SECOND EDITION

FallProof!™

A Comprehensive Balance and Mobility Training Program

Includes DVD VIDEO featuring testing procedures, training strategies, and a sample class

Debra J. Rose

FallProof!

Second Edition

A Comprehensive Balance and Mobility Training Program

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Human Kinetics

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With thanks and gratitude to all the older adults who have touched my life and inspired me to create this program.

Preface

Maintaining balance and mobility is essential to aging successfully. In addition to making it possible to perform basic activities of daily living, such as rising from a chair or climbing a flight of stairs, good balance forms the foundation on which a healthy and active lifestyle is built. Impairments in any of the multiple systems that contribute to postural stability not only limit the extent and type of physical activities we pursue as we grow older but also may result in falls, leading to further restrictions in activity and profound psychological consequences. The strong association between impaired balance and mobility and greater risk of falling suggests the need for activity-based programs that specifically *and* systematically focus on improving the multiple dimensions of the balance system, particularly among older adults.

The second edition of *FallProof! A Comprehensive Balance and Mobility Training Program* not only builds on the knowledge presented in the first edition but also provides a structured approach to the design and implementation of a balance and mobility program that reduces many of the risk factors that contribute to falling. This program remains the first published balance and mobility program to provide the reader with the fundamental theoretical concepts and practical skills needed to assess and design effective activity programs for older adults with balance and mobility disorders as well as a comprehensive set of progressive balance activities that address the important dimensions of balance and mobility. The program in this guide is based on sound, theoretical research, and a group-based version of the program has been field-tested extensively by many physical activity instructors and rehabilitation specialists working with older adults across a broad continuum of functional abilities. The innovative balance and mobility program described in this book was developed at the Center for Successful Aging at California State University at Fullerton and is currently being implemented in numerous community-based and residential care settings with considerable success. Physical activity professionals who embrace this unique multidimensional programming approach to treating balance and mobility disorders can expect to achieve the same success.

The second edition of *FallProof! A Comprehensive Balance and Mobility Training Program* is divided into three parts. Part I, The Theory Behind the Program, provides the reader with in-depth knowledge about the various body systems that contribute to balance and mobility and the common age-related changes that occur in each of these systems. The external and internal risk factors known to be strongly associated with falls among the older adult population are also discussed, as are the common medical conditions and medications known to adversely affect balance and mobility.

Part II begins by describing a concise set of balance and mobility assessments used to evaluate every client entering the FallProof™ program both before and at regular intervals throughout the program. These assessments measure the multiple dimensions of balance and mobility and provide the instructor with the information needed to determine where each participant should start in each of the six major components of the FallProof program. These components, described in the remainder of part II, include (1) center-of-gravity control training, (2) multisensory training, (3) postural strategy training, (4) gait pattern enhancement and variation training, (5) strength and endurance training, and (6) flexibility training. In addition to describing a set of progressive exercises for each component of the FallProof program, each chapter provides ideas for increasing

the challenge associated with each balance activity. Advanced progressions are based on manipulating the task demands and the environmental constraints to progressively challenge the individual capabilities of the participants. At-a-glance summary tables are also provided in chapters 5, 6, 8, and 9 to further guide the instructor.

Part III of the book describes how to implement a balance and mobility program. The first chapter in this part describes contemporary principles of motor learning that will enable instructors to foster optimal learning, develop effective lesson plans, organize the classroom environment to maximize safety and efficiency, and provide meaningful feedback to program participants. The second and final chapter describes the leadership and class management skills needed to be a successful balance and mobility instructor. It covers the important activities that must be completed (a) following the initial assessment of program participants and before the start of the program, (b) before the start of each class session, (c) during each class session, (d) between class sessions, and (e) after each follow-up assessment. It also describes how to communicate effectively with program participants.

This instructor guide will be an invaluable resource for experienced health care professionals and physical activity instructors who want to acquire the specialized knowledge and practical skills needed to develop and implement programs that improve the balance and mobility of older adults. The wide range of exercise progressions described and the ideas for manipulating the challenge associated with each exercise make *FallProof! A Comprehensive Balance and Mobility Training Program* a versatile guide in programming for older adults who come from a broad range of functional levels. Although physical activity instructors who have not yet completed the academic and practical skills training needed to work with at-risk older adults can also use this instructor guide to learn how to incorporate more balance and mobility exercises into their senior fitness programs, they should not develop a specialty balance and mobility program for at-risk older adults until they have completed additional training in the area.

FallProof! A Comprehensive Balance and Mobility Training Program is the first systematic effort to develop a structured and progressive program of activities specifically designed to address the multiple dimensions that contribute to balance and mobility.

This instructor guide serves as the core text for the balance and mobility instructor specialist certification program, which began operating at California State University at Fullerton in 2001. Readers interested in developing their knowledge and practical skills in balance and mobility training so they can become certified to implement the FallProof program should consider enrolling in this certification program. The program is staffed by an outstanding group of experienced kinesiologists and physical therapists with expertise in geriatric assessment and rehabilitation. Information about the certification program and an online application can be obtained by logging onto the Center for Successful Aging Web site at http://hhd.fullerton.edu/csa.

New to the second edition is a supplementary DVD that includes video clips and the forms you will need to assess your clients and monitor their progress throughout the program. Icons (such as the two on this page) appear throughout the text, alerting you to the contents of the DVD. You will find the instructional videos for the Fullerton Advanced Balance (FAB) scale and the 30-foot walk test particularly helpful in preparing you to administer these tests. You can also test your readiness to administer and score the FAB scale

Acknowledgments

I would first like to extend my heartfelt thanks to the wonderful colleagues I have the pleasure of working with in the balance and mobility instructor specialist certification program at California State University at Fullerton: Dr. Courtney Hall, PhD, PT; Dr. Peggy Trueblood, PhD, PT; Grace Amaya, MS; Judy Aprile, MS; Sue Grant, BS; Danielle Hernandez, MS; and Karen Russell, PTA. In addition, I would like to thank the more than 400 instructors who have been certified to teach the FallProof program over the past several years for providing me with invaluable feedback on the first edition of this book and on the program itself as they implemented it in their communities. Also, thanks to the wonderful group of older adults who served as models for the second edition of this book: Rodolfo Amaya, David Armstrong, Lou Arnwine, John and Myrtle Brothers, Hilda Corral, Ramon Corral, Stanley Dashew, Harriet Dolgin, Carlos Estrada, Ann and Gregory Foster, Ann Gardner, Ted Gibson, Danielle Hernandez, Margaret Low, Bill McGarvey, Mio Sakai, Ralph Scheffer, Ann Siebert, Donna Spradlin, Fritz von Coelln, Andy Washington, and Mildred Kiyo Young.

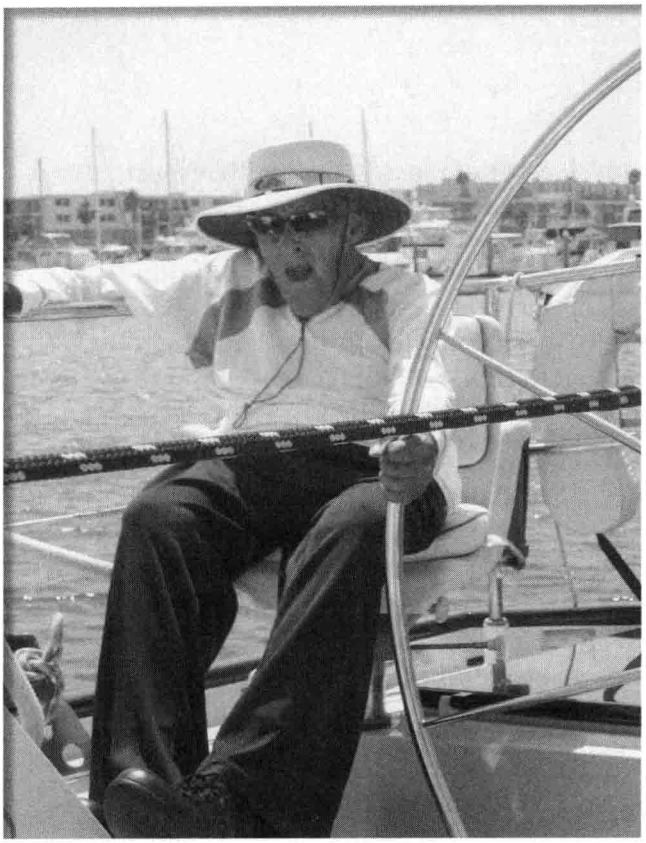
Many thanks are also extended to the Archstone Foundation of California for providing the generous funding necessary to test the efficacy of this program in a large number of community-based centers serving the needs of older adults. The Archstone Foundation has also provided the Center for Successful Aging at California State University at Fullerton with additional funding for an instructor certification program designed to provide health care professionals with the specialized knowledge needed to implement the FallProof program in their immediate communities. Thanks also to the Retirement Research Foundation for providing additional funding to examine the long-term efficacy of the program in residential care facilities throughout southern California.

by watching the case study video and scoring each test item of the FAB scale after it is administered. Finally, the DVD contains short video clips highlighting different exercise progressions related to each core component of the program and a 30-minute FallProof class with Harriet and Ben, two of my wonderful clients from the Center for Successful Aging.

Contents

Part I

The Theory Behind the Program



Courtesy of Debra J. Rose

Chapter 1

Understanding Balance and Mobility

Objectives

After completing this chapter, you will be able to

- describe terminology used in the study of balance and mobility,
- identify the multiple systems that contribute to postural stability, and
- describe the major age-related changes that occur in balance and mobility.

The control of balance depends on a series of complex processes that are triggered by either a conscious or an unconscious decision to act. Our decision to act may be a response to an internal desire to perform a certain task, a reaction to sensory events occurring in the environment, or a combination of the two. Although many of the decisions we make during the day are made at a conscious level, such as rising from a chair to answer the door or walk to the neighborhood store to purchase groceries, others are made at a subconscious level. Subconscious responses are most often associated with well-learned skills that require little or no conscious attention or with the need to respond rapidly to an unexpected threat to our stability. Whether the decision to act is conscious or subconscious, multiple systems within the body are involved.

WHAT IS BALANCE?

center of mass (COM)—In terms of the forces that act on the body and the body's motion, the COM is the point at which all the mass of the body is concentrated. The COM is also referred to as the *center of gravity* (COG) because the gravitational force due to the weight of the body also acts through this point.

Balance is the process of controlling the body's **center of mass (COM)** with respect to its base of support, whether the body is stationary or moving. For example, when we are standing upright, our primary goal is to maintain the COM within the confines of the base of support, whereas when we are walking, we are continuously moving the COM beyond the base of support and reestablishing a new base of support with each step taken. Although we often consider upright standing to be a static balance task and leaning or walking to be a dynamic balance task, we must remember that maintaining a stable upright position involves the active contraction of various muscle groups to control the position of the COM against the destabilizing force of gravity.

TERMINOLOGY

balance—The process by which we control the body's COM with respect to the base of support, whether we are stationary or moving.

posture—The biomechanical alignment of the individual body parts as well as the orientation of the body to the environment.

anticipatory postural control—Actions that are planned in advance.

reactive postural control—Actions that cannot be planned in advance due to the unexpected nature of an event.

Inevitably, when we are introduced to a new area of study, we are overwhelmed by many new and unfamiliar terms. As you read each of the chapters in this instructor guide, you too will be confronted by many new terms that are specific to the study of balance and mobility. In addition to understanding what is meant by the term **balance,** you will need to be able to define the terms *posture, anticipatory and reactive postural control, stability limits, the sway envelope,* and *mobility.*

Good **posture** is critical to good balance, and the term refers to the biomechanical alignment of each of our body parts as well as the orientation of the body to the environment (Shumway-Cook & Woollacott, 2005). When we are standing quietly, our goal is to align each of the body parts vertically and thereby expend the least amount of internal energy necessary to maintain an upright and stable position relative to gravity. To counteract the forces of gravity, a number of muscles are active during quiet standing (see figure 1.1). These include the soleus and gastrocnemius, the tibialis anterior (when the body sways backward), the gluteus medius and tensor fasciae latae, the iliopsoas, the erector spinae in the thoracic region of the trunk, and the abdominal muscles, somewhat more intermittently (Basmajian & De Luca, 1985).

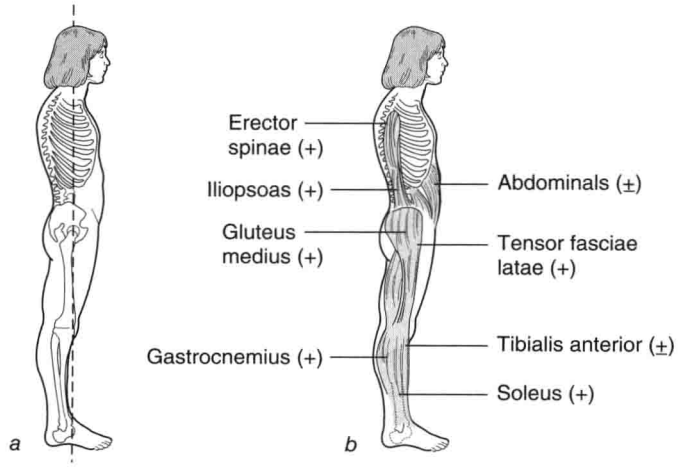


Figure 1.1 *(a)* Good postural alignment minimizes the amount of muscle activity required to maintain an upright stance. *(b)* Even when we stand quietly, a number of muscles throughout the body are activated.

Although many of our balance- and mobility-related activities allow us to plan our actions in advance, there are times when an unexpected event forces us to respond more subconsciously or automatically. **Anticipatory postural control** is the term used to describe those actions that can be planned in advance, whereas **reactive postural control** is the term used to describe the more automatically generated actions that occur when our movements cannot be planned in advance of the required action. Anticipatory postural control helps us avoid obstacles in our path as we walk to the store or run through the forest. It also assists us in adapting our gait pattern as we move from one type of surface to the next (e.g., from firm to compliant or moving surfaces, from wide to narrow surfaces). In contrast, reactive postural control becomes necessary when we have to respond quickly to an event

we did not expect (e.g., stepping in an unseen hole, being bumped in a crowd). Many of the activities described in chapters 4 and 5 will help your older clients improve both of these dimensions of balance.

How far we are willing or able to lean in any direction without having to change our base of support constitutes our **stability limits.** People who are able to align their COM directly above their base of support during quiet standing can sway as much as 12 degrees in a forward–backward direction (8 degrees forward and 4 degrees backward) and 16 degrees laterally before they must take a step because their stability limits have been exceeded (Nashner, 1989). Of course, this **sway envelope,** as it is called, often is much smaller among older adults who are beginning to experience balance problems. Reduced or asymmetric limits of stability may result from musculoskeletal abnormalities caused by weak ankle muscles or reduced range of motion about the ankles, neurological trauma (i.e., stroke, Parkinson's disease, multiple sclerosis) that has resulted in muscle weakness that affects movement in a particular direction, or a fear of falling.

stability limit—The maximum distance an individual is able or willing to lean in any direction without changing the base of support.

sway envelope—The path of the body's movement during quiet standing.

Although stability limits vary according to the individual's inherent biomechanical limitations, the task being performed, or the constraints of the environment, a significant reduction in those limits, particularly in the lateral and backward directions, will place the older adult at a heightened risk for falling. Any small disruption to standing balance quickly moves these individuals beyond their limits of stability and requires them to reach for nearby support or take one or more steps to prevent a fall.

Finally, the term **mobility** has been defined as a person's ability to move independently and safely from one place to another (Shumway-Cook & Woollacott, 2005). Adequate mobility is required for many different types of activities performed in daily life. These may include transfers (e.g., rising from a chair, climbing or descending stairs), walking or running, and other types of recreational activities (e.g., gardening, sports, dancing).

mobility—The ability to move independently and safely from one place to another.

POSTURAL CONTROL STRATEGIES FOR CONTROLLING BALANCE

Studies conducted over the years have discovered at least three distinct postural control strategies that control the amount of body sway. These strategies are referred to as the *ankle, hip,* and *step strategies* (see figure 1.2 on page 6). In the ankle strategy, the body moves as a single entity about the ankle joints as force is exerted against the ground surface. What you see when you watch a person using an **ankle strategy** is the upper and lower body moving in the same direction, or moving in phase. Because the amount of force that can be generated by the muscles surrounding the ankle joint is relatively small, we generally use this strategy to control sway when we are standing upright or swaying slowly through a very small range of motion. The ankle strategy is also used at a subconscious level to restore balance following a small nudge or push.

ankle strategy—The postural control strategy in which the body moves as a single entity about the ankle joints (i.e., the upper and lower body sway in the same direction).

In contrast to the ankle strategy, the **hip strategy** involves activation of the larger hip muscles and is used when the COM must be moved back over the base of support more quickly. When you watch a person using a hip strategy, you will see the upper and lower body move in opposite directions (i.e., move out of phase). The hip strategy becomes increasingly important as the distance and speed of sway increase or when we are standing on a surface that is narrower

hip strategy—The postural control strategy in which the upper and lower body move in opposite directions as a result of the hip muscles being activated to control balance.

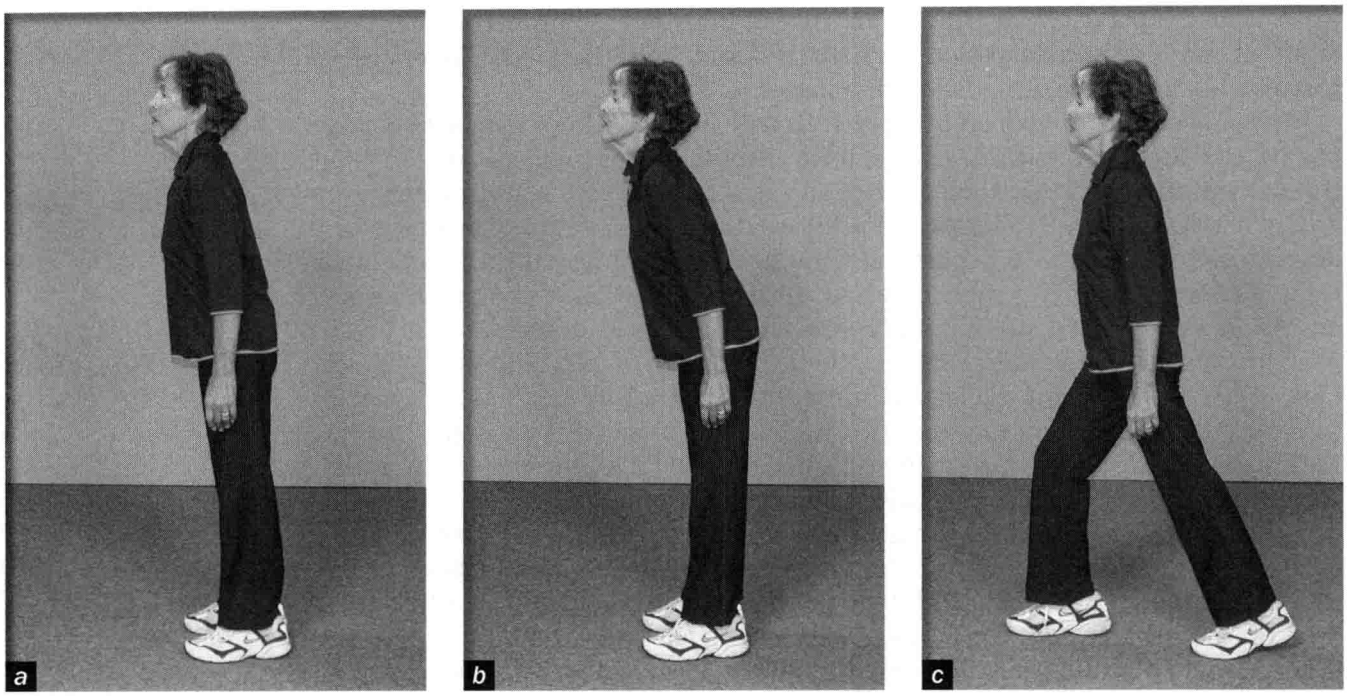


Figure 1.2 Three postural control strategies are used by adults to control balance in a standing position: *(a)* ankle, *(b)* hip, and *(c)* step.

than the length of our feet (e.g., when standing sideways on a narrow beam). In these surface conditions, we can no longer use the ankle strategy because there is not enough surface against which the feet can push in order to generate sufficient force to restore balance using the smaller ankle muscles.

step strategy—The postural control strategy used when the COM is displaced beyond the maximal stability limits or sway is too great to use a hip strategy effectively. It requires a new base of support to be established.

The final postural control strategy used to control balance is the **step strategy.** This strategy comes into play when our COM is displaced beyond our maximum limits of stability or our speed of sway is so fast that a hip strategy is insufficient to maintain the COM within the stability limits. In this situation, we must establish a new base of support if we are to prevent a fall. When executing a step strategy, a person takes one or more steps in the direction of the loss of balance. Although each of the postural control strategies presented in this section are described as distinct movement patterns, various combinations of these strategies are used to control forward and backward sway in a standing position (Horak & Nashner, 1986; Jensen et al., 1996). Moreover, recent research suggests that in many situations stepping or reaching responses may occur even before the COM moves outside of the limits of stability (Brown, Shumway-Cook, & Woollacott, 1999).

What factors are likely to limit our ability to use each of these three movement strategies? In the case of the ankle strategy, adequate range of motion and strength within the muscles surrounding the ankle joint are needed. The surface beneath the feet must also be firm and broad, and the individual must have adequate sensation in the feet to be able to feel the surface. Older adults experiencing a significant decline in sensation in the feet or ankles will find it particularly difficult to employ this strategy.

Key Point

An effective ankle strategy requires

- adequate range of motion and strength in the ankle joints;
- a firm, broad surface below the feet; and
- adequate sensation in the feet and ankles.