in their meta-analysis the AAOS found significant effects of pain and disability with increased quadriceps strength in patients with knee osteoarthritis [75].

### Osteoporosis

Women with osteoporosis of the femoral neck should participate in progressive resistance training for the lower extremities. Progressive resistance training has been shown to have the greatest effect on increasing femoral neck bone mineral density compared with other forms of exercise. Women with osteoporosis of the spine should participate in mixed type of exercise (both weight-bearing exercise and low to high resistance training) to increase bone mineral density. The exercise intervention should be done 2–3 times per week [76]. Group and home-based exercise programs that focused on gait, balance, strength, walking, and/or 3-dimensional movement (such as Tai Chi) have been shown to reduce rates of falling [77].

### Pregnancy

The American Congress of Obstetricians and Gynecologists has published the following absolute contraindications to exercise in pregnancy: hemodynamically significant heart disease, restrictive lung disease, incompetent cervix/cerclage, multiple gestations at risk for premature labor, persistent second or third trimester bleeding, placenta previa after 26 weeks gestation, premature labor during the current pregnancy, ruptured membranes, and preeclampsia or pregnancy-induced hypertension. Barring one of the above conditions, pregnant women benefit from following the recommendations from ACSM and the CDC to undertake moderate-intensity exercise 30 minutes a day most days of the week. Pregnant women should avoid contact sports, sports with a high risk of falling, and scuba diving [78].

### Diabetes

With a few exceptions as noted below, diabetics should follow the same physical activity guidelines as the general adult population, obtaining 150 min/wk of moderate-

intensity aerobic activity and 2 days/week of strength work. Exercise is safe in hyperglycemia as long as the patient does not have urine or blood ketones. If pre-exercise glucose is <100 mg/dL in a diabetic patient who uses insulin, a pre-exercise carbohydrate should be ingested in order to avoid further hypoglycemia. Patients with severe nonproliferative diabetic retinopathy or proliferative diabetic retinopathy should avoid high-intensity aerobic and resistance exercise due to increased risk for vitreous hemorrhage and retinal detachment. Patients with severe peripheral neuropathy should consider non weight-bearing activities, as decreased peripheral sensation puts these patients at higher risk for skin breakdown, infection, and joint injury with impact activities. Patients with autonomic neuropathy are at risk for decreased cardiac response to exercise. These patients should be evaluated by a cardiologist prior to initiating an exercise program [79].

### Conclusions

Exercise can serve as a low-risk, beneficial treatment for many common medical problems faced by women in the United States, from coronary artery disease to osteoporosis to osteoarthritis. Despite the health benefits that may be reaped from exercising, the majority of people in the United States do not meet the recommended daily dose of 30 minutes of moderate-intensity exercise most days of the week. Many primary care providers do not commonly prescribe exercise. Writing an exercise prescription is one way to encourage a patient to increase his or her physical activity. An exercise prescription can be written first by assessing the patient's stage of change, next assessing the patient's safety for exercise, and lastly writing a prescription using the FITT principle (Frequency, Intensity, Time, and Type). Close follow-up with the patient helps facilitate adherence. Most patients will see health benefits by incorporating 30 min/d of moderate-intensity cardiovascular activity into their daily routine. Some patients, such as those with coronary artery disease, congestive heart failure, knee osteoarthritis, and diabetes will benefit from specific tailoring of their exercise prescription based on their medical history. Involving a cardiologist, orthopedist, and/or physical therapist can help the primary care provider use exercise as medicine for patients with all kinds of medical problems. Often it is these patients who stand to benefit the most from an exercise intervention.

**Conflict of interest** Carlin Senter declares that she has no conflict of interest. Nicole Appelle declares that she has no conflict of interest. Sarina K. Behera declares that she has no conflict of interest.

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