

Exercise Prescription

SECOND EDITION

A CASE STUDY
APPROACH
TO THE
ACSM GUIDELINES

***David P. Swain
Brian C. Leutholtz***

S E C O N D E D I T I O N

Exercise Prescription

A Case Study Approach
to the ACSM Guidelines

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Preface to the Second Edition

In 2005, the American College of Sports Medicine published the seventh edition of the *ACSM's Guidelines for Exercise Testing and Prescription*. The new *Guidelines* incorporated several changes that affect how we screen clients and design exercise prescriptions. Risk factor thresholds were modified for fasting glucose, HDL cholesterol, and obesity. New minimal levels of exercise intensity for improving the cardiorespiratory fitness of healthy adults and those with heart disease were recommended. And added emphasis was placed on the importance of higher intensities of exercise for optimizing potential health benefits. Norms for interpreting fitness test results were changed.

The second edition of our book has been thoroughly revised to reflect all of the relevant changes in the ACSM's *Guidelines*. Material has been added to chapter 3 that explains the ACSM's new recommendations for exercise intensity. In fact, these recommendations were based on research that Dr. Swain published with ACSM past-president Barry Franklin. Several chapters have been expanded to provide more information regarding various special populations such as pregnant women, children, and different types of heart patients. All of the material in the case studies has been updated to reflect the ACSM's new screening criteria and new fitness norms. Moreover, the case studies in the appendix have been reformatted to allow easier access to the explanations in the answer section.

Of course, all of the great features of the first edition have been retained, such as the easy reading style and the use of many practical case studies. We trust that this edition will be a valuable tool in expanding your skills in designing exercise prescriptions for a variety of clients, and in preparing for ACSM certification.

Swain, D.P., and B.A. Franklin, 2002. VO_2 Reserve and the minimal intensity for improving cardiorespiratory fitness. *Medicine and Science in Sports and Exercise* 34:152-157.

Swain, D.P., and B.A. Franklin. Is there a threshold intensity for aerobic training in cardiac patients? *Medicine and Science in Sports and Exercise* 34:1071-1075, 2002.

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Contents

Preface to the Second Edition vii

CHAPTER 1 Case Studies and Risk Stratification 1

Screening and Risk Stratification 1
Assessing the Components of Fitness 11
Goal Setting 12
Exercise Prescription 15

**CHAPTER 2 Basic Principles for Exercise
Prescription, Now With $\dot{V}O_2$ Reserve . . . 17**

Principles of Training 17
ACSM Guidelines 23
 $\dot{V}O_2$ Reserve 25

**CHAPTER 3 Exercise Prescription
for Cardiorespiratory Fitness 31**

Type (Mode) 31
Frequency and Time (Duration) 31
Intensity 34
Added Benefit of Vigorous Intensity 35
Exercise Prescription by Heart Rate 37
Exercise Prescription by Perceived Exertion 43
Exercise Prescription by Workload 45

**CHAPTER 4 Using the ACSM
Metabolic Equations 49**

Functions of the Metabolic Equations 50
Conversion of Units 51
Walking 51
Running 56

	<i>Leg Cycling</i>	60
	<i>Arm Cycling</i>	64
	<i>Stepping</i>	67
CHAPTER 5	Exercise Prescription for Weight Loss . .	71
	<i>Energy Balance</i>	72
	<i>Weight Management</i>	73
	<i>Exercise Prescription for Fat Loss</i>	74
CHAPTER 6	Exercise Prescription for Flexibility and Muscular Strength. . .	83
	<i>Flexibility</i>	83
	<i>Muscular Strength</i>	87
CHAPTER 7	Exercise Prescription for the Older Adult.	101
	<i>Cardiovascular Fitness</i>	102
	<i>Resistance Training</i>	104
CHAPTER 8	Exercise Prescription for Heart Disease.	115
	<i>Exercise for Heart Disease</i>	116
	<i>Four Variables of the FITT Principle</i>	116
	<i>Myocardial Infarction</i>	119
	<i>Congestive Heart Failure</i>	121
	<i>Pacemakers</i>	123
	<i>Cardiac Transplant</i>	126
CHAPTER 9	Exercise Prescription for Diabetes Mellitus	129
	<i>Exercise Prescription for Clients With Type 1 Diabetes</i>	131
	<i>Exercise Prescription for Clients With Type 2 Diabetes</i>	137

CHAPTER	10 Exercise Prescription for Other Special Cases	145
	<i>Peripheral Arterial Disease</i>	145
	<i>Chronic Obstructive Pulmonary Disease</i>	149
	<i>Hypertension</i>	152
	<i>Pregnancy</i>	153
	<i>Children</i>	156
	Appendix.	163
	<i>Additional Case Studies</i>	
	<i>With Multiple Choice-Questions</i>	163
Index		195
About the Authors		199



Case Studies and Risk Stratification

Case studies are an excellent way to learn how to put knowledge into practice. Because case studies provide the learning experience closest to dealing with real-life clients, the American College of Sports Medicine (ACSM) uses them extensively in its certification examinations to illustrate the principles of exercise prescription.

The ACSM's approach to evaluating a case study involves three steps:

1. Screening and risk stratification
2. Assessment of the components of fitness
3. Exercise prescription

This chapter explores the ACSM's basic approach to evaluating case studies, with special attention to screening and risk stratification. Subsequent chapters of this book present case studies that emphasize different elements of this approach. The additional case studies provided in the appendix are comprehensive and challenge you to perform complete evaluations of a variety of real-life clients.

SCREENING AND RISK STRATIFICATION

Renowned exercise physiologist Per-Olaf Åstrand has often said that exercising is safer than remaining sedentary. This is almost universally true, because exercise produces many healthful benefits that reduce the risk of diseases associated with inactivity—coronary heart disease, cerebrovascular disease, type 2

diabetes, osteoporosis, certain forms of cancer, and so on. Yet exercise carries some risk. It increases metabolic demands on the heart and increases sympathetic nervous activity—factors that could trigger a heart attack in people who already have coronary heart disease. Because the many people with undiagnosed heart disease are particularly at risk, screening clients is critical to ensure safety. Before performing exercise testing on clients, and before enrolling them in an exercise program, you should evaluate them to determine their level of risk and to decide whether it is reasonably safe to proceed.

ACSM's Risk Levels

- **Low risk:** Young (44 or younger for men, 54 or younger for women), with no more than one coronary disease risk factor, and without symptoms or known disease
- **Moderate risk:** Older (45 or older for men, 55 or older for women) or with two or more coronary disease risk factors
- **High risk:** With one or more symptoms of cardiopulmonary disease or with known cardiovascular, pulmonary, or metabolic disease (ACSM, 2006)

Table 1.1 provides a screening form for evaluating clients regarding their level of risk to exercise. The form is consistent with the ACSM criteria for risk factor thresholds, symptoms, and relevant known diseases as presented in tables 2-2, 2-3, and 2-4 of the seventh edition of the ACSM *Guidelines*. Unfortunately, the questionnaire presented by the ACSM in that same chapter of the *Guidelines* is *not* consistent with the ACSM's own criteria in its tables 2-2, 2-3, and 2-4. Therefore, we recommend that fitness professionals use the questionnaire presented here. Hopefully, the ACSM will correct its questionnaire in its next edition. One significant discrepancy between the ACSM's criteria and its own questionnaire is that, according to the questionnaire, an older client is placed in the moderate-risk category only if he or she also has at least one additional risk factor. However, according to the ACSM's table 2-4, being older automatically puts the client in the moderate-risk category, even if the client has no other risk factors. Furthermore, the age cutoffs for men and women are one

Table 1.1 Exercise Screening Questionnaire Using ACSM Criteria

Name _____ Sex _____ Date _____

I. Risk Factors (two or more places a person at moderate risk)

- _____ 1. Have any of your parents, brothers, or sisters had a heart attack, bypass surgery, angioplasty, or cardiac sudden death? How old was your relative at the time? (Relative must be under 55 if male or under 65 if female to qualify as a risk factor.)
- _____ 2. Have you smoked cigarettes in the past six months? (Yes qualifies as a risk factor.)
- _____ 3. What is your usual blood pressure? ($\geq 140/90$ qualifies as a risk factor.) Do you take blood pressure medication? (Yes qualifies as a risk factor.)
- _____ 4. What is your LDL cholesterol level? If you don't know your LDL level, what is your total cholesterol level? What is your HDL cholesterol level? (Either LDL >130 [use total cholesterol >200 if LDL is not known] or HDL <40 qualifies as a risk factor; HDL >60 qualifies as a negative risk factor.)
- _____ 5. What is your fasting glucose? (≥ 100 qualifies as a risk factor.)
- _____ 6. What is your height and weight? (BMI ≥ 30 qualifies as a risk factor.)
Or ask: What is your waist girth? (Girth of >102 cm, or >40 inches, for a male or >88 cm, or >34.6 inches, for a female qualifies as a risk factor.)
Or ask: What are your waist and hip girths? (Waist-to-hip ratio of ≥ 0.95 for a male or ≥ 0.86 for a female qualifies as a risk factor.)
- _____ 7. Do you get at least 30 minutes of moderate physical activity most days of the week (or its equivalent)? (No qualifies as a risk factor.)

II. Symptoms (one or more places a person at high risk)

- _____ 1. Do you ever have pain or discomfort in your chest or surrounding areas (i.e., ischemia)?
- _____ 2. Do you ever feel faint or dizzy (other than when sitting up rapidly)?
- _____ 3. Do you find it difficult to breathe when you are lying down or sleeping?
- _____ 4. Do your ankles ever become swollen (other than after a long period of standing)?
- _____ 5. Do you ever have heart palpitations or an unusual period of rapid heart rate?

(continued)

Table 1.1 (continued)

- ___ 6. Do you ever experience painful burning or cramping in the muscles of your legs (i.e., intermittent claudication)?
- ___ 7. Has a physician ever said that you have a heart murmur? If so, has he or she said it is safe for you to exercise?
- ___ 8. Do you feel unusually fatigued or find it difficult to breathe with usual activities?

III. Other

- ___ 1. How old are you? (Men ≥ 45 and women ≥ 55 are at moderate risk.)
- ___ 2. Do you have any of the following diseases: heart disease, peripheral arterial disease, cerebrovascular disease, chronic obstructive pulmonary disease (emphysema or chronic bronchitis), asthma, interstitial lung disease, cystic fibrosis, diabetes mellitus, thyroid disorder, renal disease, or liver disease? (Yes to any disease places the person at high risk.)
- ___ 3. Do you have any bone or joint problems, such as arthritis or a past injury, that might get worse with exercise? (If the answer is yes, exercise testing may need to be delayed or modified.)
- ___ 4. Do you have a cold or flu, or any other infection? (If yes, exercise testing must be postponed.)
- ___ 5. Are you pregnant? (If yes, exercise testing may need to be postponed or modified.)
- ___ 6. Do you have any other problem that might make it difficult for you to do strenuous exercise?

Interpretation

Low risk (young, and no more than one risk factor): Can do maximal testing or enter a vigorous exercise program.

Moderate risk (older, or two or more risk factors): Can do submaximal testing or enter a moderate exercise program.

High risk (one or more symptoms, or disease): Should not be tested without a physician present; should not begin an exercise program without physician clearance.

Created by the author (DPS) based on information provided in chapter 2 of *ACSM's guidelines for exercise testing and prescription*, 6th edition (ACSM, 2000), and updated with the 7th edition (ACSM, 2006).

year different in the ACSM's questionnaire and its table 2-4. There are other discrepancies as well between the ACSM's questionnaire and the ACSM criteria.

Note that the ACSM screening criteria are intended specifically to determine a client's risk *prior to* exercise and are not intended as a complete list of coronary risk factors. For example, the ACSM is well aware of the fact that exposure to tobacco in any form—chewing tobacco, cigars, pipes, cigarettes, or secondhand smoke—elevates the risk of serious disease. Yet only active cigarette smoking appears in the official criteria, in recognition of the greater risk from this form of exposure. Also note that several risk factor criteria have changed from the sixth to the seventh edition of the ACSM *Guidelines*. Specifically, an HDL cholesterol less than $40 \text{ mg} \cdot \text{dl}^{-1}$ is now a risk factor (as opposed to <35), a fasting blood glucose of $100 \text{ mg} \cdot \text{dl}^{-1}$ or more is now a risk factor (as opposed to >110), and new criteria have been added for determining the presence of obesity.

When screening clients, always explore the answers to their questions rather than taking simple answers at face value. For example, when asked, “Do you ever have pain or discomfort in your chest or surrounding areas?” a client with a recent muscle strain during bench pressing might answer yes, but would not be at elevated risk of heart disease. Coronary ischemia is not usually experienced as a sharp pain—rather, it appears as a pressure or discomfort, normally occurs during times of stress (including exercise), and is relieved by rest. Similarly, dizziness is common (and benign) when people sit up rapidly. Swelling of the ankles may not indicate cardiovascular complications if it results from long periods of standing with little movement. You must interpret clients' responses with prudent judgment. However, if a client has symptoms that might be due to cardiopulmonary disease, refer him or her to a physician before continuing with exercise testing or programming.

With regards to risk factors, note that each category may be counted only once. For example, if a client's blood pressure is 148/96 mmHg, he or she has an elevated systolic blood pressure and an elevated diastolic blood pressure, but is credited with one risk factor, hypertension. Of course, having *either* an elevated

systolic blood pressure *or* an elevated diastolic blood pressure is sufficient to assign the risk factor. Similarly, high LDL and low HDL cholesterol values count singly or together as one risk factor, dyslipidemia.

The interpretation section at the bottom of table 1.1 summarizes the ACSM's recommendations about the form of exercise testing and the intensity of exercise training that clients are ready to enter after the screening process. Low-risk clients are unlikely to experience cardiovascular complications during even the most strenuous exercise. Thus, you can offer low-risk clients submaximal or maximal exercise tests without a physician's supervision, and you can enter these clients into moderate or vigorous exercise programs without first obtaining a physician's clearance.

You can offer moderate-risk clients a submaximal exercise test, such as a bike test performed at a moderate intensity for the prediction of $\dot{V}O_2\text{max}$; but you should not give them a maximal exercise test at a health club or other fitness site. Moderate-risk clients should undergo maximal exercise testing only in a clinical setting (i.e., with a physician available in the immediate vicinity). They can enter moderate-intensity exercise programs such as walking clubs or moderate-intensity resistance training but not vigorous programs such as running or competitive sports. If they want to enter a vigorous exercise program, they must first obtain physician clearance—preferably involving a clinically supervised stress test.

High-risk clients should not receive any exercise testing or programming without the direct involvement of the medical community. Exercise tests should be medically supervised. Entry into any exercise program, even of a moderate intensity, needs to be preceded by physician clearance based on stress testing.

CASE STUDY 1.1

Risk Stratification

John is a 42-year-old who is 5'8" (173 cm) tall and weighs 178 lb (80.9 kg). He works as a construction laborer. He has been smoking about a pack of cigarettes per day for over 20 years. His father had a heart attack at age 61. John has no signs or symptoms of cardiopulmonary disease. His blood pressure is 136/82 mmHg on medication. His total cholesterol is 220 mg · dl⁻¹. His fasting glucose is 96 mg · dl⁻¹. He has come to your facility to learn more about ways to reduce his risk of heart disease. How many ACSM risk factors

does he have, and what risk stratification category is he in? Can you perform a submaximal or maximal fitness test on him at this time? Can he enter a moderate or vigorous exercise program before obtaining physician clearance?

John has three risk factors: cigarette smoking, hypertension (because he is on medication, even though his current blood pressure is reasonable), and dyslipidemia (based only on knowing his total cholesterol, which is above 200 mg · dl⁻¹). He is not obese, although his body mass index (BMI) of 27.1 kg · m⁻² puts him in the overweight category (see table 1.2). He would not be classified as sedentary because of his physically active job. He does not have a family history of heart disease *for screening purposes*, because his father's heart attack occurred after the age of 55. His fasting glucose is normal. Although John is considered to be young (under 45), he is in the moderate-risk category because he has at least two risk factors. He is not in the high-risk category because he does not have any signs or symptoms of cardiopulmonary disease or any known cardiovascular, pulmonary, or metabolic disease.

You can safely give John a submaximal test of his cardiovascular fitness as part of an overall appraisal of his condition. He cannot undergo a maximal test unless physician coverage is available. John can safely begin a moderate-intensity exercise program, but he would need physician clearance before embarking on a vigorous exercise program.

Table 1.2 Body Mass Index Categories

BMI (kg · m ⁻²)	Category	BMI (kg · m ⁻²)	Category
<18.5	Underweight	30.0-34.9	Obesity, class I
18.5-24.9	Normal	35.0-39.9	Obesity, class II
25.0-29.9	Overweight	≥40.0	Obesity, class III (morbid)
≥30.0	ACSM criterion for obesity		

BMI is calculated as body mass in kg divided by the height in meters squared. It may also be calculated from English units as follows: (body weight in lb × 703) / (height in inches squared). The factor 703 converts from English to metric units.

Adapted from "Executive summary of the clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults," *Arch Intern Med.* 158(17): 1855-1867. Copyright 1998 American Medical Association. All rights reserved.

CASE STUDY 1.2

Risk Stratification

Joan is a 32-year-old sales consultant. She smoked three to five cigarettes per day until she quit nine months ago. She is 5'4" (163 cm) tall and weighs 128 lb (58.2 kg). Her grandfather died of heart disease when he was 63. Her mother has type 2 diabetes. Her blood pressure is 106/70 mmHg. She has a total cholesterol level of 192 mg · dl⁻¹, an LDL level of 134 mg · dl⁻¹, and an HDL level of 46 mg · dl⁻¹; her fasting glucose level is 87 mg · dl⁻¹. She walks her dog for 15 to 20 minutes once or twice a day. Stratify Joan's risk status and decide what type of exercise testing and programming she can perform.

Joan has only one risk factor: dyslipidemia. Her total cholesterol is in the desirable range, but LDL cholesterol is more important than total cholesterol. Because her LDL is above the threshold level of 130 mg · dl⁻¹, she meets the criterion for this risk factor. Her HDL is normal, but *either* a high LDL or a low HDL level places a client at risk. Joan has been smoke-free for more than six months, so cigarette smoking is not a risk factor (risk for heart disease drops quickly after smoking cessation, approaching the risk of nonsmokers in one to two years; ex-smokers approach normal risk levels for lung cancer and pulmonary disorders in 10 to 20 years). Joan's BMI is normal at 22.0 kg · m⁻². The heart disease in Joan's grandfather and diabetes in her mother do not elevate her own risk of having a heart attack during exercise. Joan would not be considered sedentary because her three hours of walking per week exceeds the ACSM's recommendation of at least two hours of moderate activity per week (i.e., 30 minutes or more on most days of the week; if "most days" is interpreted to mean at least four out of seven, this yields a total of two hours or more per week).

Because Joan has only one risk factor and is young (under 55), she is in the low-risk category. You can give her a maximal test of her aerobic capacity without a physician present. However, you may not need a maximal test: A submaximal test would provide sufficient information to proceed with her exercise prescription. Joan can safely enter a moderate or vigorous exercise program. If you prescribe a vigorous exercise program, be sure to set the initial intensity at a level appropriate for her current level of fitness—not out of fear of a heart attack, but to prevent excessive musculoskeletal strain at the onset of her program.